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Wild deer in Wales, their impact and management in agriculture, private forestry and woodlands managed for conservation in Wales

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WILD DEER IN WALES, THEIR IMPACT AND MANAGEMENT IN AGRICULTURE, PRIVATE FORESTRY AND WOODLANDS MANAGED FOR CONSERVATION IN WALES

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By

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ABSTRACT

Wild deer have been increasing in abundance and distribution in Wales. Species present are Fallow, Roe, Red and Muntjac. Previously there has been no comprehensive research into assessing deer impacts in Wales. Research shows that overabundance of wild deer can have negative impacts on land-use activities including forestry, agriculture and conservation.

Landowner questionnaires, vegetation and deer surveys carried out identify that whilst deer are currently not a significant issue nationally in Wales there are regional and deer species specific issues. The baseline data identifies that whilst negative deer impacts in Wales are increasing there is still capacity for deer to increase in abundance and provide a positive contribution within the Welsh countryside. Fallow are the most common species that have an impact, particularly in south and west Wales. Developing roe populations also have potential to add to the negative deer impacts across Wales. Results indicate that mid Wales will be the next region that will develop negative deer impacts. Increases in deer distribution and abundance is occurring at a greater rate than previously estimated.

In woodlands managed for conservation, the research illustrates the value of small, short term exclosures and use of landscape level deer and impact evaluation methodology. Results highlight the usefulness of vegetation assessments, browsing indices and indicator plant species to monitor deer impacts.

Deer are one component of woodland and it is important factors affecting deer are considered within a landscape framework. Research data has been used to formulate a conceptual model for assessing risks of wild deer in

Wales becoming a problem in woodlands managed for conservation. The model establishes that in addition to land-use type and habitat preference by deer the other key factor that needs to be addressed to reduce the deer risk is the early implementation of a deer management plan, particularly monitoring.

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CHAPTER 1

IMPACT OF DEER AND OTHER HERBIVORES ON BIODIVERSITY AND THE MANAGEMENT OF WOODLANDS FOR CONSERVATION IN WALES

1.0 Introduction

Deer are just one of many variables and many herbivores within a complex matrix of interactions within a landscape (Corney et al. 2004 and Kirby, 2001). Landscape ecology has been identified as a key part of understanding system ecology and its management (Ferris et al. 2000). Under the Convention for Biological Diversity agreed in 1992 biodiversity is defined as 'the variability among living organisms from all sources including inter alia, terrestrial, marine and other aquatic ecosystems the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems'. Since 1992 biodiversity has become a widely used term and is often interpreted in different ways (Thompson and Starzomski 2007) particularly due to its complex inter-dependent structure (Kratochwil 1999). In the UK, biodiversity and nature conservation is led by the UK Biodiversity Action Plan (HMSO 1992). The plan includes 391 Species Action Plans, 45 Habitat Action Plans and 162 Local Biodiversity Action Plans with targeted actions.

The information and research discussed in this study set out to examine the impact of wild deer in Wales, particularly on woodland biodiversity and specifically woodland vegetation. In order to assess the significance of wild deer in Wales we examine the conservation value and management of woodlands and biodiversity before discussing in more detail the impact of deer and other herbivores on biodiversity. We then discuss the current situation of wild deer in Wales and their impacts and management.

In order to put the research into context this chapter reviews previous and current research and examines the complex deer-human interactions that influence deer management. This chapter examines what impact herbivores have and then more specifically deer have on woodland biodiversity. The influences of deer on both the floral and faunal components of woodland ecosystem are discussed before we examine conservation management of woodlands in the UK and Wales and issues relating to wild deer that influence their management. It is recognised that deer also have a role within the nutrient cycle within an ecosystem (Pastor et al. 1993) but this chapter will focus on the impact of herbivores on flora and fauna within a woodland ecosystem.

1.1 Conservation Value of Woodlands in the UK and their Management.

JNCC recently published a progress report into the conservation status of habits and species in the UK (JNCC 2006). The Common Standards Monitoring Programme investigated 57% of sites designated of nature conservation value. There are a total of 6,569 designated sites covering an area of 2.4 million hectares so the sites studied equate to approximately 3744 sites, covering 1.37 million ha which is approximately 5% of the UK land area. Of the woodlands surveyed 56% were identified as being in favourable condition whilst 43% were classified as unfavourable. 16% of unfavourable condition woodlands were classed as recovering whilst 11% were classed as declining. Over grazing by deer was the second most significant negative influence on sites of protected conservation status (Figure 1.1). Lack of site management was seen as the most significant feature of sites being in unfavourable condition after over grazing including over-grazing by deer and livestock. The JNCC report highlights a number of issues from the report. Firstly, the significance of impact of deer browsing is often not recognised for a number of years after deer have become established. Recognition by land managers may also be delayed by staff turnover and changing management priorities. The lack of monitoring is a significant issue in Wales. Of the total 6,569 SSSI designated sites in the UK, only 1,019 are located in Wales covering an area of 235,000ha which makes up only around 10% of the designated UK site area.

Grant schemes to enhance biodiversity and qualities of the landscape in Wales are increasingly being introduced and management plans implemented. Schemes such as the agri-environmental scheme 'Tir Gofal' and the move towards multi age broadleaf woodland stand management ('Continuous Cover Forestry') as part of the 'Better Woodlands for Wales' strategy (WAG 2001) influence the impact of wild deer on biodiversity.

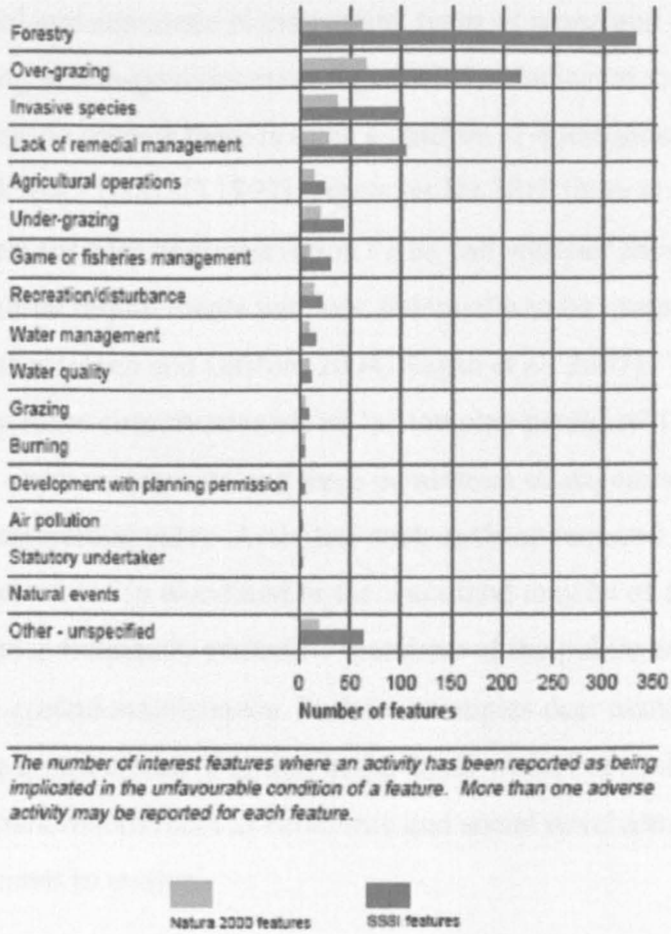


Figure 1.1. Activities associated with unfavourable conditions in woodland habitats (JNCC 2006).

Biodiversity management activities to assist the conservation of rare flora and fauna including small mammals (eg. Wood mice *Apodemus sylvaticus*), also incorporates habitat management such as hedgerow and field margin conservation (Kotzageorgis and Mason, 1997) and hazel coppice conservation. The improvement of landscapes through vegetation enhancement may also help to provide movement corridors and high quality feed sources for deer. In turn, increasing deer habitat utilisation potentially leads to increases in related deer impacts. The renewed use of livestock to graze woodland in some cases may have also accelerated the impact of wild deer as when livestock were previously grazed deer were absent.

In the current social and economic climate many types of woodland managed for conservation belong to non-governmental organisations dedicated to conservation and as with other woodland owners there is often a conflict of management ideals and practices. With UK BAP (HMSO 1992) targets set for 2010 there is much debate as to the selection criteria for sites of conservation value and whether sites are managed to meet species or habitat requirements with one potentially to be managed to the detriment of the other (Bonn and Gaston, 2004, Regan et al. 2007). This has recently been referred to by some conservationists as 'action plan paralysis' (Anon). Some woodland may be small and remote and there is minimal management; others may be larger and be of commercial value. Activities such as those required for charcoal making may be carried out in woodland or the woodland may be of aesthetic value that ensures the site is frequently visited by members of the public and as such often requires extensive ground maintenance. In these examples deer management may or may not be seen as a cost effective option in the small wood but could become an essential management requirement as economic and social development of woodland management continues to evolve.

The key to conservation of woodlands is to identify woodland characteristics that provide resistance to disturbance and elasticity to adapt to changes both natural and man-made without negatively affecting the conservation value of the woodland (Brang 2001). With large herbivores population dynamics must be understood and the application of management should balance conservation objectives alongside environmental and economic objectives (Gordon et al. 2004)

The role of public opinion and landowner perception is very often under-estimated as a factor when considering wildlife conservation and woodland management (Liddle 1997, Tarrant 2003, Deer Initiative 2003). Public perception is often the key factor when conservation policy is determined. People who only visit conservation areas for recreation are often unaware of the work that is required to maintain them.

Also they do not also see the interactions within ecosystems that mean that constant management is required. They also demonstrate key preferences and anthropocentric attitudes to particular species. The ranking of both flora and faunal species and habitats in terms of importance can often dictate management options and the channelling of funding for research and management which may be to the detriment of other species or habitats. Education is seen as a key factor in equalising the imbalance by highlighting the complex nature of interdependent ecosystems.

Whilst pro-active management of woodlands for conservation is essential, a management option that is often overlooked is the option of non-intervention (Peterken 1981, Sydes and Grime 1981, Peterken and Backmeroff 1988). Un-managed woodlands allow natural habitat succession to occur to a stable climax community ecosystem in the absence of human intervention which in itself is the mechanism by which the ancient and semi-natural woodlands of current conservation status evolved. It is important however that these woodlands are still monitored in order that evolutionary disturbance can be identified and any urgent remedial management activity carried out (Danielsen et al. 2005).

1.2 Impact of deer and other herbivores on woodland biodiversity.

It is important to understand the ecological processes that drive the sustainability of woodlands at a landscape level, particularly in the modern land management climate (Ferris et al. 2000). The impact of the grazing regimes of large herbivores such as deer and livestock need to be examined to provide a greater understanding of landscape functions (Kirby, 2004).

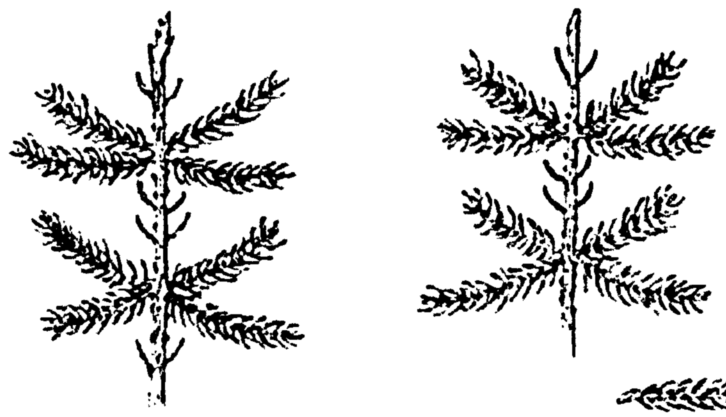
Some mammals can cause significant damage to woodlands through grazing and browsing (Gill 1992a). Grazing by herbivores such as deer can affect the overall diversity of the woodland through influencing species richness. Over-grazing, browsing, trampling or dunging can create gaps that encourages new plant species emergence whereas under-grazing can reduce species richness (Putman 1994). Whilst deer have an influence on biodiversity it is important to be aware that agricultural and forestry practice also directly affect biodiversity (Benton et al. 2002.).

1.2.1 Impact of Herbivores on Biodiversity

Herbivorous browsing of woodlands has been recognised for a long time as a serious woodland issue (Ashby 1959). As part of an ecosystem it should be recognised that within a system with many components there is often a cumulative effect of direct and indirect activities by different sources and this is no different with herbivores (Strauss 1991). For example birch browsed by moose in the first year appeared to change leaf quality and produced an increase in insect and hare browsing in the following year (Danell and Huss-Dannell, 1985).

Non-mammalian herbivores such as birds and insects interact with woodland biodiversity through feeding and nesting activities (Campbell 1974, Dennis 1997). Common seed eating birds such pigeons can also affect regeneration of woodland species such as oak and also influence long term woodland development (Mellanby 1968).

Physical impacts by herbivores are usually created through browsing, fraying and trampling (Hodge and Pepper 1998). Browsing is where herbivores selectively feed on buds, shoots and foliage or remove bark from stems or branches. Selective removal of under-story vegetation can have long term effects on the viability of some plant species populations (McGraw and Furedi 2005) and the impact of deer on flora is discussed in more detail later in this chapter. Removal of bark from stems and branches by gnawing or rubbing is known as bark-stripping. Rubbing bark off trees is also known as fraying and usually occurs as a result of male deer rubbing new antlers to remove 'velvet' or to mark territories. The species that causes the damage can often be identified through differences in browse pattern (Figure 1.2.).



Browsing by deer and sheep leaves ragged ends on stems and branches. The shoots are always eaten.

Rabbits and hares leave clean diagonal cuts on ends of stems and branches. The shoots are often left lying by rabbits, always by hares.

Figure 1.2. Identification of mammal browsing damage (Hodge and Pepper 1998)

1.2.2 Impact of Mammalian Herbivores on Woodland Biodiversity.

Small mammals such as voles, rabbits and squirrels affect biodiversity and woodlands, particularly in terms of bark stripping of regenerating trees and the browsing of young flora (Hodge and Pepper 1998, Putman 1994). To give examples of the range of impact of small herbivores on biodiversity in woodlands we can compare rabbits, voles, mice and squirrels. Whilst rabbits cause damage primarily through browsing and bark stripping up to a height of 540mm (Pepper 1998), voles and mice not only cause similar damage around the base of the tree but also can bark strip higher up the stem commonly from one to two metres in height and also harvest tree seeds (Rogers-Brambell 1974). Damage to woodland through grey-squirrel damage is recognised widely as a serious threat to woodlands in the UK (Mayle et al. 2003). Grey squirrels cause damage to woodland particularly through extensive bark-stripping that can result in tree death, and browsing of tree seeds. Roots, bulbs, invertebrates, birds eggs and nestlings may also be taken.

Larger herbivores often have a more visible effect on woodland biodiversity (Table 1.1). In particular herbivores affect regeneration and vegetation structure which in turn affects other species of organisms. The level of impact can either be positive or negative depending on levels of grazing or browsing (Mitchell and Kirby 1990).

Table 1.1 Classification of some herbivores and their potential impact on upland woodland vegetation (Mitchell and Kirby 1990)

Herbivore	Type	Impact
Cattle	Grazer	Low selective herbaceous bulk feeder, trampling damage may be considerable in regenerating woodland. Will browse unselectively.
Horse	Grazer	Low selective herbaceous bulk feeder, creates large mosaics in grassland, tendency to strip bark. Will browse unselectively.
Sheep	Grazer	Highly selective herbaceous feeder, inclined to browse especially when the quantity and quality of available herbage is low.
Red deer	Grazer/Browser	Highly selective grazer, more inclined to browse especially when the quantity and quality of available herbage is low; bark stripper.
Goat	Browser/Grazer	Highly selective browser, will graze herbage when quality is high, bark stripper, destructive to saplings.

The grazing of ungulates is a common woodland management tool to regulate under-story vegetation (Frank 1998) although where excessive grazing occurs by other herbivores in addition to deer the effect can become negative (Linhart and Whelan, 1980). A moose for example can browse on 10,000 buds, tramples 25m square, producing 14 faecal pellet groups and ten litres of urine a day (Dannell & Bergstrom

2002) illustrating its effect on the woodland ecosystem in terms of nutrient recycling. Where fencing may be poor and sheep incur into woodland they can also negatively affect regeneration that can only be rectified by the exclusion of the sheep (Pigot, 1983).

The grazing of woodlands by livestock, particularly cattle, has been widely documented (Armstrong et al.2003, Mayle 1999a). Research has shown their value to biodiversity although positive influences on biodiversity are reliant on timing of exposure of woodland to livestock grazing pressure and must be closely monitored and managed (Armstrong et al. 2003). Low levels of woodland grazing by large herbivores such as deer can promote a greater diversity of vegetative species and structure (Mitchell & Kirby 1990). Grazing of woodland vegetation has specific direct and indirect effects on the ecosystem and the long-term sustainability of the woodland flora and fauna, as illustrated in Table 1.2. The table also provides a useful tool to demonstrate how different intensities of grazing affect the floral and faunal components of a woodland ecosystem.

An example of the landscape level influence of grazing impacts by livestock and large herbivores such as deer have been illustrated within riparian systems with fish habitats (Platts 1984, Larson et al. 1998, Hunt 2003). Where there has been excessive grazing by sheep and/or deer in upper river catchments areas problems can be created causing riverbank erosion and an increase in siltation and acidification effects. Vegetation responses are often localised and very site specific depending on riparian stream habitat and grazing. These effects in turn, influence freshwater habitat and its species composition. Looking at the wider landscape however, it has been indicated that it would also be difficult to carry out accurate research to establish the link between the woodland and freshwater ecosystems to determine the influence of grazing due to the complex interaction between natural and manmade parameters that need to be considered (MacDonald et al. 1991). These parameters also vary over time and therefore analysis can only provide a basic assessment of the significance of the functional relationships within the ecosystem.

Table 1.2. The impact of increased grazing intensity on flora and fauna of woodland (shaded boxes indicate areas of most interest to nature conservation). (Mitchell and Kirby 1990)

No grazing → High grazing intensity

Trees & Shrubs	No regeneration due to competition from dense ground vegetation	Creation of regeneration niches	Loss of seedlings Damage to saplings	Loss of saplings, Severe tree browsing	Barking of mature trees Loss of shrub layer	Creation of parkland or moorland
Higher Plants	Reduced diversity dominated by by a few species	Reduction in vigorous species Increase in diversity	Reduction in vegetation structure. Increase in grazing tolerant species	Loss of plant diversity, particularly of grazing sensitive species	Loss of cover and damage due to trampling. Bare ground	Impoverishment due to net loss of nutrients from the system
Lower Plants	Reduced cover and diversity due to competition from higher plants	Increase in cover of ground dwelling species as competition from higher plants reduced		Damage to ground dwelling species due to trampling	Reduction of drought sensitive bryophytes	Increase in epiphytic lichens associated with parkland
Small Mammals	High small mammal populations, a few species predominate	Increase in diversity as structural diversity increases	Reduction in small mammal populations as ground vegetation structure simplified		Reduction of populations through competition for food	Loss of diversity and abundance. Species of open ground predominate
Birds	Favouring birds of dense shrub layers	Increase diversity as structural diversity increases	Increase in species favouring low shrub cover	Loss of ground nesting birds due to poor concealment	Loss of species dependant on berry bearing shrubs	Reduction in in raptors dependent on small mammals
Inverte-brates	High populations of phytophilous	Increase in diversity as sward structure diversified	Increase in dung utilising species	Decline in woodland species		Increase in parkland and moorland species

1.2.3 Impact of Wild Deer on Biodiversity.

Although some work has explained the impact of wild deer on biodiversity it remains difficult to monitor, quantify and evaluate (Gill 2000). Deer themselves have an impact on biodiversity not just through the effects of their browsing activities but also through such activities as trampling and soil impaction, seed dispersal and nitrogen recycling as well as providing a host for a number of insects, bacteria and viruses (Crawford et al. 1993).

When considering biodiversity it is important to remember that deer themselves are an integrated ecosystem component and not just an external influencing factor. It is important to recognise that their health and welfare is as important as other component species and deer can be negatively affected by other species in their environment. The harassment of ungulates by insects can cause body weights to be reduced as adaptive behaviour reduces food intake (Colman et al. 2003). Within ecosystems ungulate browsing can also be negatively affected not just by lack of food sources (Choquenot and Ruscoe, 2003) but also habitat fragmentation (Bright, 1993) and habitat availability (Stalmans et al. 2002).

It is important to emphasise at this point that physical characteristics such as geology, topography and climate are also of huge influence when it comes to successful woodland plant growth and plant species abundance (Corney et al.2004).The success of annual plants has been directly related to differential light and soil fertility conditions (Fridley, 2003). The overhead tree canopy determines the levels of light, wind, temperature and humidity within the woodland ecosystem and this in turn affects regeneration, growth rate and competition of plant species present either positively or negatively (Pedersen and Howard, 2004, Barnes 2003).

1.2.3.1 Impact of Wild Deer on Flora.

Wild deer can affect flora composition in a variety of ways. Direct browsing of plants can alter the vegetative diversity of plant species (Dannell & Bergstrom, 2002). Most wild deer species are intermediate browsers or selective concentrate foragers and feeding strategies are often adaptable depending on resources. Larger deer such as red and fallow deer are intermediate feeders whereas smaller deer such as roe and muntjac are concentrate selectors (Hoffman 1985). Direct impacts include plant defoliation and defloration which affects photosynthesis, growth rates and plant survival. Indirect effects include an increase in species richness when dominant plants are removed allowing less competitive, grazing-tolerant plants to grow as well. Deer also influence plant species composition through mechanical seed dispersal (Crawley 1983), particularly grasses and herbs (Gill and Beardall 2001). Decaying deer carcasses also recycle carbon and nitrogen into the soil that is then available to be utilised by plants (Chapin III et al. 2002).

Problems with deer browsing occur as a result of excessive browsing linked to deer overabundance (Cote et al 2004). Browsing is not necessarily damaging as some plants have been shown to compensate for browsing damage and continue to grow without long-term damage (Crawley 1983). At the individual plant level deer often positively select larger shoots within flower ramets and browse varies between ramets. This suggests that deer positively select shoots for size, chemical or nutrient composition and this can prevent overall damage to certain flora (Strauss 1988). *Trollius* or globeflowers for example have been shown to increase in abundance following roe browsing (Alcock, 2000). Another well-documented example of positive browsing is the removal of Bramble (*Rubus fruticosus)* from woodland shrub layer opening up the canopy (Morellet et al. 2001). Whilst the opening of the shrub layer can encourage plant productivity and regeneration at ground level through improved light conditions (McPherson and Weltzin 1998) the removal of shrub cover can affect the survival of young regeneration by making it vulnerable to climate elements or browsing by herbivores (Harmer 1995). An example of the influence of deer browsing on flora has been the increase in forbs and grasses in Wytham woods, Oxfordshire as a result of muntjac grazing (Morecroft et al 2001). Plant species that are negatively affected by deer browsing include Dog's Mercury (*Mercurialis perennis*) (Cooke et al.1995), Bluebells (*Hycinthoides non-scripta*) (Cooke 1997) as well as other tall-growing herbs, ferns and forbs such as Lords and Ladies (*Arum maculatum*) (Diaz and Burton, 1999). A woodland plant species that is not influenced by deer browsing is bracken *Pteridium aquilinim*) (Kirby 2001).

In terms of influencing woodland biodiversity on a large-scale deer show a significant dietary preference for deciduous tree saplings such as hazel (*Corylus avellana*), field maple (*Acer campestre*) and ash (*Fraxinus excelsior*) (Cooke and Farrell 2001). At very low densities deer browsing can encourage natural tree regeneration in most cases where deer are at a higher density their impact is negative (Harmer and Gill 2000). Heavy browsing of tree saplings as a result of increasing deer density that then reduces regeneration will lead eventually to a change in the dominant tree species in the woodland (Figure 1.3). This change influences the growth of plants at subsequent lower levels particularly at the shrub and ground layer (Tilghman, 1989).

Recognition of the indirect effects of deer browsing is important as in the majority of cases the effect of deer on plant competition (Harmer 2001) is through the provision of open areas and reduction in vigorous plant species through trampling and browsing. Deer also act as a seed vector (Hulme 2002) in conjunction with other animals (Herrara 2002).

Figure 1.3. Deer Impacts Index (Marquis et al.1992).

1.2.3.2 Impact of Wild Deer on Fauna

Browsing by wild deer on woodland under-story vegetation can have a direct and an indirect effect on a variety of fauna from invertebrates (Baines et al, 1994, Stewart

2001) to small mammals (Flowerdew and Ellwood 2001). Deer compete directly for vegetative food sources due to overlapping habitat and resource use (Latham et al.1997). Deer browsing can reduce tree regeneration removing ground cover nesting and feeding resources that is utilsed for birds (Goguen and Mathews. 1998). It has been suggested that in some areas of high deer density competition between deer and birds for understory resources such as those found in coppice woodland may be responsible for the decline in songbirds in lowland Britain (Gill and Fuller, 2007). Deer carcasses in addition to nutrient recycling also provide an important micro-climate for invertebrates such as certain species of *Coleoptera* (Melis et al. 2004).

Many species of butterflies demonstrate a preference for cleared coppice woodland habitat (Bigham 1998). Roe deer in particular, show a preference for hazel coppice and can severely and indirectly reduce tree growth thereby removing butterfly habitat (Feber et al 2001, Petley-Jones 1995). Muntjac browsing has also been linked to a decline in egg-laying sites specifically for White Admiral Butterflies (Pollard & Cooke 1994). A change in vegetation structure or reduction in food sources such as Hazel (*Corylus avellana*) could potentially also lead to a reduction in small mammals (Flowerdew and Ellwood 2001) such as Shrews (*Sorex araneus*), Harvest Mice (*Micromys minuteus*) and Field Voles (*Microtus agrestis*). The reduction in these mammals can potentially in turn then lead to the reduction of terrestrial predators such as Tawny Owls (*Strix aluco*).

Other woodland birds are also affected by an increase in deer densities through a change in food sources (particularly invertebrates) and a loss in vegetation and cover available to ground nesting birds such as Nightingales (*Luscinia megarhynchos*), (Fuller 2001). In addition to deer and other mammals, insects including ants, beetles and butterflies also graze on plants often specific species (Strauss and Zangel 2002) that are vulnerable to deer browsing and these effects are not identifiable for a relatively long period of time by which time the damage may be difficult to reverse as the cause may not be obvious.

The presence of deer in some woodland can be beneficial, particularly to invertebrates (Gill 2000) that occupy particular niches such as parasites or dung beetles that rely on deer to provide a resource. In some circumstances deer are in direct competition with invertebrates for vegetation for food sources and can remove invertebrate habitat. However some browsing helps to create open areas (Stewart 2001). There is therefore, great debate over what the ideal deer density is to ensure successful regeneration but prevent long -term damage to the vegetation structure of the habitat but this leads to the suggestion that deer should not be totally excluded from areas but managed at a 'bio- neutral' level and recognised as a valuable component of the ecosystem.

1.3 Wild Deer in Wales and Great Britain.

1.3.1 History of wild deer in Great Britain

Historical information regarding the presence or absence of wild deer and their characteristics in the UK and Wales can be easily gathered from a variety of sources. Comprehensive texts including Perry 1978, Yalden 1998a, 1998b and Ward 2005 who have reviewed data and literature surrounding estimation of deer abundance and distribution in the UK. More recent attempts have been made to assess and predict deer distribution data and advise on current and future populations and the factors affecting their sustainability and management (Mayle 1996, Mayle 1999b, Mayle et al. 1999, Ward 2005, White et al 2004). These predictions may prove more successful at the more local, regional level due to the number of variable features affecting deer and their abundance at a landscape level making predictions difficult. In this chapter we examine deer distribution, then briefly discuss characteristics of the individual deer species before examining habitat use, feeding preferences and then deer impacts and their assessment. Finally we examine the options available for deer management and the constraints placed on methods available and their application in the UK and Wales.

At present there are six species of deer found wild in Great Britain. In order of the greatest abundance these are Red (*Cervus elaphus*), Roe (*Capreolus capreolus*), Fallow (*Dama dama*), Muntjac (*Muntiacus reevesi*), Sika (*Cervus Nippon*) and Chinese Water Deer (*Hydropotes inermis*) (Yalden 1998b). Four of these species of deer currently occur in the wild in Wales. These are Fallow, Roe, Red and Muntjac (Ward 2005).

Wild deer have been present in the UK for thousands of years and over the past few centuries as habitats have improved and there has been a total loss in natural predators such as wolves the wild deer population sizes and distribution have expanded (Perry 1978, Yalden 1998a). Through increases in their population size and distribution deer have come into conflict with commercial countryside activities such as forestry and agriculture (Gill 1992a and 1992b, Putman and Moore 1998) through competition for resources as well as affecting the overall landscape composition through their effects on biodiversity.

Historically, Elk (*Alces alces*) and Reindeer (*Rangifer tarandus*) were present in Great Britain around 11-10,200 bp during the postglacial period although some research suggests that Elk and Reindeer died out around 3,000 bp there is some evidence they were present for around another 1,000 years (Yalden 1998a). At around the time that Elk and Reindeer died out Red (*Cervus elaphus*) and Roe (*Caprelous capreolus*) became established as native species. Red and Roe populations fluctuated greatly over the centuries particularly due to hunting pressures, world events such as wars, urbanisation, changes in forestry and land management as well as climate change. Fallow (*Dama dama*) were introduced by the Normans in the 11th Century (Yalden 1998b) and this period also saw the introduction of the first hunting laws in terms of favouring the ownership of the deer to landowners and establishing the crime of Poaching. Sika (*Cervus nippon*), introduced from Japan in the late 19th century via Ireland founded the origin for populations found in the wild today (Ratcliffe 1987). Muntjac (*Muntiacus reevesi*) and Chinese Water Deer (*Hydropotes inermis*) have been introduced into the wild as a result of escapes and releases from deer parks and their British origin is from captive stock from Woburn Abbey, Bedfordshire. The deer population was established around 150 years ago although become established in the wild in the later 20th century (Corbett & Harris 1991).

1.3.2 Wild Deer in Wales

In Wales the geography and topography allow deer to graze freely and selectively in woodlands although as the population increases the deer are more likely to start grazing out in pasture land and up on open hillside. Different woodland types react to a range of deer densities in different ways (Gill 2000). Predator-prey interactions also produce fluctuations in populations (Townsend et al. 2000) and evidence suggests that foxes have been shown to influence roe deer population recruitment (Kjellander et al. 2004). It has been identified that density independent factors such as climate may have a more important effect on deer populations through increasing mortality than density dependence factors (Putman et al. 1996) that are likely to affect fecundity. Habitat quality (rather than population density) is more likely to determine fertility (McIntosh et al. 1995) which supports the likelihood of deer populations in Wales continuing to increase.

In addition to the four main species of deer found living in the wild in Wales, Sika (*Cervus nippon)* have been observed but their sightings can be associated with Wildlife Parks (Mayle & Fletcher 1998). The only permanent population of Sika in the wild in Wales are red/sika hybrids with a probable minimum number of 30 individuals (Besset pers comm.2003, Havard pers comm.2003) and originate from a now closed wildlife park in Ceredigion. The release of Chinese Water Deer into the wild in North Wales was recorded in 1953 but no deer survived to establish a viable population (Slater, 1988).

In a 1996 Forestry Commission research project (Mayle & Fletcher, 1998) reports of deer sightings suggested that there was a very large 'unknown' deer population in Wales but on investigation all the sightings can be attributed to red deer that could be associated with past and presently operating deer farms. The research project also highlighted the lack of knowledge at the professional forester level in terms of identifying, monitoring and assessing deer that needed to be addressed to ensure more accurate monitoring of the wild deer population. The population and more importantly the distribution, of the main four species of deer found in Wales appear to have increased over the last thirty years (Ward, 2005). The distribution maps that follow (Figures 1.5, 1.6, 1.8 and 1.11) in this chapter are of the different deer species distribution in the United Kingdom. The maps show the pre 1972 data alongside the most recent 2000 data. If trends in the impact of wild deer that have been evident in England and Scotland are representative (DEFRA 1994a), it is only a matter of time that without further monitoring, research and implementation of management requirements that the wild deer population in Wales could have a significant impact on the Welsh countryside and its biodiversity.

Analysis of the Welsh data suggests that wild deer have expanded their ranges on average 2 to 3% per annum, whereas individually, sika and muntjac have expanded the most rapidly at nearly 6% and 9% respectively (Ward 2002 unpub.). These data are based on occupancy or non-occupancy of land per $10km^2$. This quantified estimate is similar to analysis of data from the 1972 and 2000 BDS Deer surveys which illustrated that deer have expanded at a UK level (Table 1.3).

Table 1.3. Estimated rate of change of wild deer species abundance in UK per year (Ward 2005).

UK Wild Deer Species	Rate of change of distribution per year (%)
Red	0.3
Fallow	1.8
Chinese Water Deer	2.0
Roe	2.3
Sika	5.3
Muntjac	8.2

Information from land owners and managers suggests that in Wales Muntjac and sika or more specifically red/sika hybrids are increasing in abundance at a greater rate than the rest of the UK and therefore may be a greater threat in terms of increasing levels of impacts than other species of deer. This assumes that increasing deer abundance is directly related to negative impacts on the environment which may not necessarily be the case.

Human activities such as the building of houses and roads also influence local deer distribution and an increase in road network and roadside verge habitat has also provided an ideal sanctuary and movement corridor for wild deer as well as other species of wildlife (Underhill and Angold 2000). An increase in suitable habitat may aid an increase in deer distribution and abundance but currently no evidence exists to suggest that road networks have a notable affect on increasing deer abundance. There is however clear evidence of how roads negatively affect deer habitat selection and utilisation by creating barriers to deer movement across them (Hubbard et al. 2000). There are a reported 30-50,000 road traffic incidents in great Britain involving deer per annum and whilst the number of deer injured or killed is unknown these collisions result in an average of ten human fatalities per year and many more injuries (Deer Initiative, 2005).

In the UK, climate change is also now a factor that is being investigated as a factor influencing the future deer population and its behaviour (Irvine et al 2007). In the future if global warming proceeds as predicted milder winters, warmer wetter spring may produce earlier calving dates and faster growth which will reduce juvenile mortality leading to deer populations increasing further. Increases in spring productivity in vegetation will improve food resources and may increase the deer carrying capacity within some habitat types. We will discuss carrying capacity later when we discuss deer management options (1.7.2). Reduced rainfall may create water stress that may influence deer behaviour and encourage migratory behaviour based on water resource availability.

In the rest of this section we will discuss the distribution and biology of the four deer species found in the wild in Wales in addition to their impacts and management. The maps illustrating the UK distribution of the deer were published by the Mammal Society in 2005 (Ward 2005) using data from work by the British Deer Society, Scottish Natural Heritage, Forest Research and The Wales Deer Initiative (by this author). In addition the Biological Records Centre provided further historical records. Data was not collected for Northern Ireland or Eire.

1.3.2.1 Fallow Deer (*Dama dama*).

Fallow (Figure 1.4.) are the most widespread and most abundant species of wild deer found in Wales at present (Fig 1.5). Useful references include Chapman and Chapman (1982) which gives a comprehensive background to the history, ecology and behaviour of fallow in the UK. Fallow populations have fluctuated over the centuries and the most recent re-introductions occurred following the Norman invasion in the 11^{th} Century (Chapman & Chapman 1982). Recent carbon dating of fallow bones in Sussex (Sykes 2009) suggest that fallow may have been introduced by the Romans as early as AD60. Escapes and degradation of deer parks over the last two centuries have resulted in the establishment of a number of large fallow populations in Wales. Fallow in the areas of Welshpool, Llandeillo, Dolgellau, St.Asaph and Resolven can all potentially be linked to historic houses and estates where they are likely to originate from. Some Deer Parks still exist at these sites today and include deer at Powis Castle in Welshpool and Margam Park near Resolven as just two examples. Over the past five years the core fallow populations around Wales have increased in abundance and are now perceived to cause more damage in woodland in terms of browsing as well as grazing out on grassland. Work in the Wye Valley suggests that there may be between 1500 and 3000 fallow in the Lower Wye Valley area alone (Symmons 2006).

Fallow stand about 90-95 cm at the shoulder and the males weigh between 45 and 95kg depending on maturity. Does are smaller and weigh between 35 and 45kg. Bucks can be identified by the presence of unique antlers and have a dark dorsal stripe that runs to the tip of long tail. There are four main colour variations: Common, Menil, Melanistic (or black) and White. Bucks have easily recognised large palmated antlers.

Figure 1.4. Fallow Deer Group (Photograph by Forestry Commission)

In terms of behaviour fallow deer can be found most commonly in herding groups of between 10 to 150 individuals depending on the degree of forestation in their habitat. Herd ranges vary but females can use an area of up to 40ha. Fallow rut from the end of September to Mid November and does can conceive from about 16 months old. The gestation period is about 33 weeks and Fallow usually produce single fawns in June. Fallow are primarily non selective roughage grazers (Hoffman 1985) and their diet consists of mainly grass with selective feeding on crops and woody browse (Chapman and Chapman 1982, Mayle 2003).

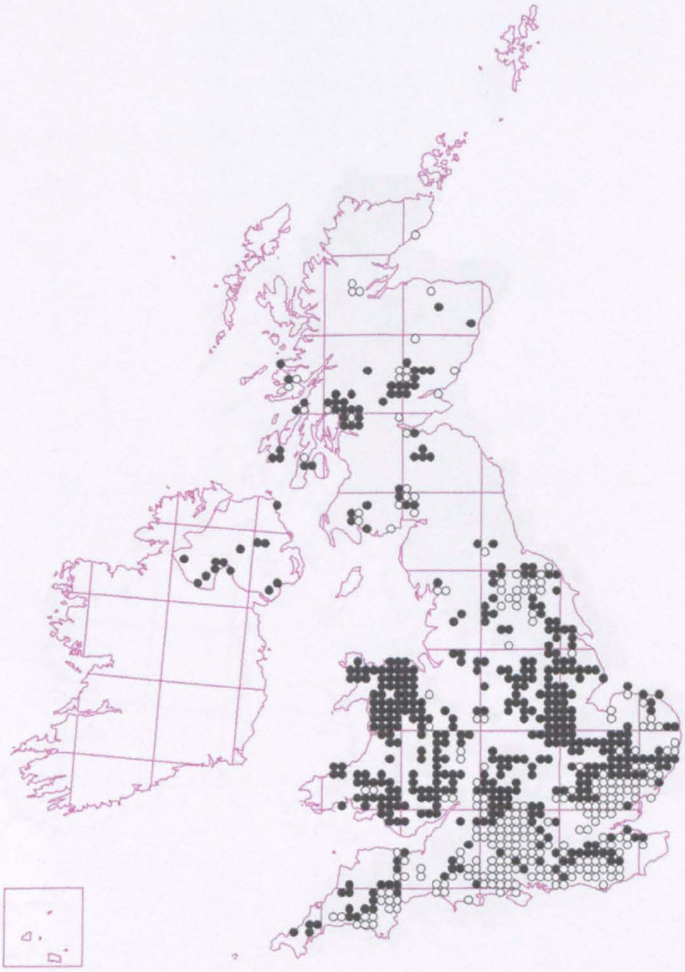


Figure 1.5. Distribution of Fallow Deer (*Dama dama*) in United Kingdom. (Map Ward (2005)○ Data pre 1972, ● data 1973 to 2002)

1.3.2.2 Roe Deer (*Capreolus capreolus*).

Roe national range has increased significantly over the past thirty years in Great Britain (Figure 1.6 and 1.7). Useful references include Fawcett (1997) and Prior (1995) that gives a useful introduction in the history, ecology and behaviour of roe deer in the UK. Although one of the two true native wild deer species in Wales about two hundred years ago roe had become extinct in Wales and have only recently started to recolonise Wales. The population has continued to grow although originally in the 1960s Roe was reported to only be found around borders region of England and Wales and not in Wales (Fawcett 1997) which with more recent data has proved to be inaccurate (Ward 2005).

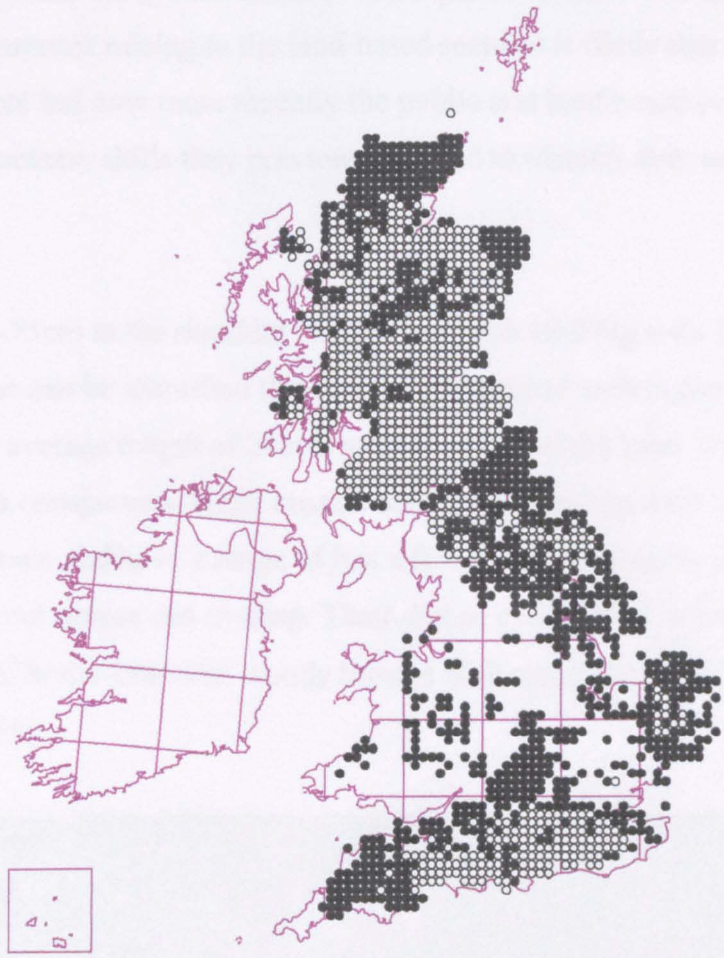


Figure 1.6. Roe Deer (*Capreolus capreolus*) Distribution in United Kingdom (Map Ward (2005) ○ Data pre 1972, ● data 1973 to 2002)

Data collection regarding Roe abundance in Wales has been scarce prior to Deer Initiative Wales research. Roe populations in Wales have significantly increased in size and distribution over the last few decades. Previously unrecorded populations have been identified as far west as Aberystwyth and north near Bangor. Roe have also been noted in suburban areas including Tredegar near Merthyr Tydfil in south Wales.

The apparent increase in deer numbers has less to do with dramatic immigration and recruitment over this period than with an increase in survey effort as it became clear from landowners surveyed that sightings of roe deer were more frequent than survey reports of the British Deer Society suggested. With increased awareness with regard to wild deer in Wales being introduced over the past five years with landowner surveys and awareness raising to the land-based sector it is likely that the deer have always been there but now more recently the public and land-based professionals have obtained the necessary skills they previously lacked to identify deer and their presence.

Roe stand at 60-75cm at the shoulder and bucks weigh 18-27kg with does weighing slightly less. Roe can be identified through the presence of antlers usually three pointed with an average length of 24cms with a coronet at the base. Roe also have no visible tail and a conspicuous black muzzle and white chin. Most roe can be found in pods of 3-4 animals and have a range of just a few square kilometres although some do range wider and ranges can overlap. Their diet as concentrate selectors (Hoffman 1985) consists of herbs, bramble, woody browse with some grazing on grass and crops (Prior 1995).

Figure 1.7. Roe Buck in regenerating clearfell woodland area (Photograph by Forestry Commission)

The rut is earlier in the year than the other larger species of deer and occurs in late July to early August as opposed to September, October. Does do not produce offspring until late May similar to the other species and this is because roe does have 'delayed implantation'. Delayed implantation is where after fertilisation the egg develops slowly and does not implant in the uterine wall until the following December after which normal development continues (Aitken 1974). Healthy Roe does can produce between 1to 4 offspring per litter depending on food intake and body mass (Hewison and Gaillard 2001).

1.3.2.2 Red Deer (*Cervus elaphus*) and Red/Sika Hybrids.

Although native to the UK, Red deer became extinct in Wales as a result of over-hunting and loss of habitat (Perry 1978). Following the escape of deer from deer parks and farms across Wales reported by landowners and deer managers a small population of red deer have become established (Figures 1.8 and 1.9.).

The largest known red deer population in Wales exists in the Brecon Beacons National Park and maximum size of the population is estimated to be 150 to 250 deer (Coleman pers comm. 2002). Unlike their Scottish or even in some areas English counterparts whose populations are much larger and where there is more competition for resources the red deer in Wales remain living in woodland habitats in small family groups and are not to be found herding out on open hill on higher ground. Because of the small deer groups and increasing migratory pattern it is difficult to establish an accurate population size.

Red Deer stand up to 1 to 1.5 m to the shoulder and weigh up to 220kg. The deer live mainly in single sex groups for the majority of the year and the rut takes place between the end of September and late November. Their diet consists of grass, crops, heather with some browsing on trees and shrubs (Clutton-Brock 1982).

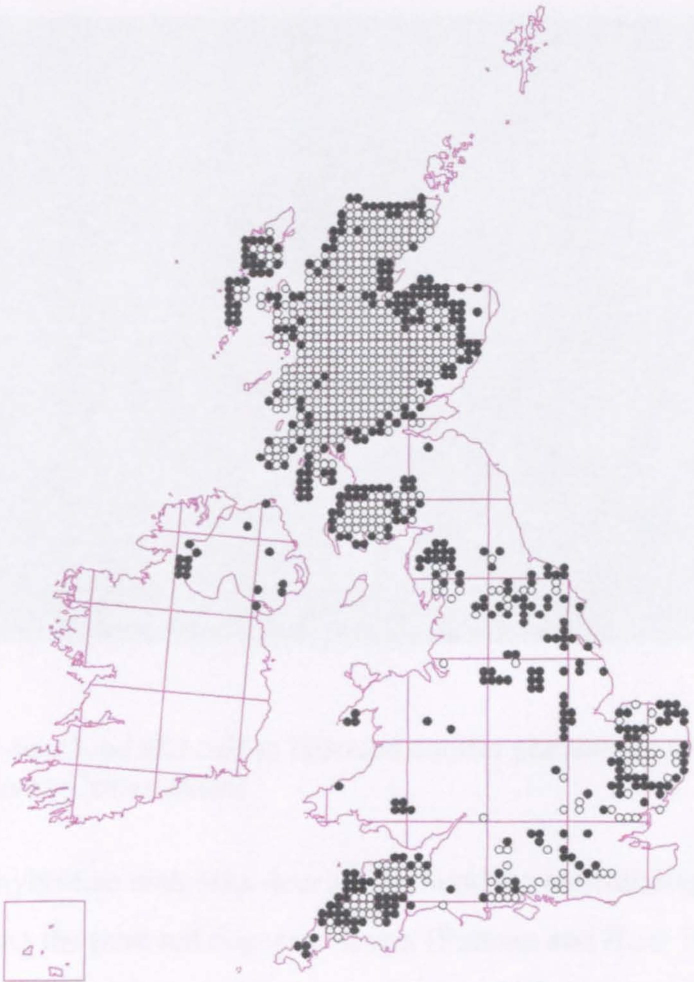


Figure 1.8. Distribution of Red Deer (*Cervus elaphus*) in United Kingdom (Map Ward (2005) ○ Data pre 1972, ● data 1973 to 2002)

In addition to the red deer populations, a small population of sika/red hybrids (Figure 1.10) living in the wild in Wales persists on the west coast. The Wildlife Trust that now owns the site where the deer are centred believe the hybrids originate from a wildlife park. The park was closed and the deer released have hybridised and established a population. Whilst data from deer management group landowner surveys suggest the population may not number more than 30 individuals the population is recruiting well and damage to trees in the surrounding area has been identified. Landowners some distance away from the area the herd is centred on also report sightings which suggest the population is expanding.

Figure 1.9. Red deer hind and calf in browsed conifer plantation (Photograph Forestry Commission)

Red Deer easily hybridise with Sika deer and in Scotland hybridisation is a problem in terms of preserving the pure red deer population (Putman and Hunt 1995).

The future of the population has started the debate in Wales with regard to the management of non-native species of deer amongst landowners and policy makers such as the Countryside Council for Wales. Red/Sika hybrids in England and Wales have only recently been recognised as a management issue having been included for the first time in the latest revision of the Deer Act through specific legislation in the Regulatory Reform Order (Deer) 2007 (HMSO 2007). Whilst as a small non-native population it could relatively easily be removed they live mainly on a Wildlife Trust Reserve where the public are keen to see them as the deer are used to humans and can be seen daily. The deer management group that has been established that aims to minimise the damage caused by the deer but currently resists suggestions that the deer should be removed completely from the area due to public interest in the deer.

Figure 1.10. Red/ Sika Hybrids in West Wales (Photograph by West Wales Wildlife Trust)

1.3.2.3 Muntjac Deer (*Muntiacus reevesi*).

The UK wild muntjac population originates from captive stock from Woburn Abbey, Bedfordshire and established between 150 years ago (Corbett & Harris 1991) and 100 years ago (Chapman et al 1994) and have increased in abundance particularly over the later half of the 20^{th} century (Ward 2005). Useful references include Chapman et al. (1994) and Chapman and Harris (1996) as they provide a good introduction to muntjac species characteristics including ecology and behaviour. In the 1860s the escape of muntjac from the private collection at Woburn Abbey led to the establishment of a wild UK muntjac population (Figure 1.11).

Increased sightings of Muntjac in Wales, particularly in South Wales by land owners and land managers have now started to occur and have confirmed that the species has established a healthy breeding population (Figure 1.12). It is believed that the muntjac in Wales originate not only from the natural spread of the expanding population but also significantly through the translocation and release of the deer by humans (Chapman et al. 1994). Evidence of human intervention and release of muntjac into areas in Wales can be suggested through the apparent correlation between the spread of muntjac across south and north Wales through the M4 and A55 road corridors alongside other anecdotal evidence that would suggest the spread is not natural migration. Muntjac are non-native species and this translocation and release is illegal under Schedule 9 of the Wildlife & Countryside Act 1981.

Figure 1.11. Muntjac on field edge (Photograph Forestry Commission)

Muntjac stand at 40-60cm at the shoulder and weigh between 10 - 18 kg for males and 9-16kg for females. Male muntjac can be identified through single or double point 7-10cm antlers and although females do not have antlers both carry canine teeth that at up to 4cm long that are often visible. Females can breed continuously from six months old and do not have an annual reproductive cycle. The gestation period is about 120 days and multiple births are not uncommon. Their diet includes bramble, herbs, nuts and fruit, coppice shoots and flowers (Chapman et al., 1997, Mayle 2003).

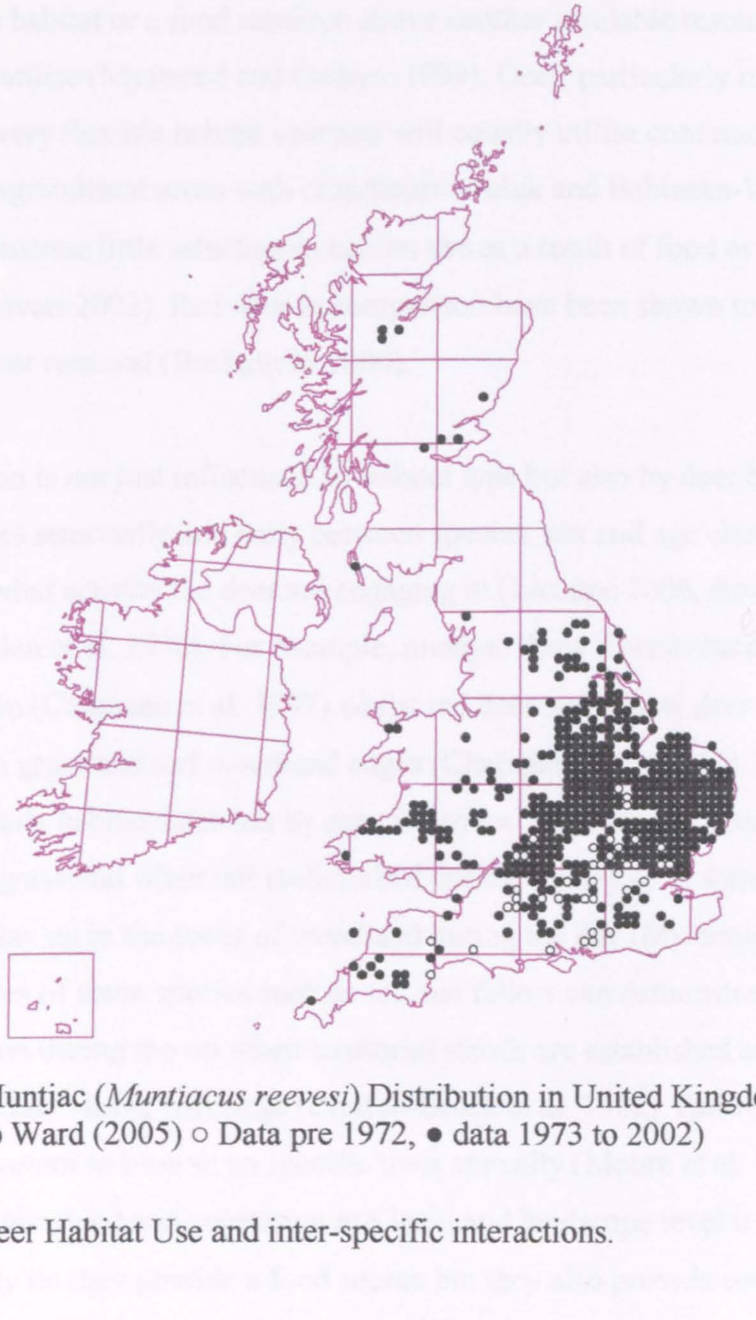


Figure 1.12. Muntjac (*Muntiacus reevesi*) Distribution in United Kingdom. (Map Ward (2005) ○ Data pre 1972, ● data 1973 to 2002)

1.4 Wild Deer Habitat Use and inter-specific interactions.

1.4.1 Wild Deer Habitat Use.

Deer have been shown to be very flexible and adaptable in habitat use (Putman 1994) and modelling their behaviour becomes very difficult (Moij and DeAngelis, 2003).

Habitat preference or more specifically habitat selection where deer choose to occupy one area more frequently than another area can be illustrated where as an example, roe may select one habitat or a food resource above another available resource they are also known to utilise (Mysterud and Ostbye. 1999). Deer, particularly roe have been shown to be a very flexible habitat user and will equally utilise continuous woodland cover or open agricultural areas with crop fields (Auluk and Babinska-Werka, 1990). Roe also demonstrate little selection in habitat use as a result of food or cover removal (Cimino and Lovari 2003). Red deer in comparison have been shown to be more sensitive to cover removal (Borkowski 2004).

Habitat selection is not just influenced by habitat type but also by deer behaviour which can varies seasonally and daily between species, sex and age class of deer depending on what activity the deer are engaging in (Licoppe 2006, Bowyer et al. 2002, Van Deelan et al. 1998). For example, muntjac show a preference for occupying dense vegetation (Chapman et al. 1997) whilst red deer and fallow deer prefer more open areas with grassland and woodland edges (Chapman & Chapman 1997). Seasonal and daily habitat selection by deer for cover can vary and deer may feed out in the open on grassland when left undisturbed during the day or in some areas at night and then lay up in the cover of woodland during the day (Mysterud and Ostbye 1999). The males of some species such as roe and fallow can demonstrate specific habitat utilisation during the rut when territorial stands are established and marked with both scent and visible markings (Clutton-Brock et al. 1982). Fallow have also been shown to return to browse on specific trees annually (Moore et al. 2000). Deer species utilise woodland and vegetation at a local and landscape level in a variety of ways as not only do they provide a food source but they also provide cover (Bender et al. 2004). Fallow have been shown to cause a higher degree of damage in plantations surrounded by cover within woodland as opposed to plantations in open arable areas (Moore et al. 1999).

In Wales the research that has been carried out with regard to deer habitat use and deer densities has been for public forestry by Forest Research for fallow (Smith and Mayle 1994a and 1994b and Smith, et.al. 1995). This work suggests that fallow show significant selection for Restock conifer sites (5 years after planting), Retention

Conifer (>54 yrs), Mature Larch (>21 yrs) and thicket Conifer (10-20 yrs) (Smith and Mayle 1994). It was also shown that as deer density increases the deer utilise less selected habitat sites such as agricultural and grazing edge sites. Figure 1.13 shows a comparison of habitat selection between Margam, Coed- y Brenin and Hendre in Wales (South, North- West and South- East Wales). Fallow at low densities show a selection for broadleaves and when deer density increase and competition for feed and habitat increases less common habitats are utilised including farmland and moor land.

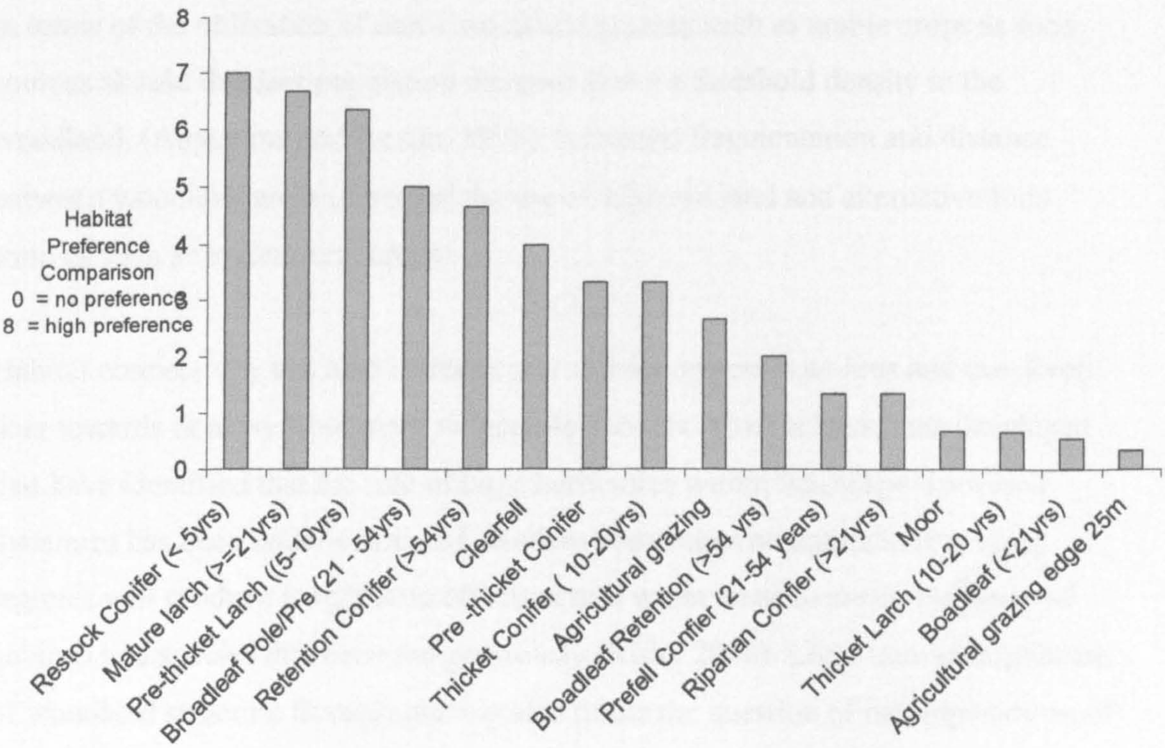


Figure 1.13. Fallow selection for woodland habitat type across three areas across Wales (From Smith and Mayle 1994a, 1994b and Smith et al 1995)

We have previously discussed the manmade influence on deer population increases in distribution and abundance through the provision of habitat and movement corridors along road networks. It is also important to acknowledge that natural landscape connectivity and wildlife corridors affect wildlife habitat usage (Haddad et al. 2003). It has been shown that boundaries between different vegetation types often become a focus for over-grazing by large herbivores (Palmer et al. 2003). Boundaries such as hedgerows on farmland are also of importance to other species such as small mammals (Kotzageorgis and Mason 1997) which is where deer can have an impact and we have discussed the impact of deer on woodland flora and fauna at the beginning of this chapter.

Range areas and primary movement corridors can render what appears to be a robust ecosystem in terms of vegetation success vulnerable to deer browsing (Van Deelen et al. 1998). Fragmentation of deciduous woodland has also been shown to be important in terms of the utilisation of non – woodland grazing such as arable crops as food sources should the deer population increase above a threshold density in the woodland. (Augustine and Jordan. 1998). Increased fragmentation and distance between woodland areas increased the use of adjacent land and alternative food sources such as agricultural crops.

Habitat connectivity can also increase deer utilisation across an area and can divert deer towards or away from more vulnerable habitats. Models have been developed that have identified that the role of large herbivores within landscape woodland dynamics has been under-estimated. Modern constraints on naturalistic grazing regimes will produce longer term effects across wider areas to create the range of habitats and species that occurred previously (Kirby 2004). Long-term manipulation of woodland structure through grazing also raises the question of the implications of removing grazing. The need to identify clear recovery targets and management activities following deer damage to conservation woodlands and illustrates the importance of modelling deer browsing history (Coomes et al, 2003, Vila et al, 2005, DeCalesta and Stout 1997).

In addition to habitat selection and landscape connectivity factors, habitat use by deer is affected either temporarily or permanently by disturbance. Examples include disturbance by fire either naturally occurring or manmade (Borkowski, 2004, Rogers et al. 2004) or sudden weather changes (Labisky et al. 1999). Disturbance can also be as a result of change in land-use such as removal of cover as a result of agricultural intensification (Cimino and Lovari, 2003) or from access by the public for recreation (Reimers et al. 2003). Commercial land management activities such as logging also create short –term disturbance and change in deer habitat use (Linnel and Anderson, 1995).

1.4.2. Wild Deer Species Interactions.

In the previous section we have identified that habitat use for food resources and cover is a key influence on deer behaviour. In a countryside where several species of deer may cohabit it is important to understand species interactions before we look at feeding selection and where competition between species can occur. Recent information suggests that the co-location of different deer species may in fact be the result of inter-specific co-operative behaviour potentially as an anti-predatory strategy (Bartos et al. 2002). There is also clear evidence of inter-specific competition for resources in woodland. The potential for inter-specific competition becoming a key factor in deer species distribution depends partly on the respective population sizes. Competition will increase as deer population increase. It was found that in lowland commercial pine forests whilst roe and muntjac had a generally similar habitat use there were specific differences in key preferences for habitat use and food resources at certain times, particularly winter when demands overlap between species (Hemami et al. 2004).

Muntjac easily co-habit with other deer species such as Fallow and due to their fast aseasonal reproductive cycle (Chapman et al. 1997) they are able to migrate and colonise new areas increasing the distribution of the population rapidly. It has been identified that red deer may displace roe deer through inter-specific competition for habitat resources although this situation can also be explained through climatic tolerance levels of the different species (Latham et al. 1997). As deer numbers are likely to increase then intraspecific and interspecific competition will be become an increasingly important factor affecting deer distribution and abundance and it is likely to affect deer management priorities. Where more successfully productive and competitive deer species such as muntjac occur they will need to be prioritised for management over other deer species.

1.4.3 Wild Deer Feed Selection.

As previously outlined deer feeding selection varies between species (Hoffman 1985). For grazers and intermediate feeders such as red and fallow it has been shown that their habitat use is influenced by adjacent land-use and in particular in terms of the utilisation of agricultural grassland as opposed to forestry and woodland (Mysterud et al. 2002) due to the effects on development of body weight.

Variability in feeding is also influenced by preferred forage availability, time, location, climate and topographical factors (Gill et al. 1997, Latham et al. 1997, Labisky et al. 1999 and Mysterud et al. 2001.). The seasonal migration of some species of deer such as red deer between low and high altitude as well as the shift in plant species availability also affects deer browsing patterns (Conrad et al. 2001). Levels of rainfall in particular affect levels of recruitment to deer population as well as offspring survival (Ginnett and Young. 2000). This in turn affects the distribution of deer and the habitats utilised through migration and variable topography (Mysterud et al. 2001). The location of manmade obstacles such as road networks also affects deer distribution (Rowland et al. 2000).

In addition to variation in feeding preferences between species in some cases there are also clear differences between sexes in terms of dietary preferences (Staines et al. 1982, Putman et al. 1993). Differences between sexes also appear more significant at certain times of year to meet the developmental needs, particularly of body weight for the different sexes during the breeding season (Bugalho et al.2001). Red and Fallow males have been shown to eat higher quality forage over winter compared to females in spring and summer (although in terms of volume males are more likely to consume larger volumes of poorer quality feed than females) suggesting that availability is a key factor determining dietary selection (Staines et al 1982, Putman et al.1993). The demand for higher forage quality also in turn affects migration, particularly with preferences for higher altitude and north facing slopes where the high quality forage tends to grow (Mysterud et al. 2001). It has also been shown that some deer species will not browse particular plant species to extinction in a local area It has also been suggested that roe can also appear to eat more of an usually less palatable but abundant plant species as opposed to a less abundant more palatable plant species to potentially manage and conserve the food resources in their home range. There is also a trade-off between feed quality and quantity consumed depending on forage availability (Illius et al. 2002).

1.5 Deer Impacts.

The importance of the impacts of wild deer have been widely debated as they have both negative and positive influences in both natural and manmade environments (Benner 2000, Hunt 2003, Petley-Jones 1995, Rose 1995, West and Parkhurst 2002). As the populations of wild deer have increased, so too have their impacts, particularly on forestry (Gill 1992a). There has also been an increased impact on woodland ecology (Fuller and Gill 2001) and the impact of herbivores including deer have been discussed earlier.

Deer influence can be direct or indirect on the natural environment (Baines et al 1994, Gill 2000, 2003, Kirby 2001). More specifically deer can affect the flora (Alcock 2000, Cooke 1997, Gill and Fuller 2007) and fauna (Dannell and Huss-Dannell 1985, Feber et al 2000, Stewart 2001) within it.

Commercial land management enterprises such as forestry (Cooke and Lakhani, 1996, Ward et al 2004) or agriculture (Doney and Packer 1998, Langbein and Rutter 2003, Putman and Moore 1998) are also affected. Deer also influence the human environment through their impacts on gardens (Cole 1997), in urban areas (DEFRA 2006) and in situations such as deer and vehicle collisions (Hubbard 2000). The economics of deer damage and deer management are discussed in more detail later.

There are a variety of ways of identifying if wild deer are present and assessing their impact in an area (Mayle et al 1999 and Cooke, 2006b) and estimating population size and damage are discussed in the next section and form the basis for the research presented in the following chapters.

1.6 Assessment of Deer Damage.

We have discussed deer impacts and that where the impacts that occur are negative they are often referred to as damage (Benner 2000) we have also discussed the variability in that their assessment can be subjective (Reimoser et al. 1999). Quantifiable deer populations and impacts are important for effective deer management as they support or oppose perceived levels of deer damage which in turn can influence overall management objectives and methodologies. The implications of landowner and public perception on conservation management have been discussed earlier. It is important to monitor levels of deer impacts (damage) in order that management decisions can be made when the damage reaches the threshold levels that are perceived by the owner/ manager as no longer tolerable without further action (Putman 2003, Danielson et al. 2005).

It is important to note that although a population census is not essential on an annual basis it is critical that their impacts are monitored regularly

(Smart et al. 2004). We will discuss methodologies to assess deer population size later in Chapter 4 and will focus in this section at the assessment of physical deer damage.

Different approaches are used to assess wildlife and deer damage (Melville et al. 1983). The most common method to assess deer damage is by landowner survey (Putman 1986, Putman and Moore 1998). Landowner questionnaires have been used to estimate the perceived levels of deer presence and impact to tree and arable crops. The scale of survey varies from a local single land holding or compartmental scale to larger landscape level and national levels. This can be very subjective and relies on perception of deer damage which as we have already discussed is highly variable.

Often is not practical to examine every tree and methods used revolve around examining a representative sample. One such method is the nearest neighbour method (Pepper 1998) that involves the selection and examination of a predetermined number of clusters of trees as a sample within a site to assess for damage:

$$\text{The percentage damage} = \frac{\text{number of damaged trees counted}}{\text{total number of trees assessed}} \times 100$$

Damage assessment, control and prevention of damage are dependent on the land-manager's objectives (Hodge and Pepper 1998) and what is defined as critical damage (Poore 1995). The type and severity of damage on particular species of crop, and at what age the crop is when it is damaged determine the economic importance of deer damage (Welch and Scott 2001, Welch et al. 1991). This variation is generally as a result of the severity of damage and ability of the crop to recover to produce a viable crop (Gill 1992a).

Whilst browsing of leader shoots of sitka spruce may reduce the timber quality of the crop in the long term by increasing multi-trunking some studies have shown that growth of the tree as a whole may increase (Putman and Moore 1998) so therefore the importance of the damage depends on what is actually being valued. It is also essential that damage is identified as being caused by deer (Mayle 1999b) as opposed to domestic stock, squirrels, rabbits and voles which can also cause damage through browsing and bark stripping. The height and cleanliness of the cut on browse and the size and shape of teeth marks can identify the cause of the damage fairly accurately. It is also important to record the indirect economic value of deer damage such as the repair or replacement of fencing that has been damaged by deer movement.

More recent methodology being developed to quantify deer damage involves assessing deer impacts through indicators of deer presence and deer browsing, the most recent of which use indices (Cooke 2006b, Tabor 2004). The use of indicator plant species to assess the conservation value and health of floral sites has been used extensively for some time (Peterken 1974, Godefroid and Koedam 2003) and are used as a conservation tool to indicate site classification using systems such as the National Vegetation Classification System (Whitbread and Kirby 1992, Hall et al 2004). Simplification of the assessment methodology develops the use of a browsing index (Morellet 2001) to produce a deer and damage scoring system to assess deer presence and deer damage (Cooke 2007).

The Cooke methodology uses a scoring system and involves walking as many tracks and access routes within a site and counting the number of physical signs of deer presence and impacts as possible. These assessments are then ranked 0-3 (zero, low, medium and high) and combined to give the woodland an overall score of 1-12. It can be suggested through experience of carrying out the Cooke Survey as an assessment technique in assessing Better Woodlands for Wales sites that a score of 7 is potentially the score at which biodiversity impact damage becomes unacceptable and action must be taken but this is very dependant on woodland type and landowner management objectives. This methodology is also very subjective as it relies on the experience of the surveyor and the landowner objectives may lower or higher tolerance of deer activities. Looking for signs of deer in dry lowland woodlands in East Anglia is very different to looking on steep wet sites in areas such as the Wye Valley in South Wales.

1.7 Deer Management.

The vulnerability of the ecosystem in terms of the impacts of deer feeding preference and deer use will determine the deer browsing pressure (Mayle 1999b). The topography and geography of the site will then determine the application if required of suitable management tools such as fencing, culling or deterrence methods. Social factors that affect the deer management strategy are probably the most important factors as the landowners' concept of what impact the deer are having will determine the level and method of deer management (Conover, 1998). A commercial forester or farmer experiencing a high level of crop damage value is more likely to implement more intensive deer management. In this section we discuss options for deer management and the tools available.

1.7.1 History of Wild Deer Management in the UK.

Prior to 1950 deer management was carried out locally as required by the landowner for the purposes of acquiring venison and hunting trophies. It was in the 1940s that Forestry Commission first began to raise awareness of the need to manage deer for the purposes of damage control. Legislation has existed in one form or another since the middle ages. The Deer Act 1991 (HMSO 1991) has recently been amended in 2007 following a comprehensive review alongside other game related law in order to improve the ease with which deer can be effectively managed and recognise the impact of wild deer.

Deer research has evolved to support deer management and as more has been learnt about wild deer and the damage that they potentially cause the need for co-ordinated information about deer has increased. Research into distribution, assessing deer populations and deer management options has then enabled the development of a more pro-active collaborative approach deer management using best practice.

In England and Wales the Deer Initiative has developed since 1995 and has evolved considerably since its formalisation in 1999. In 1995 the Deer Initiative England was established and in 1999 the Wales Deer Initiative was established. The Red Deer Commission (latterly The Deer Commission for Scotland) was established in Scotland in 1959 and is the only UK Deer Initiative with legislative powers (HMSO 1996) to enforce deer management activities. In 2008 it was announced that the DCS would be incorporated into Scottish Natural Heritage (Scottish Government 2008).

Whilst the initiatives recognise and support collaborative deer management the history of the Deer Commission for Scotland has evolved over a considerably longer period to provide a Commission with statutory powers. The Deer Initiative for England and Wales has no legislative powers to support collaborative deer management. In a DEFRA consultation in 2004 (DEFRA 2004a) when the revision of the Deer Act was being considered the issue of legislative powers for England and Wales were discussed but it was felt that the landowning community was so diverse that is was not a practical option. The resultant action plan encouraged landowners to minimise deer damage and engage in sustainable deer management through appropriate grant schemes for forestry, agriculture and biological conservation (DEFRA 2004b).

In order to manage wild deer successfully it is important that where possible deer populations are monitored, assessed and managed proactively. Deer management prescriptions should not only be implemented with respect to specific deer species but also with regard to their densities, distribution and their impact on the surrounding environment and its management (DeCalesta and Stout 1997). It is also important to integrate important economic and social factors such as the income provided through leasing of stalking and the sale of venison as well as the public perception-led decision making process that varies between landowners (Gordon et al. 2004). In a survey carried out by the British Association for Shooting and Conservation the two main threats to deer management were assessed by deer managers to be anti-hunt activities and public ignorance (Marshall and McCormick 2006). In recent years as education and awareness of the need for deer management has increased the public has become more accepting of the need for deer management and the methods that are used (Watson, 2005).

1.7.2 Deer Management Options

There is no single, universally successful management strategy and the success of minimising the negative impacts of wild deer rely on addressing a number of economic, environmental and social factors (Gordon et al. 2004). Specifically the successful management of deer centres around one particular issue and that is the land management objectives that determine what deer density can be tolerated and at what levels the deer should be managed (De Nahlik 1995). It is also important to note that as deer density increases the pressure on food resources negatively affect deer body mass, size and fecundity and this can influence the accuracy of assessing population trends at high densities (Anderson & Linnell. 2000).

The most successful deer management strategies involve the management of deer using a combination of culling and fencing across an area determined by the geographical landscape. This can often be carried out on a co-ordinated basis through a Deer Management Group (DMGs). DMG objectives vary significantly. Objectives can range from the reduction of deer impacts to forestry, agriculture and biodiversity to the reduction of damage to gardens or reduction of deer–vehicle collisions. DMGs have also been established to act as 'poacher-watch' schemes to monitor and protect the health and welfare of the deer. At the landowner level, Deer Management Plans (DMPs) take into consideration land-use and habitat type alongside deer specific issues and need to be reviewed on a regular basis to maintain an effective, dynamic deer management strategy (Figure 1.14). Those landowners with an economic, land management interest are more likely to engage in pro-environmental activities such as investing money in conservation activities than those whose interest is recreational (Theodori and Luloff, 2003) as they have a wider understanding of the wider benefits of environmentally pro-active activities.

The deer management strategy at both local and landscape level aims to ensure that the wild deer population is at a level in balance with its surroundings and has for a long time been described as a carrying capacity (Forbes and Overholts 1931) although a more specific definition of carrying capacity is the maximum population size that can be supported indefinitely intraspecific competition has reduced the net rate of increase to zero (Begon et al. 1996). The holding capacity of a habitat such as woodland in relation to deer can vary in terms of impact and management effects (Figure 1.15).

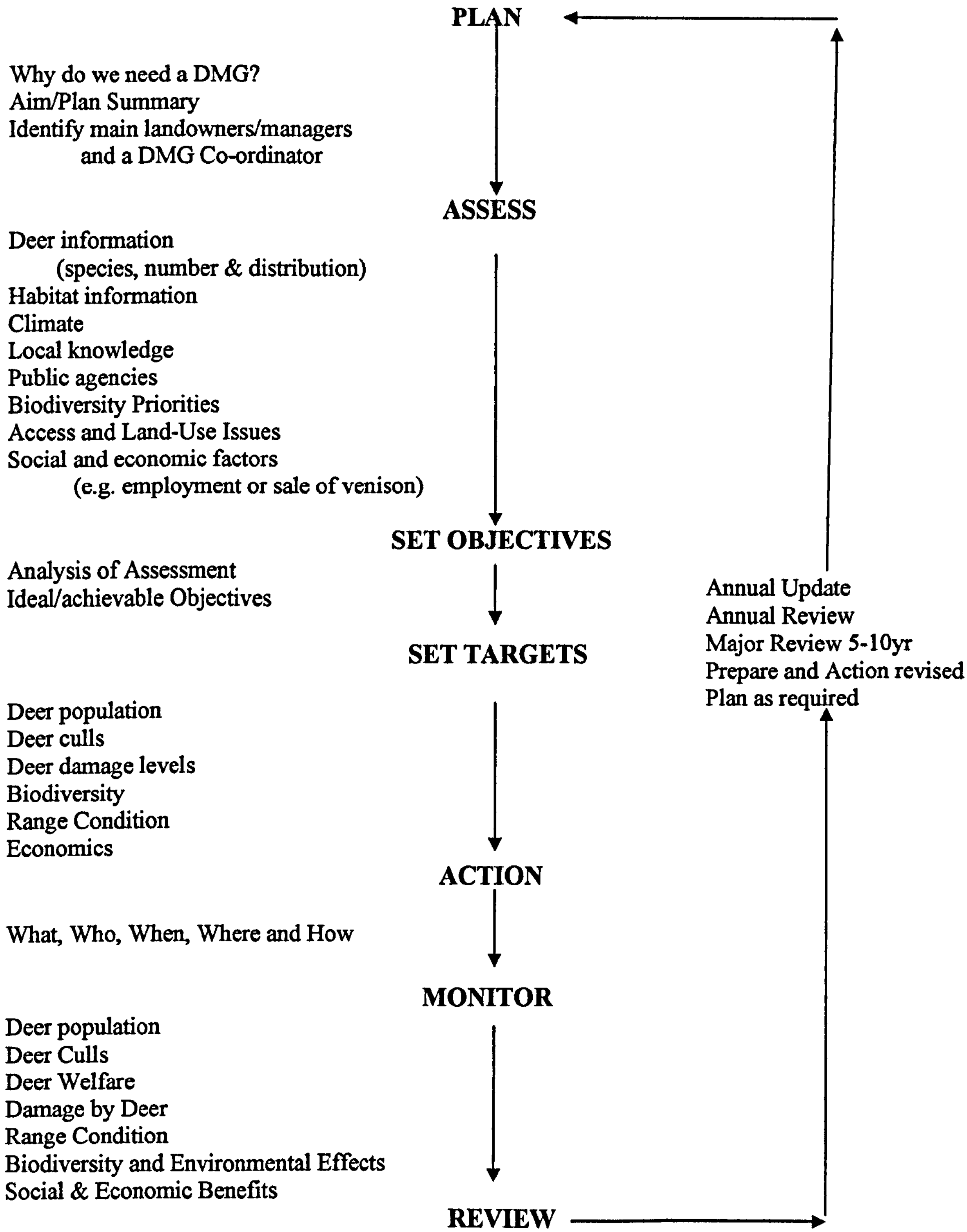


Figure 1.14. Deer Management Group (DMG) Planning Process. (Adapted from Collaborative Deer Management: Guidelines for a Deer Management Plan. 1999. Deer Commission for Scotland).

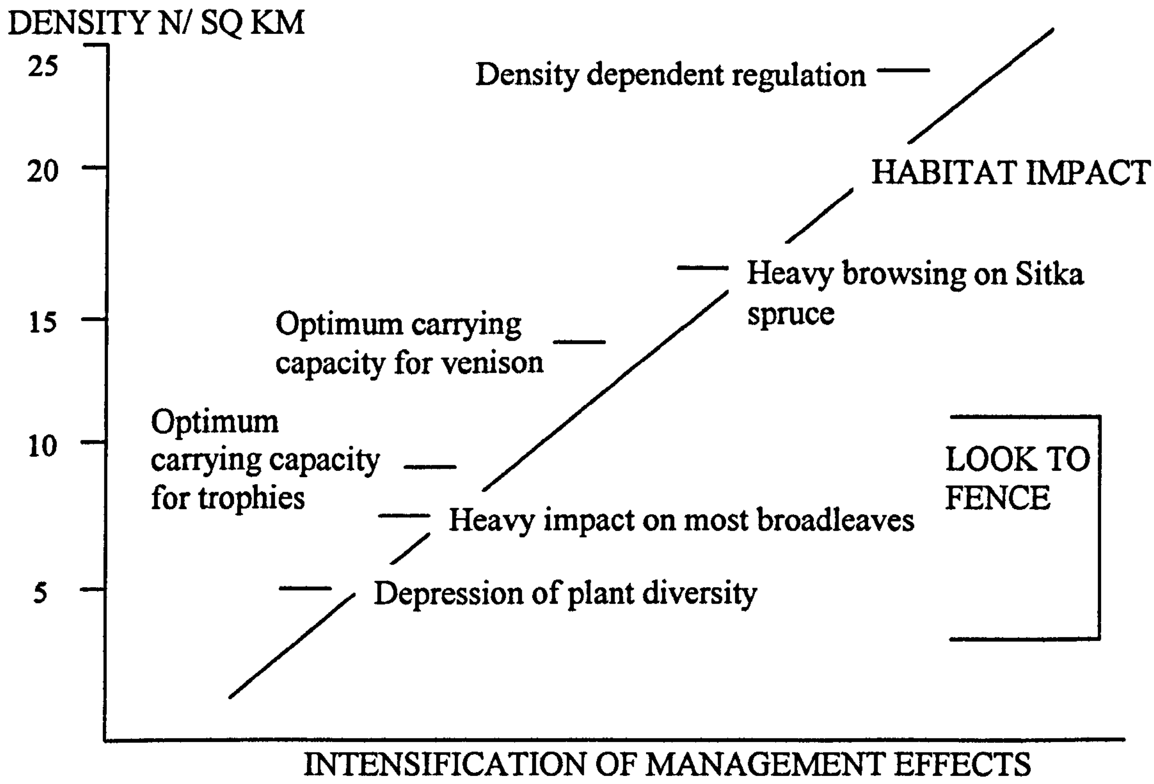


Figure 1.15. Woodland carrying capacity for red deer (Ratcliffe 1998)

Calculations can be made to determine the maximum number of a species of deer that can be tolerated in an area and this enables a deer management strategy to be determined, particularly in terms of cull numbers (Armstrong and Bathgate 2006). In this example illustrated (Rutter 1999) the holding capacity of the woodland is the maximum number of deer a landowner can tolerate.

$$\text{Maximum number of deer Tolerated} = \frac{\text{Woodland Size (ha)} \times \text{Holding Capacity (no.deer)} \times \text{Damage Tolerated (ha)}}{\text{Adjusted Vulnerability Factor}}$$

Rutter (1999) suggests that the 'Holding Capacity' is based on how many deer of a particular species can live in a particular woodland type. 'The Damage Tolerated' is set by the landowner depending on what their crop and what the desired outputs are. The 'Holding Capacity Unit Size' is 1,000 hectares as this is the area on which all calculations are based but could be adapted to smaller units. If a smaller unit area were used the impact of deer by larger migratory species could be lost as the impact may not be observable equally over smaller areas compared to the impact at a landscape level. The 'Adjusted Vulnerability Factor' is vulnerability of the woodland type to deer browsing and is calculated by assessing the size, age and species of tree crop in the woodland. For example hazel has a higher vulnerability than sitka spruce. In a mixed woodland vulnerability factors are averaged out over different compartments of different tree species.

Other deer population models exist. One used by Forestry Commission (Armstrong and Bathgate 2006) takes into consideration herd dynamics including recruitment and mortality rates in addition to modelling the likely effects of a predictive cull programme. Whilst to be able to calculate an ideal deer density is useful, due to the complex UK mosaic landscape the capacity of the woodland to support deer populations can vary hugely between sites. The deer densities provided by these calculations may be of limited use. Where they can be of use is where a site where deer management is being carried out and there is a known level of damage occurring. Research has recently focused more on the importance of assessing and monitoring deer impacts as opposed to solely deer numbers and therefore it could be suggested that cull models are potentially of less importance to determine deer management objectives but do however establish how a deer population can be successfully reduced effectively over time.

In organisations where financial resources are low, culling is often the most cost effective method if carried out in conjunction with neighbours. Fencing is not only expensive but also has a huge impact on the visual landscape of the countryside. Fencing can also have indirect effects such as altering the movement pattern of deer herds which can move their impacts to other areas which may increase the problem they are causing. Very often the critical factor as to whether deer management is implemented is the availability and awareness of deer impact information. When the appropriate information from research and experience is made available it makes the options for deer management more practical for discussion and implementation.

Organisations that are funded through public donation such as the National Trust or Woodland Trust also face the added pressure of carrying out management policies in agreement with its members. In a British Association for Shooting and Conservation survey of deer stalkers and managers in 2006 over 80% of respondents viewed public perception as a major threat to stalking in the future (Marshall and McCormick 2006). The ethics of deer management are often debated (Blake 2003, Green 2005) and in recent years research, education and training of land and deer managers has become a key tool to improving deer management and deer awareness.

In areas where there is public access this also affects deer management strategies as not only does increased access affect deer movement (Taylor and Knight 2003), but some members of the public may disagree with culling deer. The use of a firearm must also be controlled and used safely which relies on the training and development of accurate and experienced deer managers. Land-use, particularly where members of the public have access also influences the implementation of the most appropriate method of deer management. Fencing is rendered useless if gates are left open or are not working correctly (Trout and Pepper, 2006) and deer managers may have the period of time made available to them for culling reduced or removed depending on the use of the woodland by the public. Where it may have been ideal to cull during the hours shortly after dawn and before nightfall this may be made impossible if people are walking there before or after they go to work and as such timing of stalking may need to be adapted. Where culling is taking place close to urban areas they may also be the need to use sound moderators on rifles to reduce the noise emitted on firing a rifle, which if heard could alarm members of the public.

The influence of public perception of deer and their associated impacts and how they determine deer management activities cannot be over-estimated and we discussed this with regard to UK conservation policies and priorities earlier There have been steps made to quantify the 'Cultural Carrying Capacity' for deer in an area and incorporate it into deer management where intention is to integrate stakeholder perception and efficacy of carrying out effective deer management to meet the needs and perceptions of what an ideal deer population size should be (West and Parkhurst, 2002).

With an increase in wild deer utilising the suburbs of towns and cities the impact of wild deer on gardens is a widely debated problem (Cole 1997) and the general public are becoming more aware of wild deer and the problems they can cause (Mitchell, 2006). Some landowners do not have the knowledge to identify the extent of damage and deer are all too frequently under-managed or management is not instigated until the damage is very severe (Conover, 1994).

There are a number of options available to control the number of deer present and the remainder of this chapter discusses the merits of the different types of deer management techniques used in the UK and the related associated constraints and issues. The most commonly used management tools that are used or are being considered in the UK include the use of fencing to keep deer out of an area or to protect individual trees, the use of a cull management plan as well as the use of deterrents or immuno-contraceptives. Landowners must also take into consideration legislation (Thornley, 2007), handling of venison (HMSO 2007b) and the economics involved when implementing a deer management strategy which will be discussed further.

Whilst outside the UK other techniques are used to manage deer the main methods used involve culling although methods can vary depending on the location of the deer population, particularly the specific cull method used and the time of year and scale of management carried out (DeNicola et al. 1997, Messmer et al. 1997, Hall and Gill. 2005) Other options that exist include the use of natural predators such as coyotes and wolves (Ballard et al. 2001) and the use of novel repellents or deterrents which will be discussed later.

1.7.2.1. Fencing.

The correct use of fencing when applied is an effective tool to minimise deer damage (Trout and Pepper 2006). It has been known for some time that fencing of an area enables relief from grazing and the recovery of ground flora (Ross et al 1970) but not only does vegetation recover but so do its associated fauna such as small mammals (Putman et al 1989). However, there are problems that have been identified with the long term effect of excluding deer as in areas where deer browse vegetation is often dominated by browse tolerant floral species that affects the long-term development of a site such as woodland and its ecosystem (Anderson and Kattz 1993). Exclusion of deer also removes the effects of their disturbance such as trampling on vegetation and soil (Mohr and Topp 2005). Excess trampling of soil can increase the loss of soil nutrients which influences plant growth

(Wardle et al.2001) that may or may not benefit the stability of the woodland ecosystem depending on the severity.
It is important that the use of fencing is planned at a landscape level to take into consideration a number of important integral features (Figure 1.16.) that influence the success of a fencing application. Fencing can be used in two ways. Individual trees can be protected by tree guards or areas of woodland can be fenced off (Figure 1.17). Depending on the value of the crop and the period during which the crop is vulnerable the cost of fencing can be relatively high. The cost effectiveness of selected fencing is a key consideration when looking to reduce deer damage (VerCauteren et al. 2006). The minimum height of fencing recommended for excluding deer is 1.4 m for muntjac, 1.6m for fallow and roe and 1.8m for red deer (Table 1.4.).

It is recommended that fences be erected using high tensile wire and developments in plastic mesh netting with high tensile characteristics are also providing optional capacities for temporary fencing (Trout and Pepper 2006). In addition to wire fencing in some areas electric fencing has also been utilised as a means to prevent entry by deer into a vulnerable crop area (Pepper et al.1992). Electric fencing has been found to be particularly effective with regard to the exclusion of red deer but of little use with Roe and is not recommended above other types of fencing (Pepper et al.1992). Electric fences however, are prone to failure through power loss from wire earthing against vegetation as well as central/battery power failure (Cooke & Lakhani 1996). With future technological development and the use of power from natural renewable energy resources electric fencing could become a viable tool for deer exclusion in the future (Trout and Pepper 2006).

Table 1.4. Recommended deer fence for each deer species (adapted from Pepper 1999).

Deer Species	Height (m)	Mesh Size (mm)
Red	1.8	300 x 300
Fallow	1.5	200 x 200
Roe	1.2(<5ha) 1.5(>5ha)*1.	200 x 150
Munjtac	1.5	100 x 100 but 75 x 75 preferred for humane reasons*2.

*1. General recommendation based on the need to jump over the fence and the ease to walk around the fenced area.

*2. An adult Muntjac head can pass through a 100 x 100mm mesh but not the body. When the head is withdrawn there is a danger of the antlers becoming snagged hence a smaller size is preferred for humane reasons

Due to anecdotal evidence from landowners and deer managers of the true effectiveness of deer –proof fencing, particularly the use of tree guards as well as the associated expenses for building and maintaining fencing, there is now a move towards the use of temporary, re-useable fencing as a means to protect vulnerable crops. Recommendations suggest fencing protection is the most valuable in the first two years of tree establishment in terms of seedling survival. It has been found that saplings of several broadleaf tree species (eg. Ash *Fraxinus excelsior* and Oak *Quercus robur*) and greater than 30cm tall can survive several years of severe browsing (Harmer 2001). Fencing is a particularly viable option for landowners who do not wish to cull deer as part of their management programme and this is often the case for membership organisations that are concerned with animal welfare and conservation issues. Although fencing costs are usually higher than other methods, grants to offset costs are available primarily through the Forestry Commission as part of wider woodland management grants (Forestry Commission Wales 2006). Membership organisations can also use volunteers to carry out work such as maintaining brash fencing to reduce the overall economic cost to the organisation.

There are difficulties associated with deer fencing in addition to cost and build and maintenance practicalities. Firstly the fencing may reduce the aesthetic value and in areas of outstanding natural beauty large expanses of deer fence may not be appropriate at any cost (Trout and Pepper 2006). There is also the requirement to ensure that no deer are fenced into an area when the fence is erected as without the capacity to move freely in and out of the area the deer can cause even more damage. From discussions with forestry commission staff and private landowners and managers in Wales there does appear to be a preference for minimal fencing and a landscape level deer management approach as the preferred option as deer are not perceived to be causing the level of damage where fencing is preferred option. This is in comparison to Scotland where following widespread use deer-proof fencing is now being suggested to be reducing in use as a result of the significant number of black grouse collisions (Catt et al. 1994, Baines & Summers 1997).

1.7.2.2. Cull strategies.

The reproductive capacity of wild deer varies between species but with the low deer population that is at present in Wales and with the availability of suitable habitat and feed the deer population is likely to continue to increase at a high rate similar to that of the rest of the UK (Ward, 2005). Recent thinking by Forestry Research suggests that in the next ten years with the current level of deer management the wild deer population in the UK is likely to double (Gill, pers comm., 2003). Due to the territorial and hierarchical structure of the different deer species populations it is also important that the deer manager is very selective of the individual animals culled to maintain a balanced population. A balanced population of a single species is described where in general recruitment equals mortality rates and immigration equals emigration in a healthy population (Begon et al. 1981).The use of cohort analysis from cull records over a number of years can assist in identifying the cull ratios of male: female: juvenile: old deer that can be removed from a population and yet still maintain a stable population (Lowe and Thompson-Swab 2003). Some research suggests that these reproductive ratios may remain stable irrespective of culling pressure (Laurian et al. 2000) but this does not take into consideration the long term effect of culling on a population. It is important to note that at higher densities (higher than about 20 deer/km^2) forest deer populations recruit at such a rate that it would not be possible theoretically to cull the number of deer needed to control the population (Latham et al. 1998). Forest Research has developed a model that can help to predict deer population numbers and assess the impact of different cull strategies on successfully managing deer numbers (Armstrong and Bathgate, 2006). The model however makes the assumption that the recruitment and mortality rates remain constant for the previous nine years and that culling is random across all age classes. When considering an expanding and increasing deer population where deer management is a recently introduced activity it is unlikely that the deer population and its management is as constant as the model assumes.

In order to manage a population effectively to reduce negative impacts the culling of females is one of the most important factors as it is the size and age structure of the female population that regulates recruitment. It has been shown that red deer populations not subject to predation or culling can be biased towards producing more females than males (Clutton-Brock and Lonergan, 1994). This requirement has for a long time brought a conflict into deer management between the maintenance of a population for sporting purposes where only males are culled against the maintenance of a population density where there is little or no damage to the surrounding habitat. It was not until recently that it was proved that a higher population meant lower animal body weights and less antler growth and formation thus reducing trophy quality (Jenks et al.2002).

To calculate the number of deer to cull there are a number of methods available. Firstly through carrying out a cohort analysis the age and structure of the population can be identified from cull figures and then deer can then be removed through culling proportionally (Lowe & Thompson-Schwab 2003). The most common method to calculate cull numbers is comparing culling figures to damage. Where deer are causing damage it is common to initially look to remove 30% or more of the estimated population as 30% is the likely recruitment level to the population in that year and could potentially halt an increase in deer numbers and associated damage so the situation can be reviewed (Armstrong and Bathgate 2006). It is important to start culling at a higher level in order to achieve the most effective results in terms of time spent per deer culled (Latham et al 1998). If there is damage the culling figure should then be increased until there is no damage observed or the damage is not of primarily economic importance. It is important that culls can be reduced as well as increased as excessive deer culling can increase deer migration in an area (Vieira et al.2003) and potentially greater problems in managing deer as they inhabit areas where they may not be accessible for culling. The setting of initial cull targets is quite often a result of the land-owners' perception of what tolerable deer impact levels are and the definition of 'deer damage' can vary immensely (Conover and Decker, 1991).

Cull records over time become an important tool in monitoring and managing deer populations effectively (Putman 2003). Not only do the records provide an indication of species, size, age and sex ratio to enable cohort analysis they also provide information on animal health. However this assumes that culling is random across species, sex and age class which as we have already discussed when looking at modelling deer populations based on culls is unlikely to be case. Upon gralloching the carcass and removing the pluck (internal organs) the condition can indicate the health of the animal in terms of presence or absence of lesions that result from diseases such as Bovine Tuberculosis. Inspection includes the external and internal examination of the carcass for disease. Literature highlights common external parasites (British Deer Society 1996). These include Ticks (*Ixodes ricinus L.*), Keds (*Lipoptena cervi*), Lice (*Demalinia meyeri Taschenbeg*), Warble Fly (*Hypoderma diana*) and Nasal Bot Fly (*Oestrus ovis*). On internal examination cysts from tapeworm can be identified. Liver fluke (*Fasciole hepatica*) and Lung Worm (*Dictyocaulus eckerti*) can be identified if present in the liver and lungs respectively (British Deer Society 1996).

Deer can also be relatively accurately aged through dentition analysis although the age of animal and inspection method used can vary results (Erickson and Selinger, 1969, Carter 1997). Age can be assessed from antler growth and formation (de Nahlik, 1992) but dentition is the most accurate method (Hamlin et al. 2000). Deer age and location can affect antler size and body mass (Strickland & Demaris 2000) which cannot therefore be used as a real method to identify deer age.

Cull records can also indicate other causes of death. For example, cull records can note if deer were dispatched as a result or receiving injuries after a collision with a vehicle or whether prior to death the deer had suffered previous injuries such as those relating to illegal poaching including the use of snares, dogs and illegal firearms (Thomas 2007). The use of additional statistics such as these can support deer related land management issues such as the requirement for deer and vehicle mitigation measures at a particular deer and vehicle collision hotspot or the involvement of the police in a 'poacher-watch' scheme.

1.7.2.3. Contraceptives.

Fertility control through the use of contraceptives with female deer as a method of deer management has been widely investigated as a population control method and is potentially a useful tool where culling or fencing is not practical such as urban environments (Warren 2000). The efficacy depends on primarily the method of delivery and the duration or persistence of the contraceptive effect (Hobbs et al. 2000). There are four main areas of contraception that are applicable to deer populations and these are surgical sterilisation, synthetic steroid hormones, immuno-contraception and abortion inducing hormones (Warren 2000).

There are a number of theories regarding alternative deer management strategies and although the research suggests immuno-contraception is particularly useful option, particularly in suburban deer populations (Rudolf et al. 2000) It has been widely acknowledged that contraception is not a substitute for wide scale deer management through culling (Miller et al. 2007). Porcine Zona Pellucida (PZP) vaccine delivered through syringe darts has been found to be effective for white-tailed deer (Turner et al. 1992). There are also the difficulties arising from the need to prevent treated deer entering the human food chain, and identifying individual deer for treatment and repeated application to maintain fertility control. (Warren 2000). Although there has been the development of a "bio bullet" that dissolves on impact and delivers treatment (Turner et al. 2007) marking of individual deer still remains an issue. Whilst vaccination does not require a full surgical procedure it still costs too much in terms of application to be put into practice on a commercial basis (Muller et al. 1997).

The use of chemical contraception if not injected into the animal directly is also an issue when it comes to non –target animals hence treated baited feed is not an option in non-captive deer populations and there is also the risk that venison from the treated deer may be unfit for human consumption (Warren 2000, Grandy and Rutberg 2002). In the United States where there has been a lot of work on the development of deer contraceptives the practical difficulties of applying techniques developed for other situations are widely recognised (Rudolf et al 2000, Naugle et al 2002). Recently 'Gonacon' a chemical contraception (Mammalian Gonadotrophin Releasing Hormone) has been released for commercial use in the United States which following one initial injection renders nearly all female white-tailed deer infertile permanently has been cleared for use in the United States and as this does not pose a risk to non target species it has the potentially to control small isolated populations very effectively. The chemical is also metabolised very quickly and therefore if the venison were to be eaten it could be suggested from the data that the risk to humans is also minimal (United States Environmental Protection Agency 2009). There is some concern that immuno-contraception can affects the behaviour of treated female deer (Powers et al. 2007) and that male deer also alter their behaviour as an indirect response (McShea et al. 1997) but given the reasons behind using contraception instead of other methods of deer control these potential effects on behaviour are likely to be accepted.

1.7.2.4. Deterrents and repellents.

Deterrents and repellents that use chemical, audio or visual properties to prevent or reduce deer damage can be of use (Andelt 1994). Deterrents prevent deer from carrying out an activity by affecting deer behaviour through increasing fear. Repellents are more specifically chemicals that physically deter deer from approaching or feeding on crops. Examples of repellents that use both natural and man-made chemicals to deter and repel deer include treatments such as 'AA Protect' in the UK and 'Hot Sauce' and 'Deer Away' in the USA use concentrated pepper based solutions (Andelt et al. 1994, Baker et al. 1999).

Deer can often however quickly become adapted and show indifference, even habituation to the method used (Putman 1997) and depending on target crop deer may continue to graze on crops despite high use of repellent (Andelt et al. 1994, El Hani and Conover 1995). Fallow have demonstrated an increasing indifference to light reflectors used at the roadside to reduce deer-vehicle collisions (Ujvari et al. 1998). Deer have also shown to become unaffected by noise deterrents and there use must be irregular to remain effective in any way (Belant et al. 1996). Chemical repellents that release an odour such as predator urine have also been used but the wide scale use of this has been found to be uneconomic (Melchiors et al. 1985).

Livestock, particularly sheep, have been suggested by some landowners to have some degree of success in deterring deer although deer quickly identify the range and boundaries of the animal and work round them (Rose, 1999). The reasons for sheep for example deterring deer are unproven and appear to be of less influence in areas of high deer density and may work in a similar way as predator urine.

Repellents have been found to be particularly effective to protect sprouting tree saplings during the growing season although the economic costs limit their use on a large – scale basis (Baker et al. 1999) due to the cost of concentrated application. Some chemical repellents have also been found to be phyto-toxic (Gosling and Baker 2004) which means that they cannot be used during the spring and summer months as they could kill the very plants they are trying to protect at their most vulnerable growth period. A deer repellent with phytotoxic properties that is used in the UK is 'AA Protect' (Pepper et al. 1996).

With respect to deer in gardens, whilst visual deterrents are usually recommended there has been some work done in identifying plants that are 'resistant' to deer (Cole 1997) or appear to be damaged sparingly (Nolan 1999). Resistance to herbivorous browsing suggests that some plant species have some physical or biological deterrence that discourages browsing (Macdonald and Bach, 2005).

1.7.2.5 Woodland design.

Woodland design plays an important role in reducing deer impacts (Mayle 1999). By the use of open areas such as glades and rides deer can be channelled away from vulnerable areas (Ratcliffe 1985) and into areas where they cause less damage and or can be culled effectively. The use of managed open areas located in key areas depending on soil type, vegetation and aspect also increases the visibility of deer and makes culling easier (Deer Commission Scotland 2003). In areas where fencing is not a practical tool, alternative feeding areas and areas where deer can be culled safely are important practical deer management activities and then woodland design becomes important (Pepper and Tee 1986). We have discussed deer habitat use and connectivity earlier and it is important when identifying culling areas that deer habitat selection for open areas (glades or rides) is considered when designing woodland plans to increase deer management cull efficiency (Latham 2000, Ratcliffe 1985).

1.7.3 Deer Management and the Law.

The management of wild deer in England and Wales is regulated through The Deer Act 1991(HMSO 1991). The Deer Act was amended using a Regulatory Reform Order in 2007. New changes to the Deer Act through the regulatory Reform Order (Deer) (HMSO 2007) also enable the shooting of deer out of season on the grounds of public safety on airports for example, reduce the female closed season to enable cull targets to be met and increase the range of firearms that can be used to dispatch deer for humane welfare reasons. One additional change is significant to conservation as it allows shooting deer out of season for the protection of natural heritage and this will allow an increase in deer culling in areas of high conservation value where other attempts at deer management have been unsuccessful HMSO 2007).

Red and roe and also fallow deer are listed under Schedule 5 of the Wildlife and Countryside Act 1981 (HMSO 1981) as native deer species. The release of non-native species such as Sika, Muntjac and Chinese Water Deer are restricted through Schedule 9. The management of wild deer is also regulated through the Firearms Amendment Act 1997 as well as a plethora of regulations relating to the handling and sale of venison. These Acts set out the time of year and the methods by which deer can be controlled including closed seasons when deer cannot be culled. The Deer Act also sets out the regulations with regard to the use of firearms to cull deer in order to ensure that when deer are culled it is done humanely.

The laws pertaining to deer management, particularly firearms and dates of closed seasons, are different in Scotland and Northern Ireland. In Scotland the Deer Commission Scotland has legislative powers through the Deer (Scotland) Act 1996 to enforce its deer management policy and to authorise activities such as shooting at night and out of season (except in certain circumstances) that under the 1995 Deer Act is prohibited in the rest of the UK. In England and Wales in terms of shooting deer out of season, landowners can apply to DEFRA (Department for the Environment, Farming and Rural Affairs) or WAG (Welsh Assembly Government) for permission to shoot at night.

1.7.3.1. Open and Closed Seasons

It is illegal to cull deer during their respective closed seasons (Table 1.5) except for the welfare and humane reasons for injured deer or when authority has been permitted to cull deer to protect crops against significant damage (HMSO 1991).

Table 1.5. Wild Deer Closed Seasons for England and Wales (taken from The Deer Act 1991(HMSO 1991) and amended with information from RRO (Deer) 2007 (HMSO 2007).

Deer Species	Closed Season
Red Stags	1st May to 31st July inclusive
Red Hinds	1st April to 31st Oct inclusive
Fallow Bucks	1st May to 31st July inclusive
Fallow Does	1st April to 31st Oct inclusive
Roe Bucks	1st November to 31st March inclusive
Roe Does	1st April to 31st Oct inclusive
Sika Stags	1st May to 31st July inclusive
Sika Hinds	1st April to 31st Oct inclusive
Red Sika Stags	1st May to 31st July inclusive
Red Sika Hinds	1st April to 31st Oct inclusive
Chinese Water Deer	1st April to 31st Oct inclusive
Muntjac	No Statutory Closed Season

There is the ability to shoot deer out of season under the Agricultural Damages Act 1947 although this exemption is only granted where significant economic loss can be proven and all other methods of reducing deer damage have failed. Although there is no statutory season for Muntjac it is recommended that immature or heavily pregnant does should be selected to avoid the risk of leaving dependent fawns.

Shooting deer at night is also illegal under the regulations unless permission has been granted under The Deer Act through the appropriate regional government application procedure. Night is legally defined as the time between an hour after dusk and an hour before dawn.

1.7.3.2 Firearms and Ammunition.

Through the Firearms Amendment Act 1997 for England and Wales, the Deer Act 1991 and RRO 2007 the permitted firearms for killing deer must have a calibre of not less than .240 inches and with muzzle energy of not less than 1700ft.lb. Bullets must be soft or hollow nosed. Smaller calibres of .220 have recently been authorised specifically for Muntjac and Chinese Water Deer. Where a shotgun is used a gun of not less than 12-bore may be used with a rifled slug of not less than 22.68g (350 grains) or AAA shot only in cases that meet the requirements laid down in the Act (HMSO 1981).

The deer manager must have written permission to access the land on which they are to shoot and it essential in terms of public safety that warning notices are displayed where public rights of way cross the land. All firearms must be held under the correct licence and then used and stored in accordance to the regulations. Restrictions can vary from region to region depending on the local police force's individual requirements and may place strict caveats on the use of firearms to shoot deer by specific individuals. Organisations such as the British Association for Shooting and Conservation and the British Deer Society play a key role for its deer manager members in ensuring that caveats are reasonable and within the law.

1.7.3.3 Sale of Venison.

The handling and sale of venison is regulated by Regulatory Reform (Game) Act 2007, Wild Game Meat Act 2006, The Wild Game Meat (Hygiene and Inspection) Regulations 1995, The Food Premises (Registration) Regulations 1999 and the Animal By-Products Regulations 2003. The need for a game licence to sell venison and the restriction of selling venison in the closed season were removed from the Game Act following the implementation of a regulatory reform order in 2007 (HMSO 2007). Although wild animals are currently excluded from the animal by-products regulations with regard to disposal where on site burial is prohibited, the Environmental Protection Act 1990 ensures that waste products produced in the handling and processing procedures do not present an environmental pollution hazard and incineration is recommended (Deer Initiative 2003). The Food Standards Agency has recently streamlined the regulations relating to the handling of venison in terms of the guidelines for individuals and approved game handling establishments on how, when and where venison is handled, inspected, processed and sold (Food Standards Agency 2006).

1.7.3.4 Poaching.

Under the 1991 Deer Act wild deer are not owned by any individual until they are dead whereupon they become the property of the owner of the land on which they died. To that end there are a number of laws relating to the removal of wild deer without permission (known as 'poaching') through which offenders may be prosecuted and these include:

a. Trespass. To search for deer with the intention of taking deer without the landowner's permission.
b. Removal of carcass. Theft of dead deer from the landowner to which it now belongs.
c. Trespass to take, or injure deer.
d. Attempt of trespass or removal of carcass.
e. Taking /Killing deer at night.
f. Taking/Killing of deer with a prohibited weapon i.e. Crossbow, snare, poison, shotgun.

If found guilty of any one of the offences listed above an offender is liable to a maximum of 3 months imprisonment and/or a fine up to £2,500.

The issues related to poaching ranked by landowners and deer managers of the highest concern include access to land, driving off-road and trespassing, although greater communication between landowners and deer managers was seen to be the most likely solution to the problems (Swensson and Knight, 1998). Improved communication between landowners and deer managers is one solution but it is also important to educate landowners and deer managers as to the need to manage wild deer and the practicalities of carrying deer management out.

Information obtained through police wildlife liaison officers in Wales (Charleston and Schofield pers comm. 2007) suggests that poaching in Wales is a problem in some localised areas. Gathering evidence and prosecuting criminals is difficult due to the high degree of organisation and scale of poaching carried out where areas are targeted intensely over a short period of time. Poaching is often carried out alongside other rural crimes such as burglary and theft of equipment. This adds to the effects of poaching. Recent developments in intelligence gathering and engagement of local land –users has enabled information gathering at a local level to improve and this in time, should result in the successful prosecution of offenders and reduction in deer poaching in Wales.

1.8. Economics of Deer Management.

The economics of deer management are dependent on the objectives of the deer management plan and the economically viable product. It is also determined by factors that affect the management methods employed. For example in commercial forestry, deer must be managed to enable the production of timber and the investment in deer management will depend on the value of the crop. In biodiversity terms it is difficult to determine the damage threshold that will offset deer management costs as biodiversity is difficult to quantify economically.

It is comparatively easy to determine the financial loss to a commercial forest through tree damage and unusable timber produced as a result of deer damage compared to investment in tree growth. The use of cost- benefit analysis and modelling to predict timber value loss as a result in loss of tree crop can be used to determine the economic viability of timber alongside deer management costs (Ward et al, 2004, Ver Cauteren et al, 2006). It is very difficult however, to assess the damage caused to the nature conservation value of the woodland in terms of biodiversity and species richness as we have previously discussed. From previous research however (White et al. 2004) a survey of a small number of sites suggests that early intervention on conservation sites to maintain deer damage levels (scores) below a known threshold level significantly reduces the cost of mitigation expenditure (Figure 1.18). This estimation however does not take into consideration the cost effectiveness of managing a large number of sites that may vary in size where early intervention may be difficult to implement as damage may be difficult to prove and deer management difficult to resource.

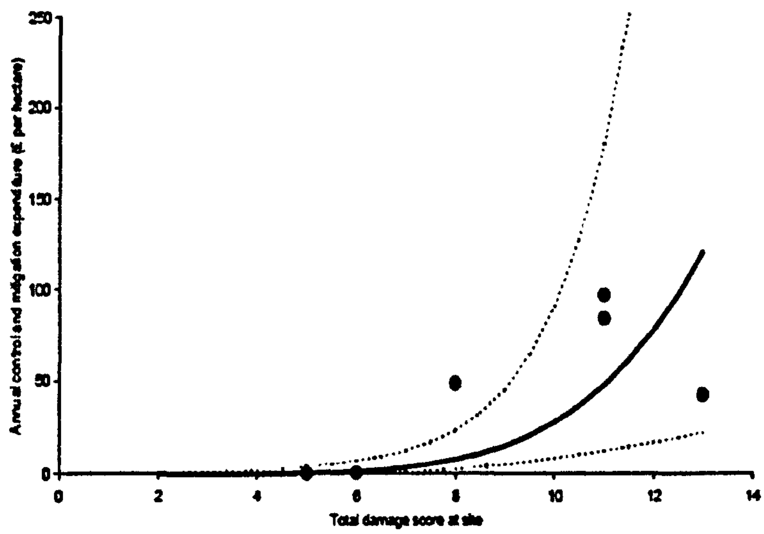


Figure 1.18. Relationship between total mitigation and control expenditure per ha per year (£)million total damage score. • Data from six conservation sites in East of England (White et al. 2004)

In terms of delivery of deer management there is a wide range of options. Management methods available vary. In operating a cull programme there is the option to employ a full- time or part-time professional deer manager on a contract basis or lease out the deer management for a rental income. In the East of England stalking fee income ranged from £30 to £40 per female deer to £100 to £350 per male deer (White et al 2004.) There are no significant differences between the abilities of a full-time professional versus non-professional (part-time or recreational) deer managers particularly in terms of shooting and carcass handling ability. The main difference is that a professional is more flexible in terms of availability as part-time deer managers usually have other employment and may only be available at weekends and holidays (Marshall and McCormick 2006).

Forestry Commission, who are one of the largest woodland and deer managers in the country invest large sums of money into research, monitoring and management of deer through Forest Research. In 2000 it was estimated that on average Forestry Commission invested an average of £4.64 per hectare (ha) per year (yr) in deer management. If deer management is broken down into regions, Northern Scotland invests £7.00 per ha/yr, Southern Scotland invests £4.60 per ha/yr. England invests £5.60 per ha/yr and Wales invests £1.34 per ha/yr. The investment is perceived to be directly related to deer numbers and related negative impacts (Trefor Owen pers. comm. 2000). It is difficult to establish more recent figures but it can be suggested that investment in wild deer management in the UK has increased. Forestry Commission Wales for example now financially supports landowners in the production of deer management plans to support their woodland management objectives under the Better Woodlands for Wales scheme. Grant aid also supports the purchase and use of fencing and culling aids such as high seats. Investment in time and resources relating to deer management also varies depending on other policy driven factors such as the commercial or perceived value of the crop they are damaging. This is illustrated when comparing England and Wales where resources in England are targeted towards conservation through Natural England funding whilst in Wales resources are targeted towards forestry through Forestry Commission Wales (Deer Initiative 2006).

It is also important that deer control is carried out by a well trained and experienced operator as the efficiency of deer control is as important as the humane and safety with which the activities are carried out. There are a variety of training courses and qualifications available and the most widely recognised is the Deer Management Qualification. At the basic Deer Stalking Certificate (DSC) Level One candidates illustrate an in depth knowledge of deer including identification and their biology and is able to demonstrate competent use of a firearm in not only accuracy of shot but also health and safety. DSC Level 2 is based on practical assessment of the deer controller (stalker) in identifying shooting and preparing the carcass of a number of animals and demonstrates the ability of the stalker to select, cull and handle an animal (Deer Management Qualification 2000). These qualifications however do not illustrate a deer manager's knowledge of land management issues and how deer and their management fit into overall land management objectives.

One major factor that affects the economics of deer management is the price of venison. If the venison price is too low the cost of time and ammunition, transport and costs of stalking leases does not make culling deer economic. Recent amendments to the Game Act (HMSO 1970) through a regulatory Reform Order in 2007 that removes the need for a game dealing licence is likely to encourage an increase in local venison sales direct from the deer manager. This is being facilitated through the development of local food initiatives such as farmers' markets.

1.9. The future of deer and their management in Wales.

In this chapter we have examined the evidence relating to wild deer and their impact in Wales and the rest of the UK. We have also identified that the species of deer found in Wales demonstrate specific behaviour that is likely to come into conflict with land management. There are a number of deer management techniques available although the key is firstly to identify the deer impact that needs to be addressed and then apply an effective management strategy. The management strategy must not just minimise deer impacts but also take into consideration wider issues such as public perception, legislation, handling of venison and the economic costs of any management activity.

Current evidence of deer population trends and impacts suggest that wild deer in Wales do not currently have a significant widespread impact on forestry, agriculture and biodiversity. The presence of deer in Wales and their impacts have only recently been investigated and whilst the damage is not economically significant there is unlikely to be further large scale investment in deer management activities until the future implications of increased wild deer populations on a spectrum of issues are more widely understood by landowners, managers and policy makers. Forestry Commission Wales' Better Woodlands for Wales grant scheme is the first land management scheme to recognise deer in Wales as a significant landscape issue and as such has invested in the provision of deer management advice and support to landowners (Forestry Commission Wales 2006). The scheme is a good example of how deer management and best practice can be successfully integrated into a land management scheme. This investment has been as a result of research across the UK carried out by Forest Research to develop monitoring and management techniques as well as lessons learnt through the work of the Forestry Commission across the rest of the UK.

Lack of evidence of deer having a significant role in damage to agriculture, biodiversity, vehicle collisions or disease means that at this stage survey and monitoring work to identify trends is the important key to the future of deer management in Wales. Monitoring will enable the identification of decision points in the development of deer management strategies in Wales. Decision points can be developed by stakeholders to determine what feature of the deer presence requires a response and to what degree. Decision points may include levels of deer damage to habitats under biodiversity action plan targets that indicate the need for an increase in deer management or the number of deer and vehicle collisions that indicate the need for a public awareness campaign.

With key conservation strategies in Wales including habitat connectivity, continuous cover forestry as well as the response to climate change there is the potential for deer populations to increase significantly and the woodland habitat to respond accordingly. Recent debate into the impacts of climate change on wild deer suggest that in some areas deer impacts may increase due to warmer climates reducing deer mortality and increased growth rates. In other areas changes in woodland vegetation may increase forage availability and as a result increase the woodland deer holding capacity. There is also the suggestion that availability of water may become a migratory influence on some species of deer (Irvine et al. 2007). Other issues such as an increase in deer found in urban situations (DEFRA 2006) may require a different response to current deer management practices and there is also the issue of minimising the role of deer in transmission of wildlife disease (Ward et al. 2007). The risk of wild deer acting as a host or vector for insect or biological pests and diseases such as Bovine Tuberculosis is likely to increase as deer densities increase (Ward et al. 2007) although disease susceptibility varies between species. This is important as a disease such as Bovine Tuberculosis is economically significant to agriculture and specifically cattle and it can also be a risk to human and wildlife (eg. Badger) health (Welsh Assembly Government 2006).

Of equal importance is the need for Wales to work with other regions in the UK that are already very pro-active in deer management to ensure best practice can be introduced as and when required into Wales in conjunction with or parallel to the rest of the UK. Currently the National Assembly of Wales' significance and the Welsh Assembly Government capacity to legislate in a national and regional context is evolving rapidly and this will influence how wild deer in Wales are managed in the future. The key to sustainable management of a healthy wild deer population in Wales is co-operative deer management at both a local and national level integrating research and policy to ensure the use of timely and accurate information and best practice. It will be essential that landowners and policy makers take a 'what if?' stance towards wild deer in Wales and consider the significance of mitigation costs in the future if wild deer in Wales are not managed now. CCW currently spends in the region of £1.6 million per annum on biodiversity grant aid to the public and private sector in Wales and yet only £7,000 on monitoring and management planning and recognises that 60% of Welsh BAP habitats are in decline and there is a lack of data on the factors affecting biodiversity in Wales (CCW 2007, 2008). There is clearly the need to move away from mitigation to prevention if the demands for this grant aid are not to continue to increase in the future.

The role of deer management initiatives has become increasingly important in the delivery of long-term effective deer management strategies. Whilst deer remain of national importance with regard to their negative impacts on biodiversity, agriculture and forestry there will continue to be a need for a focal point to co-ordinate deer research and management activities. Emphasis is moving from crop to biodiversity protection. Initially deer initiatives' roles have been to collate information on deer populations and impacts and provide management advice. As this objective is being met there will continue to be a demand for the provision of practical deer management. Whilst this transition occurred in Scotland some years ago it is only now appearing in England and will develop in Wales over the next few years. It is only now after 10 years of work in Wales that there is now enough knowledge and commitment to establish landscape level deer management strategies based around deer management groups.

The difficulties with which deer initiatives need to continue to address are based on perception. Different landowners and users view the value of deer differently. With resources available to support deer related work becoming increasing more limited as other priorities compete there is a need for a policy led change in deer management culture to integrate deer issues into a wider range of policies and management plans. These links can be from managing deer for recreational purposes to enable deer to be used as a tourism asset to managing deer for damage limitation and protection of the natural environment. The key to the success of this strategy is in allocating resources to carry out research on deer populations and their impacts and provide practical deer management advice where necessary.

In the UK the availability of quantitative and qualitative information on deer and deer management continues to improve. Modelling and predictive support can be provided to assess more accurately trends in wild deer populations that can be used to support the management of wild deer in conjunction with other habitat and species management.

A success of the Deer Initiative has been to improve communication and knowledge of deer and their impacts to stakeholder groups. A useful example of this is the incorporation of deer as a significant factor for consideration when landowners apply for forestry related grants in Wales. The work done to improve deer distribution data and the impact research being carried out is also establishing a robust database on which future trends in deer impacts and subsequent management can be based. Difficulties will continue to occur however with supporting work in Wales until land management activities and policy outside forestry including conservation recognise the value of early intervention to assess and manage an evolving wild deer population across the spectrum of areas they may have an effect.

1.10 Introduction to remainder of this thesis.

As we have discussed there is a clear understanding of deer populations, their habitat use and feeding activities in Great Britain. There are also a wide variety of strategies and techniques that have been developed to control deer numbers and their impact. We have also discussed why there is a need to manage deer and where deer conflict with commercial activities and land conservation objectives.

Previous research has identified gaps in knowledge, particularly in Wales regarding deer impacts. Whilst the results of previous research including in England and Scotland can identify potential impacts and activities there is a gap in current knowledge. More information is needed with regard to what is happening to woodland biodiversity that quantifies what is occurring in terms of deer presence and impacts and management activities being carried out.

The following chapters outline research carried out to determine if wild deer currently have an impact on agriculture and private forestry (Chapter 2) and woodlands managed for conservation in Wales (Chapter 3, 4 and 5) before taking the results of this work and hypothesising if deer impacts are likely to occur in the future by means of the development of a risk assessment (Chapter 6). The results of the work carried out for this thesis is then discussed and conclusions made in chapter 7.

CHAPTER 2

IMPACT OF WILD DEER ON AGRICULTURE AND PRIVATE FORESTRY IN WALES

2.1 Introduction

The area of Wales that is under management for forestry and agriculture has remained reasonably static over recent years (Tables 2.1 and 2.2). Since political devolution in Wales in 2000 and continued revision of legislative and governmental decision making being transferred from Westminster to Cardiff (WAG 2006a) future policies involving forestry and agriculture have an increased capacity to change the composition of the rural environment. Increased direction from the Welsh Assembly Government highlights the importance of a sustainable, well managed countryside and environment in Wales and the role of forestry and agriculture in achieving the objectives set out in these policies. The new nature of conservation and rural redevelopment strategies in Wales and the implications for the environment and the rural community are illustrated clearly in the recent 'One Wales' document (WAG 2007a) whose agenda is clearly reflected in the Wales Rural Development Plan (WAG 2008) and Wales Environment Strategy (WAG 2006b).

The most significant development in forestry in recent years has been the increase in the cover of broadleaf and reduction in conifer managed by Forestry Commission Wales (Table 2.1.). This reflects the aims of the Woodlands for Wales Strategy launched in 2000 (WAG 2001) which has a key target to convert 50% of Welsh woodland to broadleaf by 2020. Agriculture has seen an increase in land managed for grazing livestock (Table 2.2). In line with Welsh Rural Development Plan it is worth noting that grant payments for agri-environmental schemes have increased significantly over the last 5 years in order to add conservation value to farming. In 2001 Tir Gofal grants contributed £5.7 million but by 2006 this had increased to £25 million (WAG 2007a). The use of agri-environmental schemes to benefit biodiversity and the long-term management of agricultural landscapes has been shown to be very effective in meeting conservation targets such as an improvement in habitat condition (Ovenden et al. 1998).

Table 2.1. Comparison of forestry in Wales between 2000 and 2005 (Forestry Commission 2000 and 2005).

Type of Woodland	*2000 Forestry Cover (ha)*	**2005 Forestry Cover (ha)**
FC Broadleaf	10,000	97,000
FC Conifer	105,000	12,000
FC Total	115,000	109,000
Non FC Broadleaf	63,000	64,000
Non FC Conifer	111,000	113,000
Non FC Total	175,000	177,000
Total Woodland	289,000	286,000

Table 2.2. Comparison of agriculture in Wales between 2002 and 2005 (WAG 2005 and 2007a).

Agricultural Land Use	*2002 Wales Agricultural Land (ha)*	**2005 Wales Agricultural Land (ha)**
Arable Land	195,000	181,000
Permanent Grass	925,000	982,000
Rough grazing	453,000	401,000
Woodland and other land including set-aside	60,000	65,000
Total Agriculture	1,633,00	1,629,000

The change in focus of forestry and agriculture in Wales over recent years has increased the broadleaf woodland and wildlife habitat value in farmland. This has co-incided and to some extent might have contributed to the spread of wild deer populations in Wales. As deer populations increase and forestry and farming practices evolve, it is likely that deer will increasingly come into conflict with commercial rural land-use in Wales. In this chapter, the impact of wild deer on agriculture and private forestry in Wales is assessed in order to ascertain its current importance and suggest future trends.

2.2 Wild deer and Agriculture and Forestry

Deer have a variety of impacts on agriculture and forestry through their patterns of land use (Putman and Moore 1998) although these vary greatly. Damage to forestry and agricultural crops is caused primarily through the movement of deer such as red or fallow through crop fields and/ or through browsing damage to crops by other deer species such as Roe (Putman & Moore, 1998 and Putman, 1986). The perception and real cost of crop damage varies depending on type of physical damage to crop and whether this affects crop productivity.

The importance of the economic impact of wild deer is highly dependant on the crop and its current economic value, irrespective of whether its origin is forest or farm based and the proportion of total revenue the landowner receives from that crop (White et al. 2004, Torstenson et al 2002). Deer management strategies vary depending on perceived and actual damage to crops and the economic implications of implementing deer management strategies depend on the value of the crop. This was discussed in more detail in the previous chapter.

2.2.1 Wild Deer and Agriculture

The damage caused to cereal crops is the most significant of deer impacts on arable agriculture (Doney & Packer 1998) and crop damage is followed by damage to farm woodland, vegetables, fruits and root crops. Different deer species have a preference for specific crops and research suggested that roe deer appear to be a more significant species in terms of damage to agricultural crops compared to fallow and red (Putman 1986, Gill, 1992a Doney and Packer 1998). The time of year and location of the crop in terms of adjacent land–use also influences the crop vulnerability to deer browsing (Putman and Kjellander 2003). Farm woodland plantations adjacent to existing natural, semi –natural and ancient woodland are more susceptible to browsing damage compared with farm woodland plantations located in open arable habitat (Key et al. 1998) although this is often affected by landscape and relative deer abundance. It is however important to understand that deer are not the only wildlife species that cause damage to agricultural crops such as cereals. Birds and squirrels have been recorded as causing damage to crops but to a lesser extent than deer present (Tzilkowski et al. 2002).

Large species of deer such as red and fallow through grazing on pastureland intended for livestock such as beef cattle can have a significant effect on the amount of forage available for farm enterprises (Torstenson et al. 2002). The regular presence, and seasonal migration, of deer within an area is influenced by the abundance of food crops, and crop management such as fencing can reduce the degree of damage, and also affect the ability to reduce the number of problematic deer (Vercauteren and Hygnstrom 1998). For example, roe deer have been shown to select woodland areas positively in comparison to arable crops (Putman 1986) and grazing showed seasonal variations with the most damage occurring in spring and early summer although the crops recovered without significant loss of harvest yield.

The results of a questionnaire sent to landowners by ADAS in 1995 (Doney & Packer 1998) suggested that damage caused by deer to agriculture was not perceived as significant as damage caused by deer to forestry. The survey examined 2560 farms across 4 regions in England and 69% of the 1192 landowners reported deer presence on their farms. Roe were the most common species of deer observed followed by Fallow and then Red. Crops most likely to be damaged were cereals (44%) followed by grassland (6%), Root crops (3%), Fruit (3%) and vegetables (2%). 29% of farm woodland also appeared to be damaged. Muntjac were not observed. On a national basis research in collating incidents of deer damage (Putman and Moore 1998) recorded that reports of deer damage vary greatly between regions. The results of the ADAS research (Doney and Packer 1998) showed that deer impacts can be regionalised in England and may not provide a true picture of the impact of wild deer on agriculture as in many cases they record perceived damage and not quantified physical or functional damage. Putman and Moore (1998) identified that whilst Wales had a greater regional coverage of woodland compared with England where it had significantly fewer incidents of deer damage reported. Wales is likely to experience less deer damage as a result of a lower deer population as opposed to lack of vulnerable cops. A preliminary estimate of the cost of damage caused by deer to agriculture in England in 2003 was around £4.3 million annually, with cereal farms receiving the most damage (around £2.4 Million annually) and the East and South West Regions being the areas with the greatest levels of damage (Wilson, 2003).

2.2.2 Wild Deer and Forestry

Different deer species cause damage to woodland through a variety of activities including browsing, trampling, scraping and bole scoring which reduces regeneration, growth and quality of the trees and the under-story canopy (Harmer 2001). Browsing of tree saplings by deer can, over time, affect not just the timber quality but also the overall dominant tree species and thereby change the whole composition of the woodland. There has been a lot of work done to assess the impact of wild deer on forestry (Gill 1992). Loss in timber can occur primarily through bark stripping which increases rot incursion (Welch and Scott, 2001) and browsing of leader shoots (Welch et al. 1991) which causes double trunking and reduction in tree size.

Woodland management activities can also influence deer habitat utilisation, degree of impact and also the ease with which deer can be managed. Practices such as clear felling do not affect deer migration in the long term (Linnell and Andersen 1995) although there is no evidence to suggest that the deer return to an area is specifically take advantage of new plant growth in the cleared area. The migration of deer could create a 'vacuum' in other areas into which other deer enter thus increasing the impact of deer over the area as a whole (Stewart et al. 2000) although this would depend on landscape area and land-use. The degree to which an area is managed in terms of disturbance also affects the movement and impact of deer although as an example the short –term effects of logging on roe deer habitat use is minimal (Linnell and Anderson, 1995).

However, as woodlands are increasingly used for recreation the disturbance of the deer habitat by walkers often accompanied by dogs, bike riders, horse riders and cars also affects deer movement as discussed in the previous chapter. Information from landowners and deer managers in Wales suggests that increased public access could dislocate deer movement patterns and move the deer deeper into the forest, concentrating them into particular areas of woodland where competition for space and feed resources is increased. An increase in deer disturbance not only potentially increases the potential for deer to cause damage to crops but may also make any subsequent deer management activities more difficult as the deer are more difficult to locate.

2.3. Investigation into the Impacts of wild deer in Wales on Agriculture and Private Forestry

2.3.1 Methods

In order to assess the impact of wild deer on commercial agriculture and forestry on a national basis the most efficient method available is the use of landowner surveys as illustrated in a review of work done by Putman and Moore (1998) and White et al. (2004). This can be used to first provide a qualitative assessment about the nature of the damage and a quantitative evaluation of occurrence.

A landowner questionnaire was produced and distributed in 2000 and 2005 to private foresters and farmers. A total of 320 foresters were sent questionnaires in 2000 and 365 foresters were sent questionnaires in 2005. A total of 600 farmers were sent questionnaires in both 2000 and 2005. In order to reach the intended target group of Wales' landowners the questionnaire was distributed to private foresters through the Confederation of Forest Industries (previously The Timbers Growers Association and The Forest and Timber Association) and to farmers through the Wales Farm Business Survey (FBS) operated by the Wales Institute for Rural Studies at the University of Wales, Aberystwyth. The survey was not distributed to the public forestry estate as previous research by Mayle and Smith (1992) had already established baseline information for deer in public sector forestry in Wales and re-enforced the need for data collection in the private sector. For the forestry survey the questionnaire included a British Deer Society deer identification guide, and these were distributed through the Deer Initiative

Wales and CONFOR Wales mailing list with a covering letter explaining the research and a stamped addressed envelope for the return of the questionnaire. The aim of the questionnaires was not just to provide baseline information on wild deer in Wales but also to raise awareness of deer related issues to landowners and managers operating in Wales. Even if a landowner failed to complete a questionnaire they would potentially still be aware that a survey was being carried out and deer were a potential issue in their sector. For the agricultural survey, surveyors employed by the Farm Business Survey (FBS) unit to carry out the FBS annual agricultural survey took the questionnaire and the identification guide out to farms on their scheduled visits and completed the forms after verbally questioning the farmers. Prior to the data collection period the questionnaire and its purpose were explained to the surveyors. The FBS unit then collected and collated the completed questionnaire and returned them for analysis. In addition to the completed questionnaire the FBS unit also provided additional data for each farm which was only identified by a reference number. The additional data included area of holding, area or woodland and area of fodder or crops. This additional data enabled potential comparison between forestry and agricultural data and identification of land-use on farmland that may influence deer presence and impacts.

The questionnaire was split into three sections. A copy can be found at Appendix 2.1. The first section asked if wild deer had been sighted on or in the vicinity of the property. No time frame was given for the sighting (for example 'the previous year') so as not to exclude information from farmers who rarely observed deer. Even rare sightings still give an indication of the presence of a wild deer population in an area. The landowner was then asked to identify the species of deer seen. In the second section the landowner was asked to identify if the deer had caused any damage to their property and this included options such as browsing, stripping or trampling.

If damage caused was of another type the landowner was asked to specify in more detail what the problem was. The landowner was also asked to try to estimate the financial cost of the damage. In the third section of the survey the landowner was asked to provide information on the occurrence of deer management on the property and the financial cost. Options suggested to the farmer included fencing and/or culling as well as use of repellents or deterrents. The landowners were then asked the area of their holding, the area of woodland on site and its location by county.

2.3.2. Results

The results of the survey show that deer and deer damage are reported to occur in both land managed for private forestry and in agriculture in Wales area the proportion of area surveyed with damaged increased slightly between 2000 and 2005 (Table 2.3.) The differences illustrated in Table 2.3 are examined in more detail in the results that follow.

2.3.2.1. Survey

The results suggest that whilst there were no significant differences between years or counties in the number of responses returned overall (T-test Year t=-2.003, df=3, P=0.139, T-test County t=-2.676, df=39, P=0.091) there were significant differences between the two land-use groups (T-test, t=-2.003, df=3, P (2-tailed=0.001).

In 2000 and 2005, 600 completed questionnaires were returned through the FBS Unit. In 2000, 51 completed questionnaires were returned from private foresters with 39 returns received in 2005.

Table 2.3. Summary of results of survey into impact of wild deer in Wales in agriculture and private forestry.

	Forestry		Agriculture	
	2000	2005	2000	2005
Survey Area (ha)	24057	12417	83787	81818
Deer observations (sightings per 100ha)	0.26	2.02	0.31	4.3
Fallow sightings (per 100ha)	0.06	0.06	0.002	0.005
Red sightings (per 100ha)	0.02	0.01	0	0.001
Roe sightings (per 100ha)	0.01	0.02	0	0
Muntjac sightings (per 100ha)	0.004	0	0.002	0.001
Deer of an unspecified species sightings (per 100 ha)	0.01	0	0.004	0.01
Area with deer damage observed (ha)	3689 (17.18%)	913 (19.43%)	434 (0.517%)	485 (0.624%)
Estimated Cost of deer damage (£/ha)	0.77	0.25	0.001	0.01
Area with deer management activities (ha)	4134	2413	434	511
Estimated Cost of deer management (£/ha)	1.33	0.03	0	0

The questionnaires submitted through the FBS Unit were all completed by interviewers who had received a brief on the research project and as a result no questionnaires had to be discarded. Between 2000 and 2005 the county classification was revised and as a result results in 2005 for some counties were merged e.g. Dyfed and Powys.

In the private forestry survey 8 questionnaires had to be rejected and in 2000 and in the 2005 return, 10 returned forestry questionnaires were also discarded for being incomplete. The data from the forestry survey and agriculture survey can be found at Appendices 2.1 and 2.2 respectively.

Data returned covered all of the regions in Wales except Anglesey. For the ease of data analysis data from smaller South Wales counties were grouped into a Glamorgan group and a Gwent group (see Figures 2.1 and 2.2).

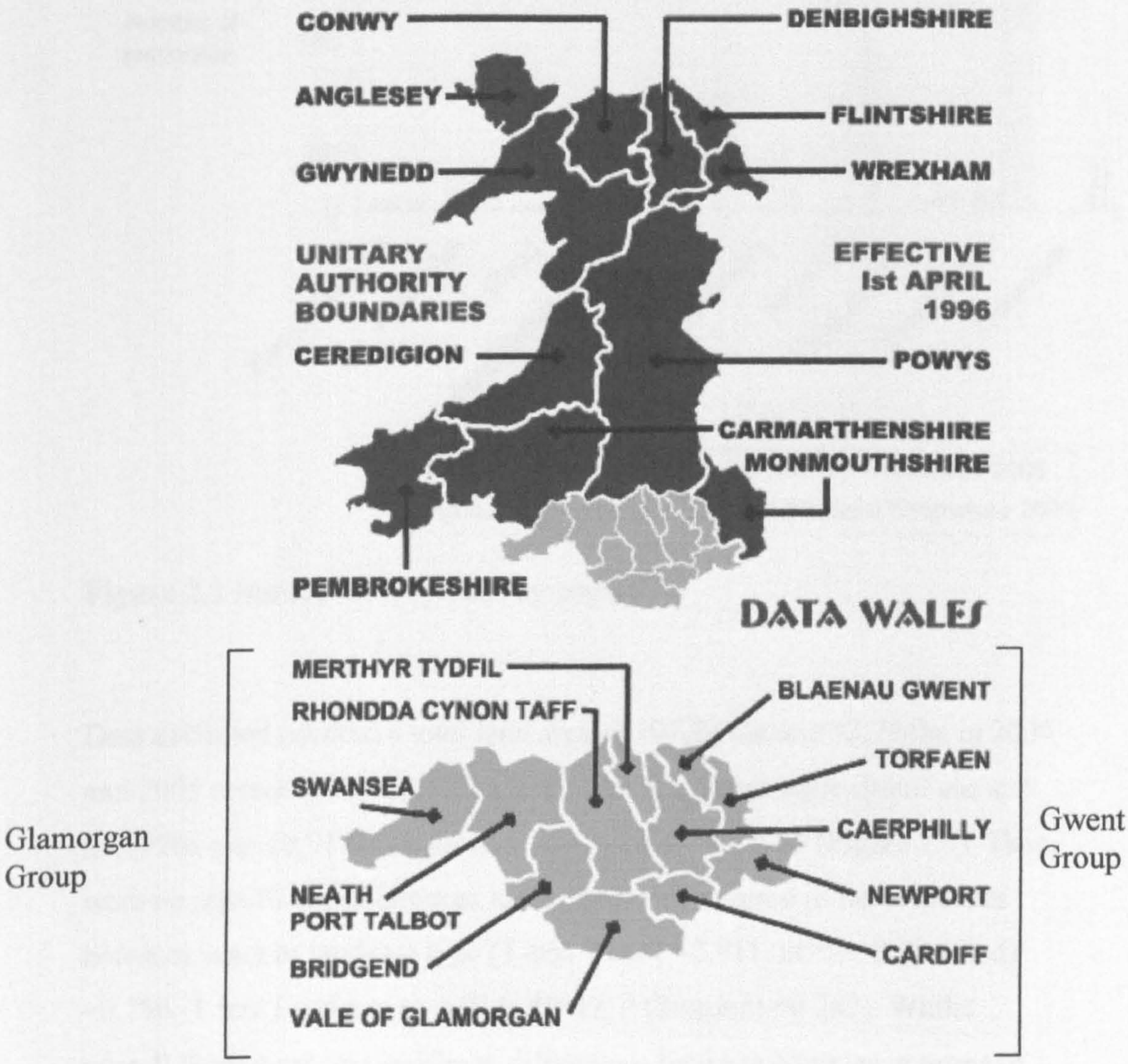


Figure 2.1. Breakdown of county boundaries for Wales

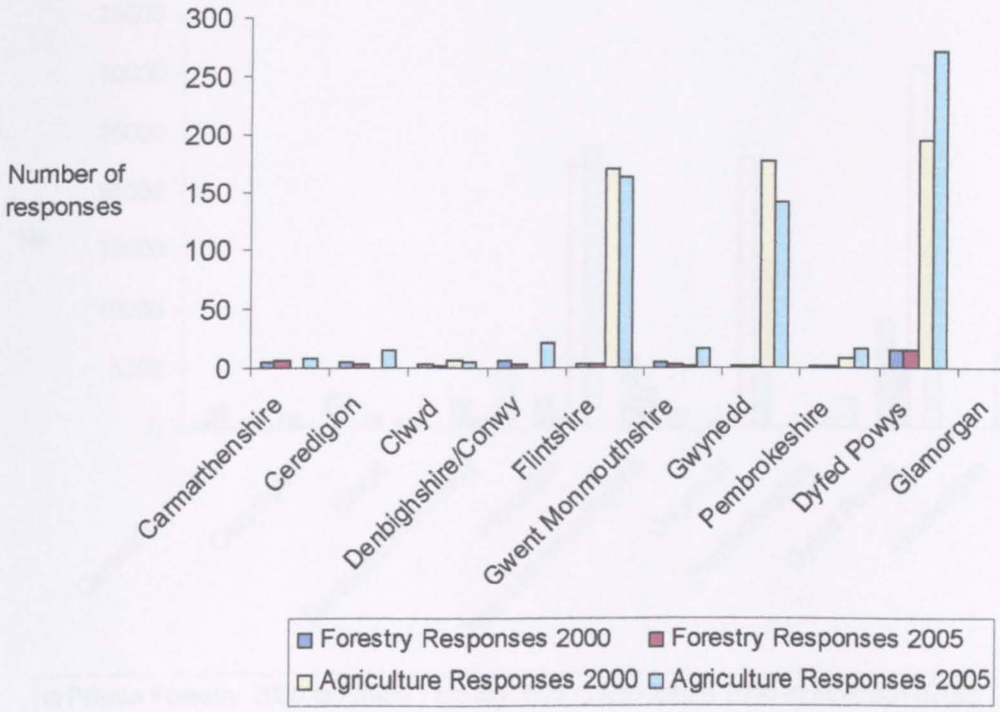


Figure 2.2 Number of responses by county

Data collected covered a total land area of 107,844ha and 92,734ha in 2000 and 2005 respectively. 83,787ha and 81,817ha was in agricultural use and 24,057ha and 10,917ha in forestry use in 2000 and 2005 (Figure 2.3). There were no significant differences in the land area covered in the responses between years or land-use type (T-test Year $t=-3.911$, $df=39$, P (2-tailed) $=0.796$, T-test Land-use $t=-3.911$, $df=39$, P (2-tailed) $=0.242$). Whilst overall there were no significant differences between counties in terms of area the responses covered (T-test, $t=-3.908$, $df=39$, P (2-tailed) $=0.39$) within land-use there were significant differences. Flintshire and Powys showed a significant difference in area of forestry and agriculture covered by the survey.

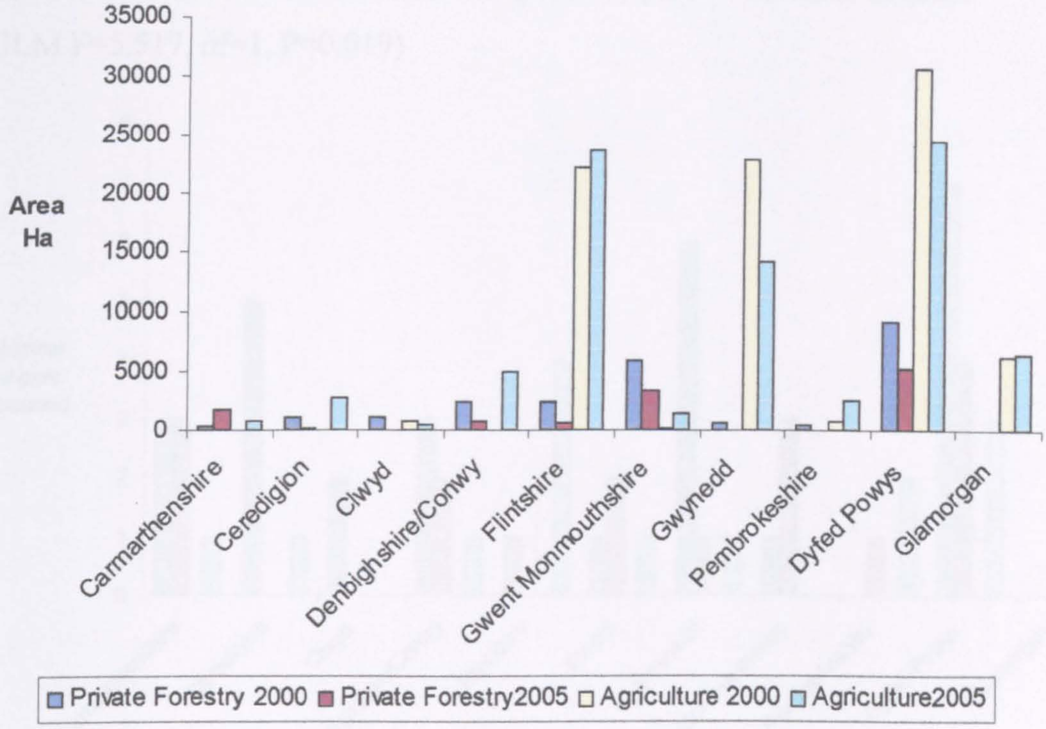


Figure 2.3. Area covered by response by county

2.3.2.2 Deer Observations

Deer were observed across all ten of the counties the survey covered. Deer observations between year and land-use type were not seen as significant (GLM Year F=0.015, df=1, P=0.903, GLM Land-use F=7.567, df=1, P=0.06) but there were significant differences overall between counties (GLM County F=18.617, df=10, P=0.045).

Wild deer were most frequently observed in Dyfed Powys across years and land-use type and significant differences in deer observations were recorded in both land-use types between counties within survey years. In 2000 there were significant differences between counties within land-use between years. Powys was the only county that showed significant differences in deer observations between land-use and year compared with other counties (GLM F=5.517, df=1, P=0.019)

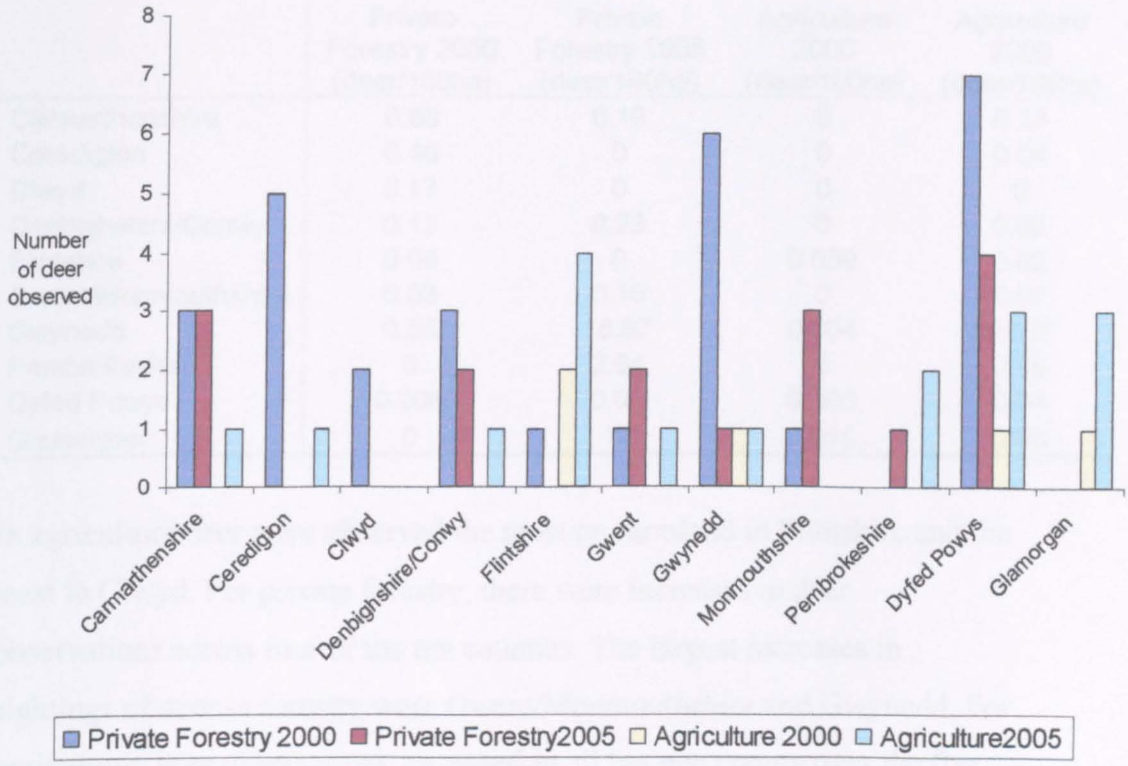


Figure 2.4 Deer observations by county

If we examine the results in terms of observations of deer per 100 hectare (Table 2.4) the data takes into consideration the variation in area covered across the survey between 2000 and 2005 which is particularly important for private forestry where the data in 2005 covered around half that in 2000. There were however no significant differences in deer observed/100ha overall between years within land use or county (GLM landuse F=1.058, df=1, P=0.311, GLM county F=0.858, df=9, P=0.573)

Table 2.4 Deer observed per county (deer/100 ha).

	Private Forestry 2000 (deer/100ha)	Private Forestry 2005 (deer/100ha)	Agriculture 2000 (deer/100ha)	Agriculture 2005 (deer/100ha)
Carmarthenshire	0.88	0.16	0	0.13
Ceredigion	0.46	0	0	0.04
Clwyd	0.17	0	0	0
Denbighshire/Conwy	0.12	0.23	0	0.02
Flintshire	0.04	0	0.009	0.02
Gwent/Monmouthshire	0.03	0.15	0	0.07
Gwynedd	0.85	16.67	0.004	0.007
Pembrokeshire	0	2.94	0	0.08
Dyfed Powys	0.008	0.07	0.003	0.01
Glamorgan	0	0	0.015	0.05

In agriculture deer were observed the most on farmland in Flintshire and the least in Clwyd. For private forestry, there were increases in deer observations across four of the ten counties. The largest increases in sightings of deer in forestry were Gwent/Monmouthshire and Gwynedd. For agriculture, deer observations increased in all but one county over the five year data collection period. The largest increases of sightings of deer in forestry were seen in Carmarthenshire and Gwent/Monmouthshire.

The most frequently observed deer species on both private forestry and agriculture were fallow, followed by red, roe and muntjac. In terms of the species observed (Figure 2.5), whilst there were no significant differences in species observed overall (GLM, $F=0.944$, $df=4$, $P = 0.548$). There were no significant differences in species observations overall between years (GLM, $F=0.204$, $df=1$, $P = 0.675$) or land use (GLM $F=7.44$, $df=1$, $P = 0.437$). There were also significant differences between deer observations between species overall within land-use type between years. Different deer species observations within land use type between years did vary but not significantly (GLM $F=5.175$, $df=1$, $P=0.085$). Private foresters however also appeared to be more consistently able to identify deer species than were farmers (Figure 2.6).

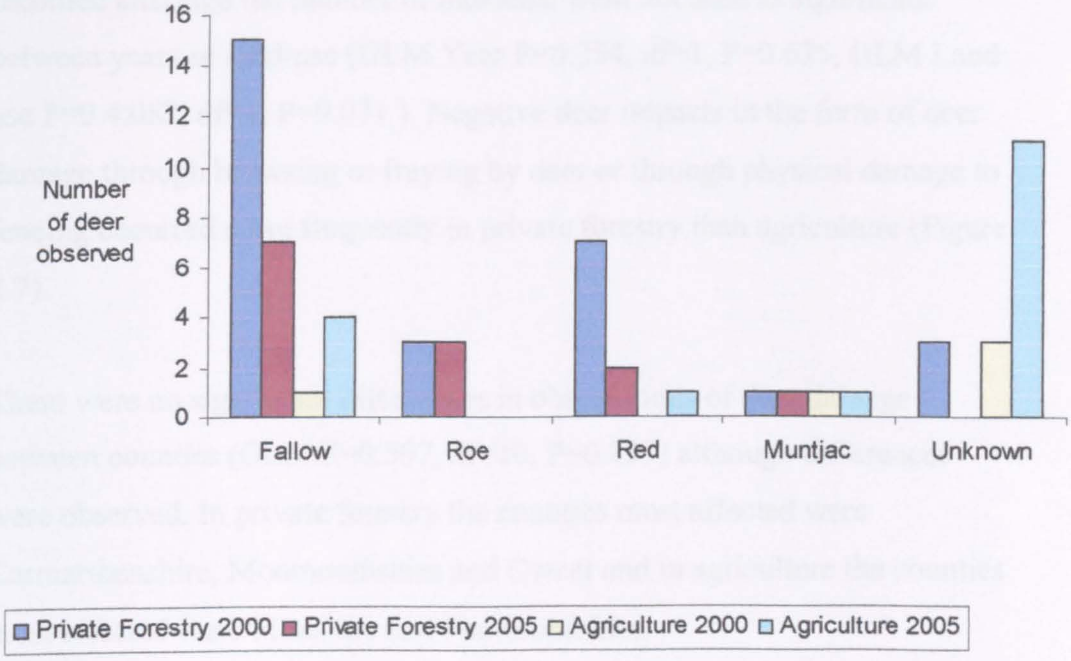


Figure 2.5 Deer observations by species

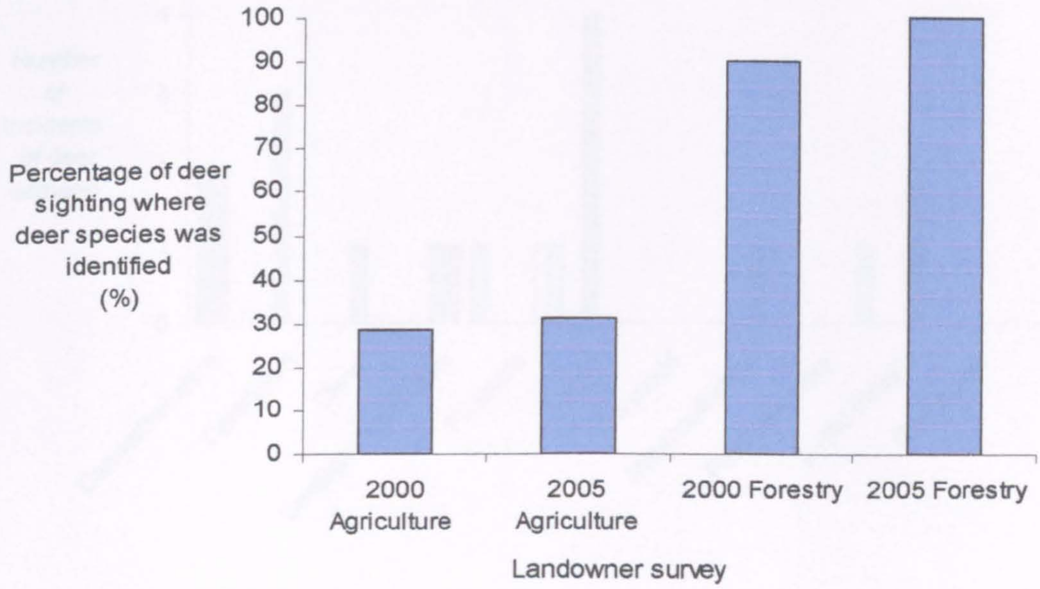


Figure 2.6. Deer observations and identification of deer species

2.3.2.3 Deer Impacts

In both agriculture and private forestry there were incidents of deer damage recorded although the number of incidents were not seen as significant between years or land-use (GLM Year F=0.254, df=1, P=0.625, GLM Land use F=0.4.082, df=1, P=0.071). Negative deer impacts in the form of deer damage through browsing or fraying by deer or through physical damage to fencing occurred more frequently in private forestry than agriculture (Figure 2.7).

There were no significant differences in observations of deer damage between counties (GLM F=0.507, df=10, P=0.833) although differences were observed. In private forestry the counties most affected were Carmarthenshire, Monmouthshire and Gwent and in agriculture the counties most affected were Flintshire and Pembrokeshire.

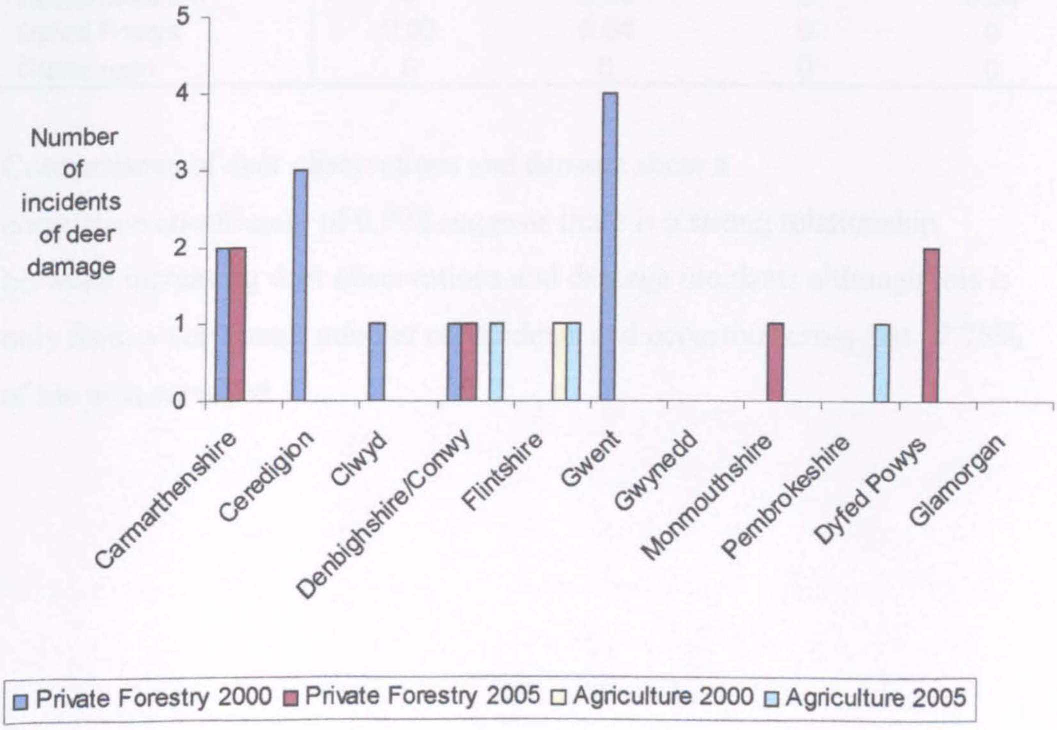


Figure 2.7 Sites by county with deer damage.

When the results are examined in terms of incidents of deer damage per 100 hectare (Table 2.5) it is possible to consider variation in the area surveyed. For private forestry deer damage occurred across all but three of the counties in Wales. The counties without recorded deer damage were Clwyd, Flintshire and Glamorgan. In agriculture damage was only recorded in three counties and these were Denbighshire, Flintshire and Pembrokeshire.

Table 2.5 Incidents of deer damage by county (incidents/100ha).

	Private Forestry 2000 (Incidents/ 100ha)	Private Forestry 2005 (Incidents/ 100ha)	Agriculture 2000 (Incidents/ 100ha)	Agriculture 2005 (Incidents/ 100ha)
Carmarthenshire	0.58	0.11	0	0
Ceredigion	0.09	0	0	0
Clwyd	0	0	0	0
Denbighshire/Conwy	0.04	0	0	0.2
Flintshire	0	0	0.05	0.04
Gwent/Monmouthshire	0.02	0.06	0	0
Gwynedd	0	16.67	0	0
Pembrokeshire	0	2.94	0	0.04
Dyfed Powys	0.03	0.04	0	0
Glamorgan	0	0	0	0

Comparisons of deer observations and damage show a
correlation co-efficient of 0.998 suggests there is a strong relationship between increasing deer observations and damage incidents although this is only from a very small number of incidents and occurred across just 37.75% of the area surveyed.

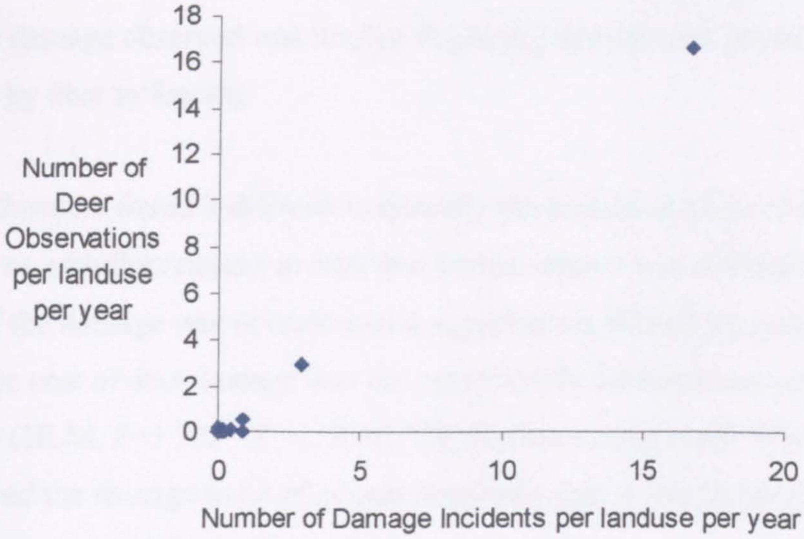


Figure 2.8. Comparison between deer observation and deer damage in Wales.

This suggests that where deer were observed they are potentially causing a proportionate degree of damage and that the deer are not causing significant damage in areas where they are not observed.

Fallow were the most common species recorded as present on sites with deer damage although there was no significant differences in the species of deer recorded as causing damage overall (GLM, F=4.193, df=3, P=0.057) In terms of species of deer that caused damage, fallow were the deer species that were reported as causing the most damage to both private forestry and to agriculture where incidents occurred in Wales (Figure 2.9). Roe and red were reported as causing occasional damage to forestry and muntjac damage was not reported. With respect to the type of damage caused (Figure 2.10) the majority of damage observed was browsing damage with some fraying and grazing. There was no significant difference overall between years or between agriculture or private forestry in the type of damage observed although there were significant differences in private forestry (GLM Year

F=1.087, df=1, P=0.313, Landuse F=0.121, df=1, P=0.733) Agricultural land the damage observed was limited to grazing damage and physical damage by deer to fencing.

The landowners found it difficult to quantify the economic value of the damage as with fluctuations in crop and timber value it was difficult to assess if the damage was of economical significance. Whilst the perceived economic cost of deer damage was not significantly different between counties (GLM, F=3.325, df =1, P= 0.098) landowners in North Wales considered the damage to be of greater economic cost if less frequent than in other areas around Wales (Figure 2.11).

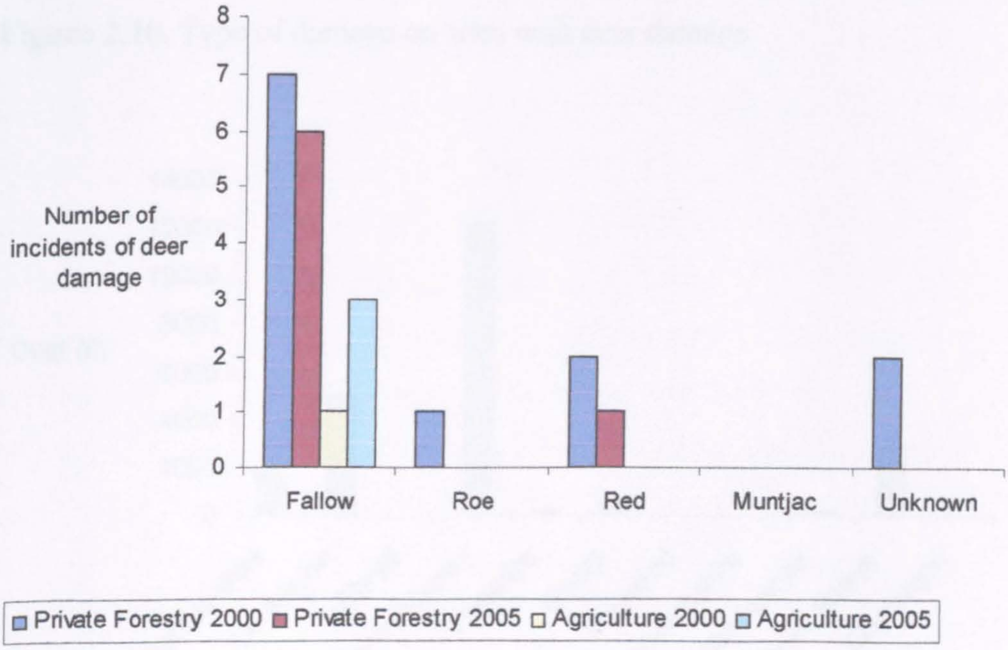


Figure 2.9. Damage by deer species

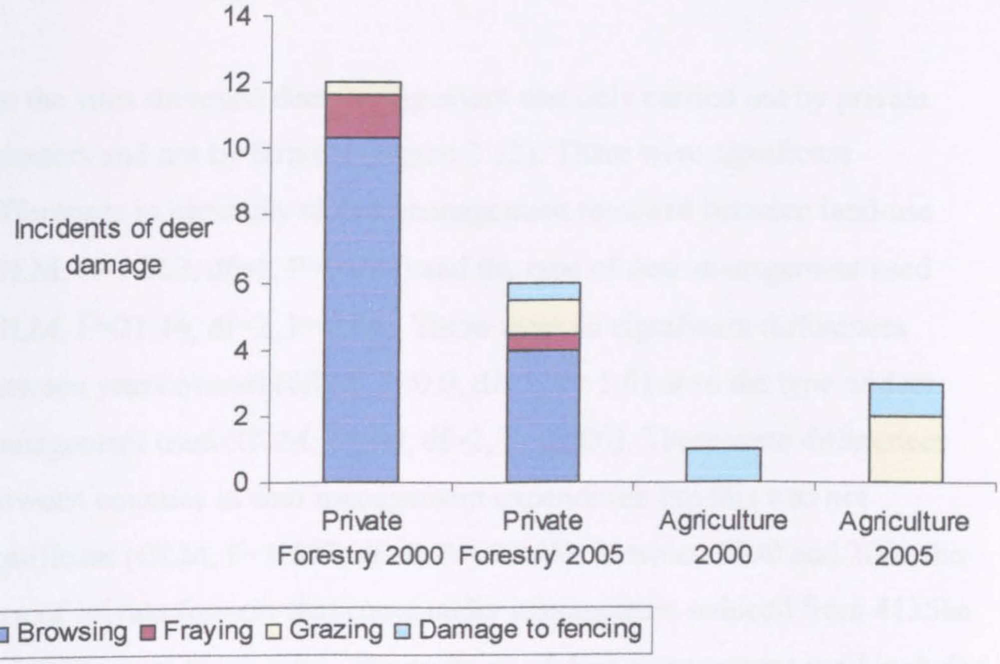


Figure 2.10. Type of damage on sites with deer damage

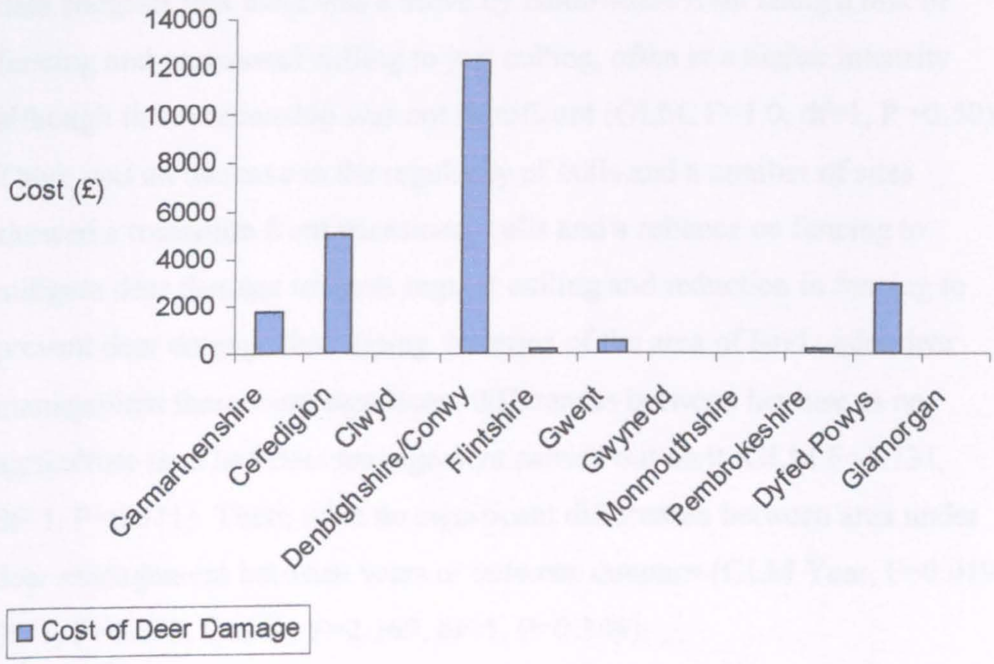


Figure 2.11. Perceived economic value of deer damage to sites by county.

2.3.2.4 Deer Management

On the sites surveyed deer management was only carried out by private foresters and not by farmers (Figure 2.12). There were significant differences in incidents of deer management recorded between land-use (GLM, $F=7.762$, $df=1$, $P=0.024$) and the type of deer management used (GLM, $F=21.44$, $df=2$, $P=0.04$). There were no significant differences between years overall (GLM, $F=0.0$, $df=1$, $P= 1.0$) or in the type of deer management used (GLM, $F=1.0$, $df=2$, $P=0.500$). There were differences between counties in deer management expenditure but this was not significant (GLM, $F=4.307$, $df=1$, $P = 0.065$). Between 2000 and 2005 the area of private forestry that came under management reduced from 4135ha to 3733ha over fewer sites. The methods of deer management used included fencing, culling and the use of repellents which in this case was the use of the chemical repellent 'AA protect' (Figure 2.13). Between 2000 and 2005 data suggests that there was a move by landowners from using a mix of fencing and occasional culling to just culling, often at a higher intensity although this relationship was not significant (GLM, $F=1.0$, $df=1$, $P =0.50$). There was an increase in the regularity of culls and a number of sites showed a transition from occasional culls and a reliance on fencing to mitigate deer damage towards regular culling and reduction in fencing to prevent deer damage developing. In terms of the area of land under deer management there were significant differences between landuse as no agriculture land had deer management carried out on it (GLM $F=7.131$, $df=1$, $P=0.011$). There were no significant differences between area under deer management between years or between counties (GLM Year, $F=0.019$, $df=1$, $P=0.892$, County $F=2.169$, $df=1$, $P=0.148$).

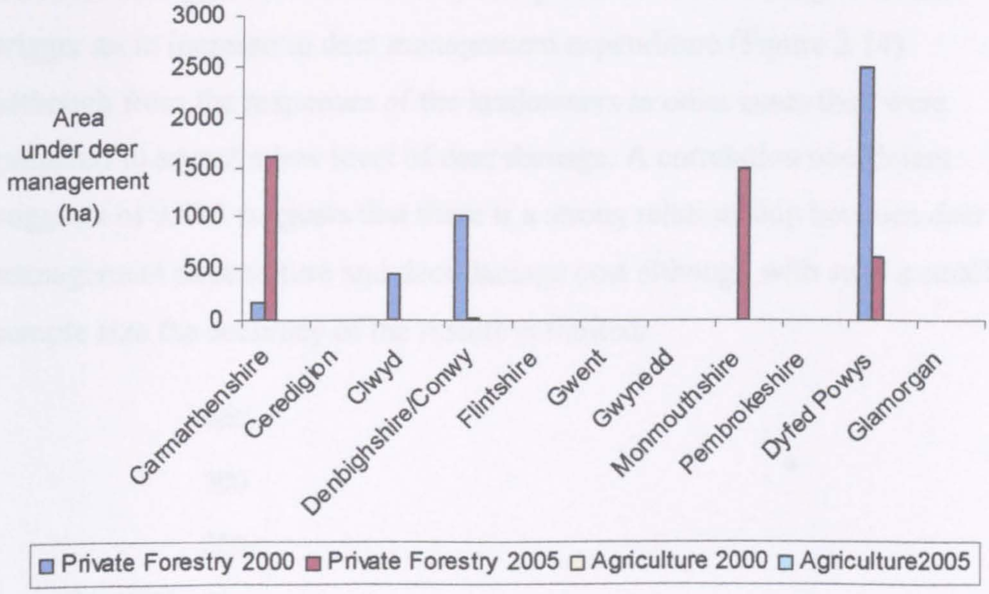


Figure 2.12. Sites by county with deer management

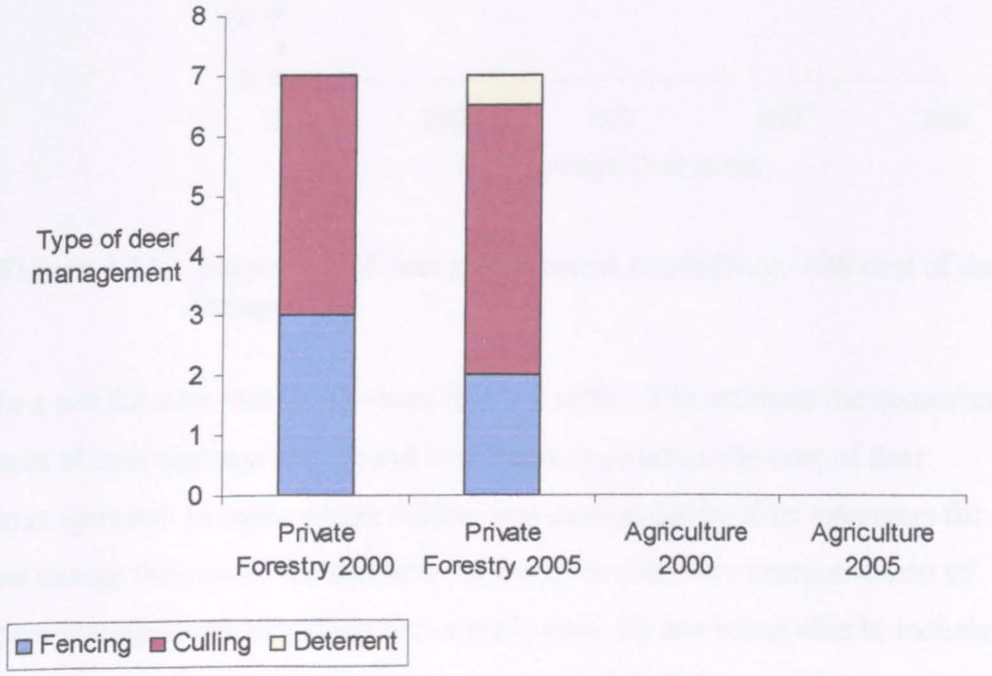


Figure 2.13. Type of management on sites with deer management

The results suggest that a relatively low perceived deer damage cost can trigger an in increase in deer management expenditure (Figure 2.14) although from the responses of the landowners in other cases they were prepared to accept a low level of deer damage. A correlation coefficient suggests of 0.913 suggests that there is a strong relation ship between deer management expenditure and deer damage cost although with such a small sample size the accuracy of the results is limited.

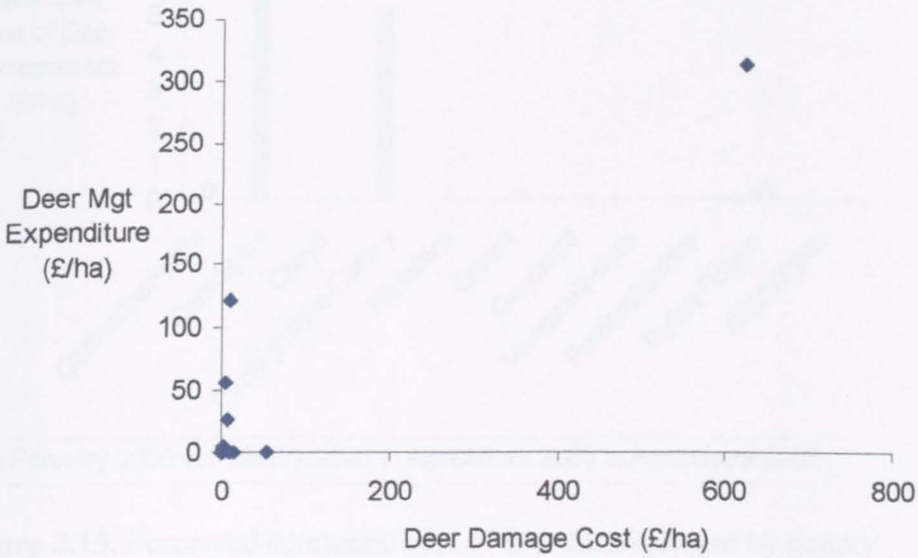


Figure 2.14. Comparison of deer management expenditure with cost of deer damage

In a similar way that landowners found it difficult to estimate the economic cost of deer damage they found it difficult to estimate the cost of deer management. In cases where culling was carried out by deer managers for no charge the cost to landowners was zero therefore the economic cost of deer management by culling is currently zero. By not being able to include the cost of culling in their estimates the true cost of deer management is likely to be much higher than the results suggest (Figure 2.15) although this could be offset by income through the sale of venison or lease of stalking rights. There were no significant differences between counties in terms of deer management expenditure, (GLM, F=1.039, df=1, P=0.314) In areas where expensive deer management such as fencing had been carried out in 2000 there was no expenditure in 2005 although there did appear to be a move from investment in fencing to culling as the most frequently selected deer management method (Fig 2.16).

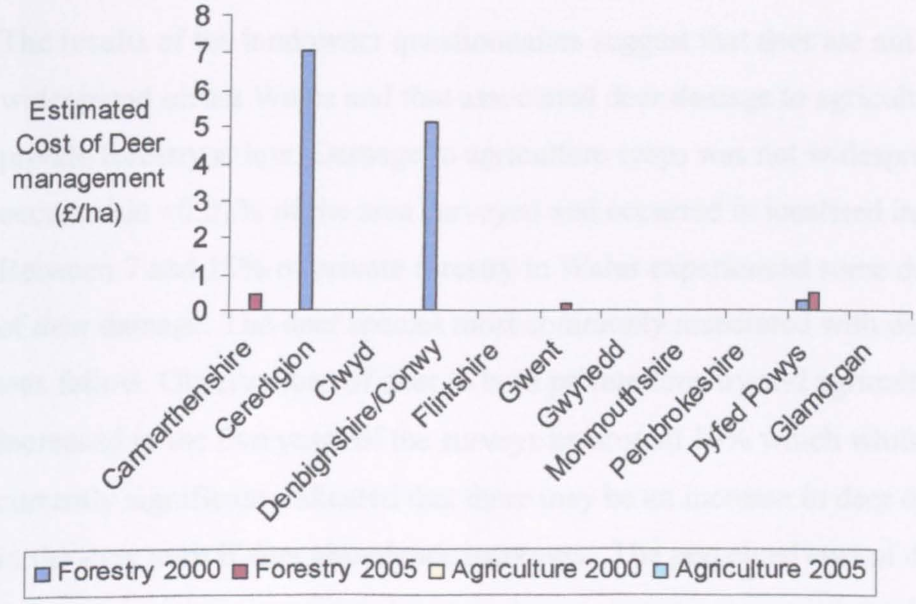


Figure 2.15. Perceived economic cost of deer management by county.

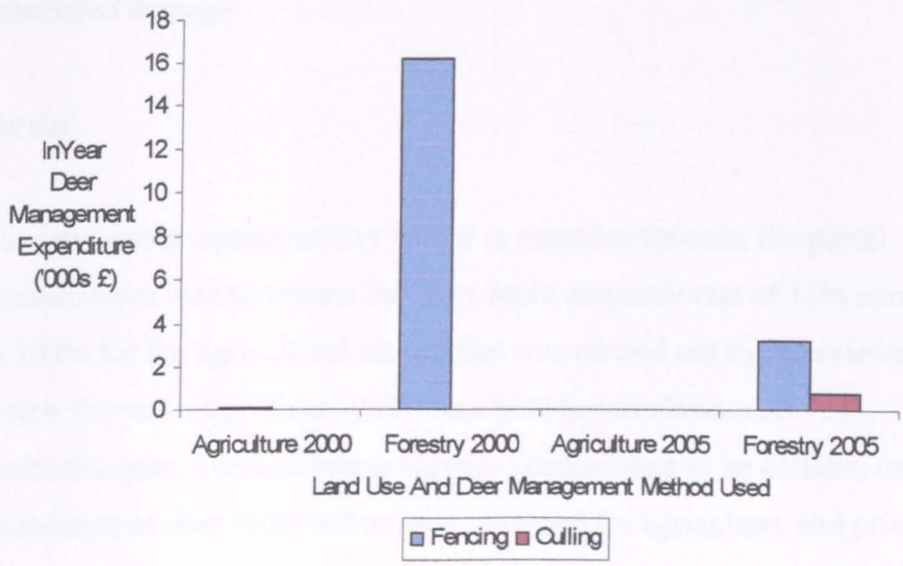


Figure 2.16. Estimated cost of deer management to landowners

Nearly all deer management expenditure in 2005 occurred in areas where previously there had been no deer management although the exception to this was Dyfed Powys where continued management occurred.

2.3.3. Discussion

The results of the landowner questionnaires suggest that deer are not widespread across Wales and that associated deer damage to agriculture and private forestry is low. Damage to agriculture crops was not widespread and occurred in <0.01% of the area surveyed and occurred in localised incidents. Between 7 and 15% of private forestry in Wales experienced some degree of deer damage. The deer species most commonly associated with damage was fallow. Observations of deer in both private forestry and agriculture increased in the five years of the surveys by around 10% which whilst not currently significant indicated that there may be an increase in deer damage in the long term if deer abundance increases. The perceived cost of deer damage was also reported as low and deer management was not carried out at a high level except in areas of high perceived deer abundance and associated damage.

Survey

The landowner questionnaires varied in response success, the postal questionnaire sent to private foresters had a response rate of 15% compared to 100% for the agricultural survey that was carried out by interviewers which showed a significant difference between landowner survey methodologies. The landowner surveys enabled data to be collated on the abundance of deer observed on land managed for agriculture and private forestry in Wales. The samples covered less than 15% of the land area managed as private forestry or agriculture in Wales. In similar surveys where over 50% of respondents reported deer damage recorded response rates were between 36% and 52% (Downey and Packer 1998, West and Parkhurst, 2002). In 2000 the survey was new and a relatively novel subject to foresters. It is likely that the decrease in responses from the forestry sector in 2005 may be linked to the perceived economic significance of deer damage at the time of the survey. The value of forestry products is recognised as a key driver for interest amongst foresters to demonstrate an interest in deer (Gill, 2003). In 2005 timber prices were relatively low and fewer private foresters were in economically viable woodland management where deer were an issue. Similar to previous landowner perception surveys (Conover 1994, Doney and Packer 1998, Langbein and Rutter 2003, Reimoser et al 1999) landowner knowledge and perceptions of damage in comparison varied greatly.

In terms of whether or not the completed questionnaires represented sector or regional activities they do provide a small representation. In terms of sector coverage forestry results represented an average of 10.39% of non Forestry Commission woodland and the agriculture results represented an average of 5% of land in Wales classed as an agriculture holding. Whilst this area is low it does not take into account the variation within each land-use type that may or may not be more vulnerable to deer impacts.

Regional levels of response reflect the area of land in either agriculture or private forestry use (Figures 2.2 and 2.3) suggesting that the results are a sample that reflects the situation regarding deer presence and impact. The survey also provided the opportunity to raise awareness of deer and deer related issues in Wales as the responses improved between 2000 and 2005 showing more identification of deer presence and impacts by landowners.

If the survey were to be repeated it could be suggested that response levels by foresters may increase because of rising timber prices and also the obligation of landowners receiving grant aid through the Better Woodlands for Wales (BWW) scheme to acknowledge deer and implement deer management. In the first two years of the BWW scheme between 2006 and 2008 around 1000ha of private woodland has been assessed with regard to deer presence and deer impact and has effectively come under active deer management. It would however be important to visit a sample of sites that returned responses to identify deer abundance and impacts levels in order to validate questionnaire results (Doney and Packer 1998).

Deer Observations

Fallow were the most frequently observed deer species although the frequency of sightings has remained fairly static over the five years of this study. In contrast, the implications of an increasing roe population is likely to influence the levels of damage seen in future years (Figure 2.5). Work done (Doney and Packer 1998, Putman 1995) suggests that roe deer are a potentially a greater threat than fallow on agricultural crops if trends in increases in deer abundance and distribution continue (Ward 2005, Yalden 1998b) are correct it is likely with the increase in roe populations discussed in Chapter 1 the impact of wild deer in agriculture is likely to continue to increase.

By comparing deer observations across different land uses in the same counties, particularly fallow, in this survey where observed on private forestry they were not generally observed on agricultural land. This may indicate habitat preference by fallow at relatively low densities for woodland compared to agriculture. It could also be due the fact that in areas where forestry is the more common than agricultural land (Denbighshire/

Conwy) deer were more frequently observed in forestry, and in areas where agriculture is more common deer are more common on agricultural land (Ceredigion). Deer only appeared on farmland where private forest area appeared to be low and this suggests that woodlands in Wales still has the capacity to hold more deer without deer becoming a problem. This habitat use is consistent with fallow habitat selection work previously carried out in Wales (Smith and Mayle 1994a, b).

It is important to note at this point that this research does not include public forestry. Extensive areas of public forest occur in Carmarthenshire, Glamorgan, Monmouthshire/Gwent and Gwynedd. The public forest estate has fully implemented deer management operations and this could influence deer and their impacts in a number of ways. Deer management such as culling may reduce the overall population in an area or it may create conditions where the public forest is more or less favourable to local deer populations in terms of resources and disturbance which may influence deer movements in private forestry or agricultural land (Root et al. 1988). If the deer populations were larger and/or increased in migration the pressure on the woodland for feed and shelter would be such that more deer may be pushed into private forest or open farmland to feed. Whilst deer remain in lower densities and do not have a significant effect on forestry then deer will continue not to be an issue on agriculture. The results however do suggest that where the area of woodland cover is reduced the deer may begin to utilise farmland for grazing. The increase in roe and to a lesser degree muntjac in both forestry and agricultural habitats is also likely to have been facilitated by the improvement of habitat connectivity at a landscape level. This issue of increasing woodland habitat connected area could result in an increase in deer abundance and impacts have been previously highlighted (Auluk and Babinska-Werka 1990).

Deer Impact

The results show that the negative impact of wild deer on agriculture and private forestry in Wales whilst not significant at a Welsh level is becoming a more important regional issue. Areas such as Carmarthenshire, Ceredigion and the Gwent/Monmouthshire area already reported deer damage. Areas in mid Wales such as Powys are also reporting a very small potential difference and potentially an increase in deer observations (Figure 2.7) and associated impacts (Table 2.7). There was no significant difference between observation levels of deer presence and deer damage incidents (Figure 2.8) indicating that the deer populations particularly the larger herding species may be relatively static in terms of migratory patterns at present and only causing damage in areas they are frequently observed.

Damage to forestry was primarily reported as browsing with some fraying. Damage to agriculture was reported as grazing to crop and pasture, with some damage to livestock fencing as a result of deer movement (Figure 2.10). Reported damage caused by wild deer between 2000 and 2005 did not increase in general although regional impacts fluctuated. Species such as red do not appear to have an impact on forestry across Wales but they however may have a localised impact on agriculture. When investigated, agricultural responses that reported damage caused by red actually reported localised damage by a small population of red/sika hybrids in one area. In terms of deer species involved in damage the results of the Wales survey are consistent with previous work (Putman and Moore 1998) and also highlight the lack of evidence of the true economic cost of deer damage.

Comparisons between the impact of deer on agriculture in Wales and England (Putman 1986, Putman and Moore 1998 and White et al 2004) suggests that firstly Wales has significantly fewer vulnerable arable and forestry crops than England. Secondly Wales has a significantly lower deer population in comparison to the rest of the UK (Putman and Moore 1998, Doney and Packer 1998). 70% of English agricultural holdings are estimated to have deer present compared to the 4.3% of surveyed farms in Wales (Wilson 2003). Where damage occurred in England damage per small holding was estimated at between £100 and £500 which is greater than that reported in Wales. It is interesting to note that Wilson suggests a threshold deer density of 0.219 fallow/km^2 or 0.486 roe/km^2 over which deer can potentially cause damage. Current deer densities of fallow and roe in Wales (forestry and agriculture combined) are lower at 0.03fallow/km^2 and 0.008 roe/km^2 suggesting that in the short term that deer damage to agriculture and private forestry is unlikely to become an issue nationally.

Damage to private forestry in Wales reflects similar trends in forestry to that found in the rest of the UK. These have been discussed widely particularly by Gill (1992 and 2003) and Putman (Putman 1994, Putman and Moore 1998). The issue of deer damage to conservation woodlands is further discussed in some detail in the next chapter. Research in Eastern England (White et al.2004) suggests that damage to private forestry within the region varied between sites and it is estimated that the economic loss to forestry was up to £13,707 across the region. However, data could not be provided to give more specific estimates and the issue of long term economic loss was highlighted as opposed to short term problems. In comparison to Wales bark-stripping by red was seen more of an important issue in terms of type of deer damage compared with browsing damage by fallow in Wales as this affected long-term timber quality more.

Management

The results show that where deer being managed in areas of high deer impact, particularly forestry there has been an increase in the level of deer awareness and deer management to attempt to address deer damage in localised areas (Figure 2 .10). It is interesting to note that whilst deer damage and management increased between 2000 and 2005 the number of sites carrying out deer management appeared to remain relatively constant and the apparent economic cost appeared to decrease (Figure 2.13). There was no active deer management reported on agricultural land in Wales in this survey which is contrary to other reports from landowners not questioned in this survey.

It is likely that the decrease in reported deer management between 2000 and 2005 in this survey is a result of a period of low timber prices which resulted in damage not being perceived as significant as well as a change in the type of deer management being used by private foresters. Estimating the cost of deer damage to crops including timber crops relates directly to the current value of crop and damage tolerance levels vary greatly between landowners (Ward et al 2004). Over the five year study period we see a move away from expensive 'one-off' deer management methods such as fencing to the more inexpensive use of deer managers who often volunteer to manage deer and only take the venison in payment.

The number of landowners involved in annual deer management activities, including use of fencing and cull plans as well as involvement in Deer Management Groups to co-ordinate deer management at a landscape level is increasing. This transition from short term mitigation to long term prevention of deer damage is believed to be highly effective in reducing the impact of wild deer (Doney and Packer 1998).

2.3.4. Conclusions

The results of this research has suggested that landowners in Wales do not perceive wild deer as currently having a significant effect on private forestry or agriculture in terms of the level of damage, its economic significance and the level of deer management that is currently being invested. The research in this chapter into the impact of wild deer on agriculture and private forestry gives a positive outlook on the future of wild deer and their impacts in Wales as levels of damage are not currently perceived as significant. As more deer are observed landowners in both the private forestry and agricultural sector appear to be increasingly aware of a balanced approach needed towards wild deer presence and their impacts and acknowledge the value of wild deer through tolerating a low level of damage before instigating deer management activities. Levels of deer damage are likely to continue to increase as deer abundance increases and where deer management is required there appears to be a developing knowledge, particularly amongst private foresters as to what options are available. There is an overlap in damage to private forestry and agriculture that occurs in a few locations and is likely to be directly related to a higher level of deer numbers and is likely to increase suggesting there will be a demand for landscape level deer management in the future.

It is important that where possible deer impact surveys are carried out to increase the area of land surveyed using a timescale and effort to collect robust information in order that future trends can be predicted. It is also clear that the results of this survey are based on landowner perception in the private sector and future work should where possible quantify more accurately the actual damage being caused by deer and compare this to areas managed in the public sector.

The results indicate that it is unlikely that damage due to fallow will rise significantly in Wales as their potential for damage has been acknowledged by landowners and fallow are now being managed at landscape levels to mitigate further increases in damage. In contrast the impact by roe is likely to increase as they become more established in Wales and the increase in farm woodland and small scale commercial broadleaf management in the agriculture and private forestry sector continues to develop, biomass crops, bio-fuel crops such as oilseed rape and broadleaf coppice wood may be particularly vulnerable.

Landscape level deer management is likely to play a key role in the future in addressing deer, impacts and management issues in the future in order that deer populations can be managed in balance with the environment and resources available. Damage to private forestry is currently being increasingly addressed through the FCW Better Woodlands for Wales. The scheme is increasing the investment in deer management and pre-emptive monitoring to address deer damage. Continued monitoring of deer abundance and impacts is required to enable further development of deer management to address deer damage issues as they arise.

Further work could also identify an intervention point at which deer management could be introduced so that it is at its most effective compared to the cost benefit value of deer damage compared with deer management. The capacity to address deer damage in agriculture can be addressed in future through agri-environmental schemes and cross compliance with other grant schemes.

CHAPTER 3

SITE SELECTION

INVESTIGATION INTO THE IMPACT OF WILD DEER ON WOODLAND VEGETATION DIVERSITY IN WOODLANDS MANAGED FOR CONSERVATION IN WALES

3.1 Introduction.

In order to assess the impact of wild deer on vegetative biodiversity in Wales it was important to select sites that were managed for conservation and environmental purposes in locations across Wales. The research utilises designated Nature Reserves in Wales managed through Wildlife Trusts with a recorded management history. A management history enables results to be assessed in conjunction with woodland management practices and not in isolation as very often single management episodes such as clear-felling (Stewart et al. 2001) or thinning (Brooks 1999) can have significant effects on the utilisation of the area by wild deer.

By using sites actively managed as nature reserves additional recording such as bird surveys and small mammal surveys enables us to identify any potential indirect effects on key species. We discussed the indirect effect of deer impacts on conservation and flora and flora in Chapter 1. Species may be classed as Biodiversity Action Plan target species that are subject to conservation and protection under the Wildlife and Countryside Act 1981.

3.2 Method

The Wildlife Trusts of Wales were approached to participate in the study that would provide them with baseline data on wild deer and their impact in their area. The Wildlife Trusts that agreed to participate in the study were Brecknock, Gwent, Montgomeryshire, North Wales and Radnorshire Wildlife Trusts (South and West Wales Wildlife Trust were unable to provide research sites).

For each woodland details of National Vegetation Classification type (Whitbread and Kirby 1992), geographical location, altitude, gradient, rainfall and soil type were recorded in order to identify if there were any differences of note between sites. It has been highlighted that environmental conditions are important to assess in order to confirm that none of the survey sites could have a specific environmental influence that would affect flora and fauna. Previous work (Watkins 1995, Rennie 1995, Small and McCarthy, 2005) has shown that light, soil properties, site topography and bio-climate alongside grazing all influence site characteristics. These affect under-story plant species community composition and the ecological site classification of sites managed for conservation in Wales. The land-use type for land surrounding each woodland was also recorded as this can influence habitat connectivity and use by deer for migratory purpose or for habitat as we have previously discussed in Chapter 1.

Information regarding site location was obtained through ordnance survey information and NVC classification and management details were obtained from the respective sites managing Wildlife Trust.

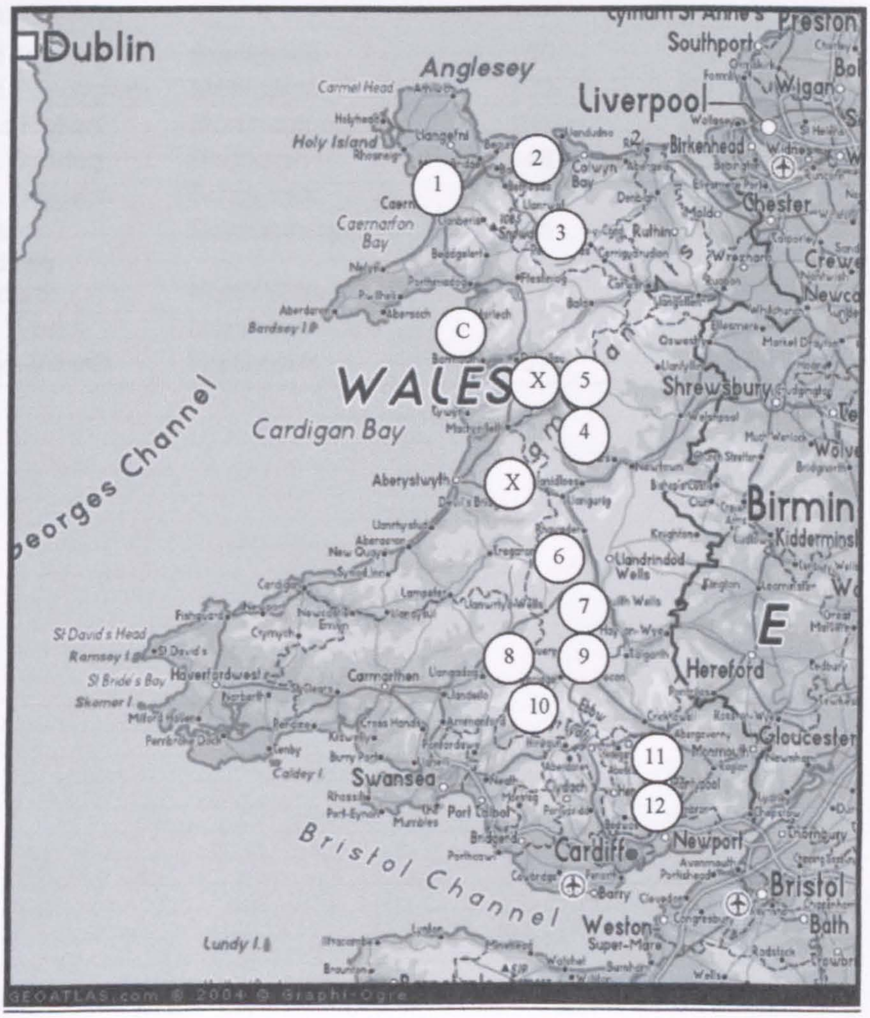
3.3. Results

3.3.1 Site Selection

The twelve woodlands selected for participation in this project are outlined in Figure 3.1. and were located from north to south Wales predominately lying in the east and central wales. The Wildlife Trusts decided independently which woodlands would be proposed for the research and the reasons varied from some Wildlife Trusts knowing that wild deer were likely to be present to those that knew that wild deer were likely not to be present and were concerned about present or future impacts. Impacts include loss of plants of high conservation value and the change in woodland habitat and indirect effects on other flora and fauna as discussed in Chapter 1.Whilst some woodland was pro-actively managed some were not. Each Wildlife Trust identified the need to assess accurately deer presence and impacts on present and future management of the woodland and had previously not carried out any deer related research. Deer related research had not been carried out primarily as deer were not seen as a current issue to be of concern with relation to the management of conservation woodlands in their region.

A total of 14 woodlands were put forward for the research and were of varying size between 1.4ha and 14ha with tree species composition dominated by broadleaf. The twelve sites used for the research (Table 3.1) were surrounded predominantly by farmland and managed grassland used to graze livestock. All of the sites were classified as lowland woodland and are bio-climatically and topographically similar (Table 3.2)

Coed –y-Brenin, a woodland managed by Forest Enterprise Wales in the Snowdonia National Park was also used in the research project as the control woodland for the faecal pellet count aspect of the deer population survey section of the project.



1. Nantporth	4. Dyfnant Meadow	7. Cwm Byddog	10. Cwm Oergwm
2. Big Pool Wood	5. Coed Pendugwm	8. Coed Drysiog	11. Prisk
3. Coed Cilycroeslwyd	6. Bailey Einon	9. Pwll –y - Wrack	12. Croes Roberts
C. Coed –y Brenin	X. Excluded site		

Figure 3.1. Map to show study woodland site locations

Table 3.1. Sites selected to investigate the impact of wild deer on woodlands managed for conservation.

	Woodland	Managing Wildlife Trust	Ordnance Survey Map Sheet	Ordnance Survey Grid Reference	Area (Ha)
1	Bailey Einon	Radnorshire	147	SO 083613	4.5
2	Big Pool Wood	North Wales	116	SJ 102841	4.1
3	Coed Cilycoroeslwyd	North Wales	116	SJ 124556	4.0
4	Coed Drysiog	Brecknock	160	SN 980310	7.3
5	Coed Pendygwm	Montgomeryshire	125	SJ 103142	3.2
6	Croes Robert	Monmouthshire	161	SO 481060	14.0
7	Cwm Byddog	Radnorshire	148	SO 216448	3.4
8	Cwm Oergwm	Brecknock	160	SO 061235	8.1
9	Dyfnant Meadows	Montgomeryshire	125	SH 998155	9.5
10	Nantporth	North Wales	114	SH 560721	5.0
11	Prisk Wood	Monmouthshire	162	SO 532087	5.4
12	Pwll y -Wrach	Brecknock	161	SO 165326	8.5

Table 3.2. Woodland site characteristics.

	Woodland	Dominant Woodland Type[1]	Soil Type[2]	Slope[3]/ Aspect	Annual Rainfall/ Temp/ Sunlight*
1	Bailey Einon	W10 Oak/ Bramble	Slow permeable, seasonally wet, acid loams and clays	East facing 1 in 2 (25°) very steep	1061-1290mm 8-8.7°C 1241-1320hrs
2	Big Pool Wood	W6d Alder/ Nettle	Naturally wet, loamy & clayey soils of coastal flats	Flat site	741-870mm 9.8-10.1°C 1391-1470hrs
3	Coed Cilycroeslwyd	W8 Ash/ Dogs Mercury	Restored soil from quarry or open cast soils, naturally wet, loamy soil	East facing 1 in 4 (14°) Very steep slope	1061-1290mm 7.1-7.9°C 1241-1320hrs
4	Coed Drysiog	W8 Ash/Dogs Mercury	Freely draining lime-rich loamy soil	South west facing 1 in 2 (27°) Very steep slope	1291-1690mm 8-8.7°C 1241-1320hrs
5	Coed Pendygwm	W10 Oak/Bramb le	Very acidic, loamy upland soil, wet peaty surface	South facing, 1 in 3 (22°) very steep slope	871-1060mm 8.8-9.3°C 1321-1390hrs
6	Croes Robert	W8 Ash/Dogs Mercury	Freely draining, slightly acidic, loamy soil	North facing 1 in 3 (17°) very steep slope	871-1060mm 9.8-10.1°C 1471-1540hrs
7	Cwm Byddog	W8 Ash/Dogs Mercury	Slow permeable, seasonally wet, acid loam and clay soils	South facing 1 in 4 (13°) very steep slope	1061-1290mm 8-8.7°C 1241-1320hrs
8	Cwm Oergwm	W8 Ash/Dogs Mercury	Freely draining lime rich, loamy soil	West facing 1 in 1 (>45°) very steep slope	1691-4577mm 8-8.7°C 1241-1320hrs
9	Dyfnant Meadows	W16/W17 Oak, Birch/ Wavy hair grass	Very acidic, loamy upland soil, wet peaty surface	East facing 1 in 8 (7°) steep slope	871-1060mm 8.8-9.3°C 1321-1390hrs
10	Nantporth	W8 Ash/Dogs Mercury	Freely draining, lime rich loamy soil	North west facing 1 in 1 (>45°) very steep slope	1061-1290mm 9.8-10.1°C 1321-1390hrs
11	Prisk Wood	W8 Ash/Dogs Mercury	Freely draining, slightly acidic loamy soil	East facing 1 in 3 (20°) Very steep slope	871-1060mm 9.8-10.1°C 1471-1540hrs
12	Pwll y -Wrack	W8/W10 Ash/Dogs Mercury Oak/Bramb le	Freely draining, Floodplain soil	South facing 1 in 3 (22°) very steep slope	1061-1290mm 8-8.7°C 1321-1390hrs

[1]Woodland Type – National Vegetation Classification (Whitbread & Kirby 1992) [2]Soil Type Classification from Soil Science Mapping Resource,Cranfield University, Natural Resources Institute. www.landis.org.uk. [3]Slope Classification from Exegesis SMD. ExeGesis, Talgarth, Brecon. *Annual Rainfall, Temperature and Sunshine Records from UK Met Office climate records 1971-2000.

3.3.2 Woodland Site Descriptions

All the sites were classified as nature reserves of some sort whether formally or informally. The sites ranged from containing or bordering Sites of Special Scientific Interest to being of local importance. A number of sites fell within landscape level areas of importance such as a National Park or Area of Outstanding Natural Beauty. Site management and access varied from no access and non intervention management regime to high public access and actively managed to produce commercial hazel coppice sourced charcoal.

Bailey Einon

Bailey Einon (Figure 3.2) is located approximately 2km East of Llandrindod Wells and is a 4.5ha ancient semi-natural woodland dominated by oak and ash. It is classified as National Vegetation Class (NVC) W10, dry oak (*Quercus rober*) over bramble *(Rubus fruiticosus*). The wood is on a steep eastern slope down to the River Ithon, a SSSI (Site of Special Scientific Interest). The lower slopes are wet and form NVC W7, Alder (*Alnus glutinosa*) and Ash (*Fraxinus excelsior*) over Yellow Pimpernel (*Lysimachia nemorum*).

The management strategy is based on non-intervention with the encouragement of natural regeneration within small coppice coups. The site is surrounded by farmland grazed predominantly by cattle. The site is accessed on a regular basis by members of the public to use footpaths across the site.

Big Pool Wood

Big Pool Wood (Figure 3.3) is a 4.1 ha reserve that contains a pond of approximately 50m diameter surrounded by 2.9ha of semi-natural woodland. The site is 200m south from the North Wales coastline and the Dee Estuary.

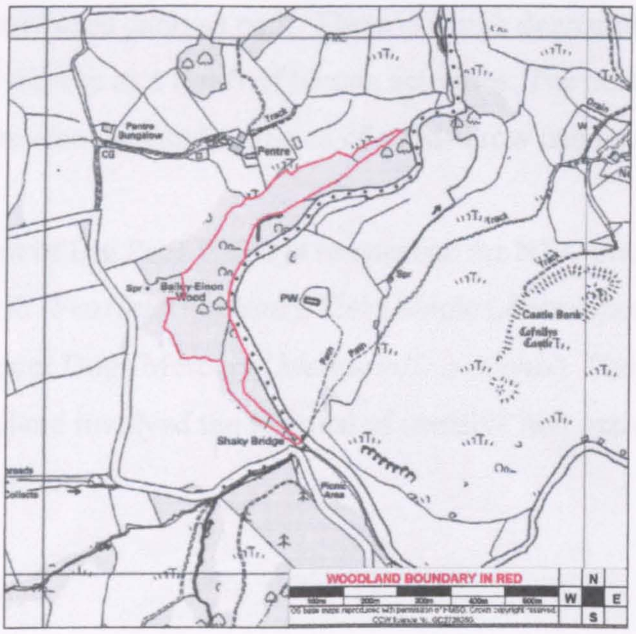


Figure 3.2. Map of Bailey Einon

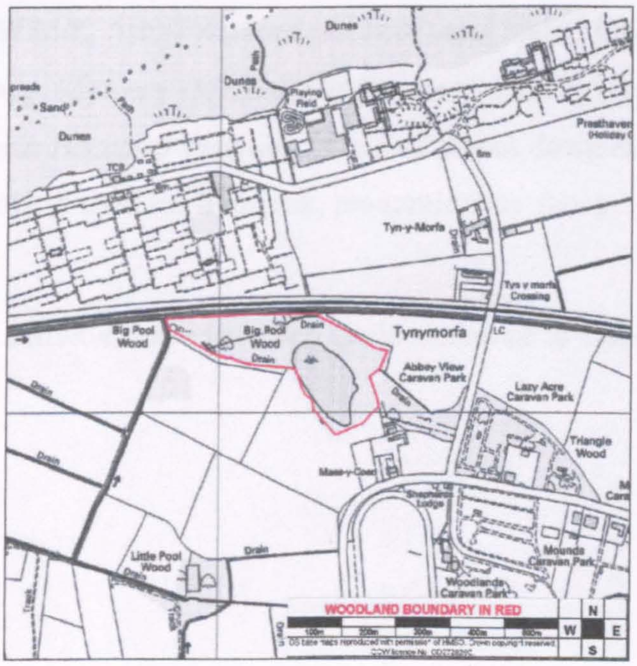


Figure 3.3. Map of Big Pool Wood

The wood can be classified under NVC W6d, Alder (*Alnus glutinosa*) over nettles *(Urtica diocia)* although there is Sycamore (*Acer pseudoplatanus*) throughout the wood. The wood is on level ground and is surrounded by grazing used intensively for horses. The site is adjacent to a regularly used rail link to the north on the other site of which is a regularly used caravan park. There is a high degree of physical and noise disturbance around the site as a result of human activities. The northern edge of the site is exposed to the elements and evidence of wind-throw can be observed.

Current management of Big Pool Wood is to enhance the NVC classification to W8/W9 which is Ash (*Fraxinus Ecelsior*), Field Maple (*Acer capestre*) with Rowan (*Sorbus acuparia*) over Dogs Mercury (*Mercurialis perennis*). The main management activity in the woodland involved the removal of invasive non-native Rhododendron (*Rhododendron ponticum*).

Coed Cilycroeslwyd

Coed Cilycroeslwyd (Figure 3.4) is a 4 ha semi-natural woodland within the Eyart Woods and Rocks SSSI that extends to the north and south of the site. The wood is classified as NVC W8d/8, Ash (*Fraxinus excelsior*) and Field Maple (*Acer Campestre*) over Dogs Mercury (*Mercurialis perennis*) and Ivy (*Hedera helix*) with some W8 Yew (*Taxus Baccata)* variation. The side slopes down eastwards and is surrounded by grassland used for livestock, predominantly sheep.

Main Management activities have involved glade clearance to encourage natural regeneration.

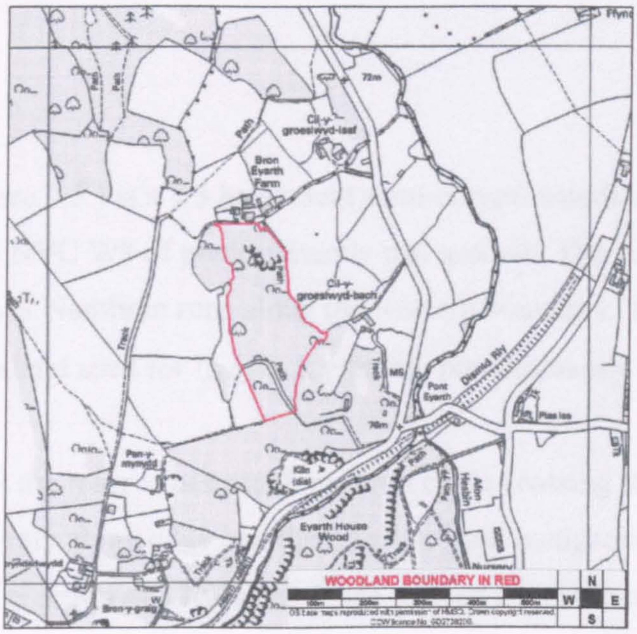


Figure 3.4. Map of Coed Cilycroeslwyd

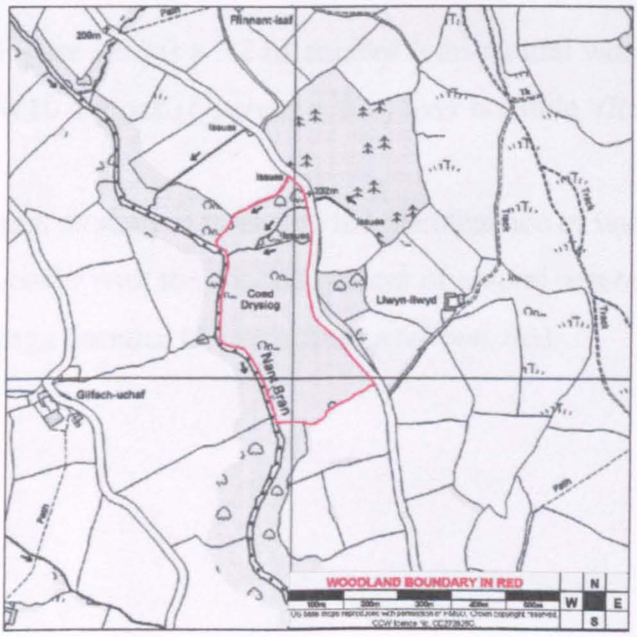


Figure 3.5. Map of Coed Drysiog

Coed Drysiog

Coed Drysiog (Figure 3.5.) is a 7.3 ha ancient semi-natural woodland and SSSI that can be classified as NVC W8 of predominantly oak and ash. The site slopes down westwards. The River Nantbran runs along the western boundary. The site is surrounded by grassland used for livestock grazing, predominantly cattle.

On the lower slopes the reserve has problems with cattle crossing the shallow river and grazing extensively along edge and the effects of soil compaction by livestock are clearly visible. The erection of a livestock fence to keep the cattle out would be very difficult.

Coed Pendygwm

Coed Pendugwm (Figure 3.6.) is a 3.2 ha ancient semi-natural woodland that is classified as NVC W10 dry oak (*Quercus rober*) over bramble (*Rubus fruiticosus*).

The main management strategy is to ensure the maintenance of uneven aged stands to provide continuous cover with the encouragement of natural regeneration and coppicing to encourage dormice (*Muscardinus avellanarius*).

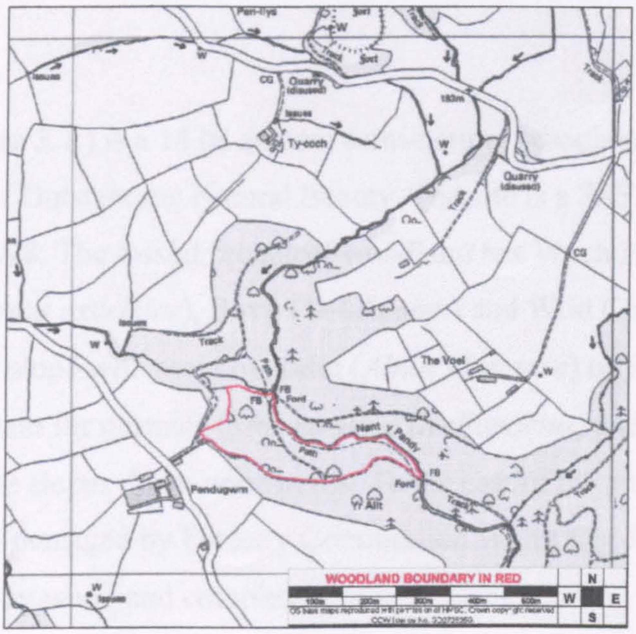


Figure 3.6. Map of Coed Pendugwm

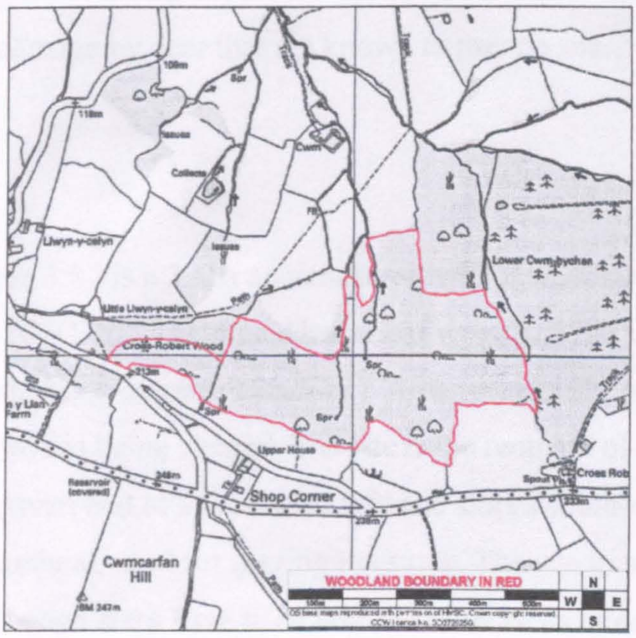


Figure 3.7. Map of Croes Robert

Croes Robert

Croes Robert (Figure 3.7.) is a 14 ha ancient semi-natural woodland located within the Wye Valley Area of Outstanding Natural Beauty. The site is a SSSI that can be classified as NVC W8. The mixed broadleaf woodland has Wych Elm (*Ulmus glabra*), Ash (*Fraxinus excelsior*), Birch (*Betula spp.*) and Wild Cherry (*Prunus avium*) on its upper slope with areas of Alder (*Alnus glutinosa*) on its lower slopes. The wood is important for dormice (*Muscardinus avellanarius*) and butterfly populations. The site slopes down northwards. To the east of the site is a large woodland (>150ha) managed by Forestry Commission Wales that forms part of the extensive Wye Valley woodland complex.

The woodland is managed primarily for the dormice with hazel coppicing providing the resources for a large charcoal making enterprise on site. The management also involves the use of brash fencing coppice coups to allow hazel regeneration to succeed following damage by deer that are known to use the site.

Cwm Byddog

Cwm Byddog (Figure 3.8.) is a 3.4ha ancient semi-natural woodland and SSSI that can be classified as NVC W8. The mixed broadleaf woodland has veteran oaks (*Quercus rober*) with Ash (*Fraxinus excelsior*). Areas previously planted with Scots pine (*Pinus sylvestris*) are being cleared. The site is the remnant of the estate woodland at the southern end of a woodland belt and slopes south-eastwards. The site is surrounded by grassland, used for grazing livestock. The site in some areas has been left derelict although steps have been taken to clear areas of dense vegetation and improve access. The site is known for its bird and insect populations.

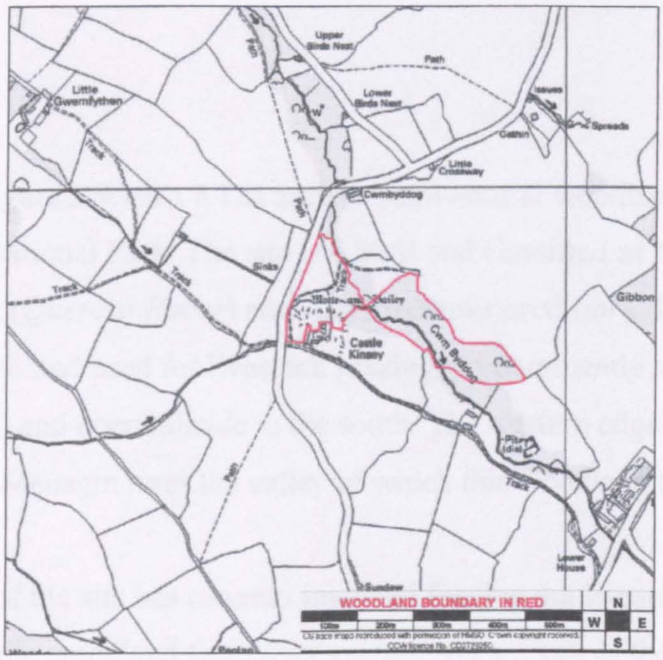


Figure 3.8. Map of Cwm Byddog

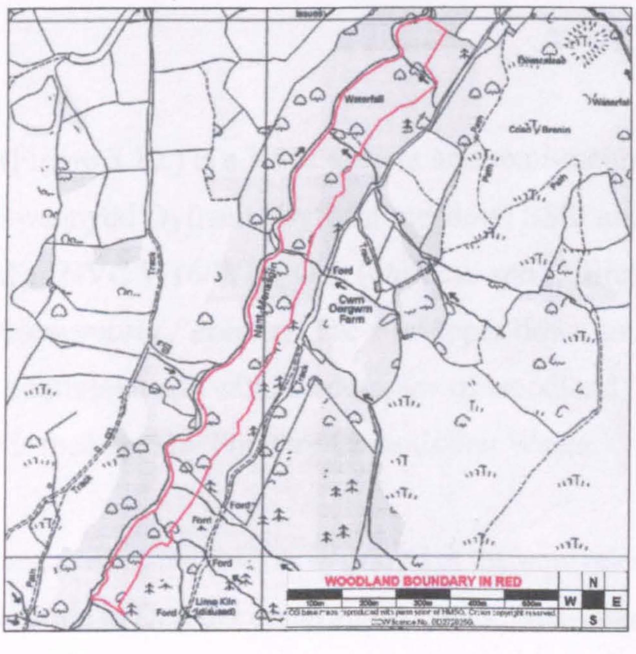


Figure 3.9. Map of Cwm Oergwm

Cwm Oergwm

Cwm Oergwm (Figure 3.9.) is a 8.1ha ancient semi-natural woodland within the Brecon Beacons National Park. The site is a SSSI and classified as NVC W8 dominated by Oak (*Quercus Rober*) and Ash (*Fraxinus excelsior*). The site is surrounded by grassland used for livestock grazing, predominantly sheep on both managed grassland and open hillside to the south. The western edge of the woodland is bounded by the Menagin river the valley of which this woodland follows.

The management of the site has recently involved fencing out livestock in order to allow recovery of the woodland from over grazing. As a result of the woodland being located on a steep slope the woodland has a non –intervention management strategy particularly which protects the wetland floral vegetation.

Dyfnant Meadows

Dyfnant Meadows (Figure 3.10.) is a 1.8ha ancient and semi-natural woodland that is part of the greater Gweunydd Dyfnant (Dyfnant meadow) SSSI and reserve of 9.5ha. The site is classified as NVC W16/W17, Oak (*Qurecus spp.*), Birch (*Betula spp.*) over Wavy-hair grass (*Deschampsia flexuosa*). The site slopes down southwards. This grassland site is on a farmland site within a complex of woodland (>900ha) called the Dyfnant Forest that is managed by Forestry Commission Wales.

The meadow grassland area of the reserve is grazed at the equivalent of one livestock unit per hectare from June to October on an annual basis. Non-intervention is the strategy at present for the woodland area.

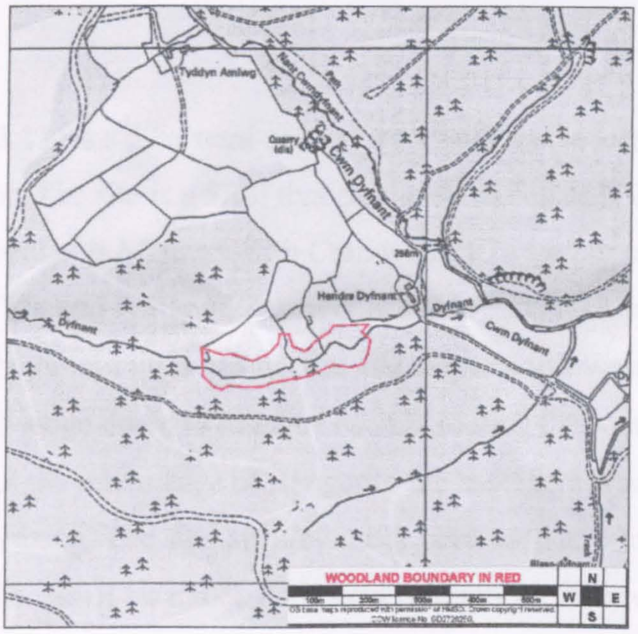


Figure 3.10. Map of Dyfnant Meadows

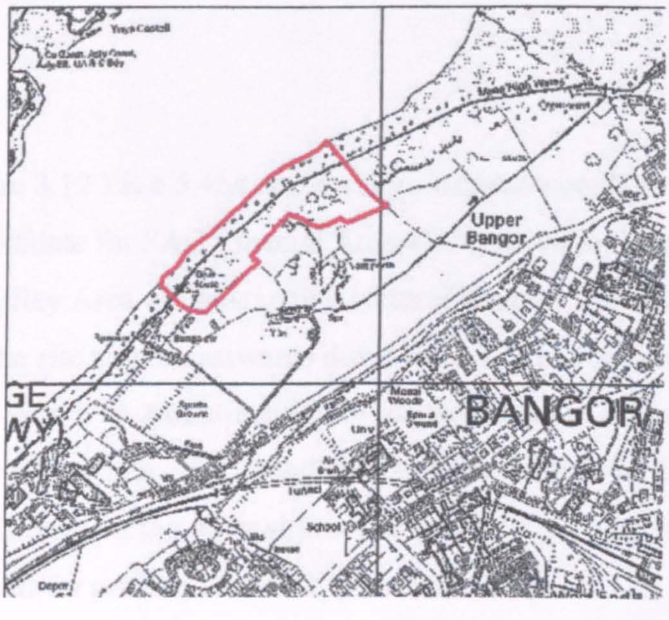


Figure 3.11. Map of Nantporth

Nantporth

Nantporth (Figure 3.11) is a 5 ha semi-natural woodland that is less than 1km from the centre of Bangor. The site is a SSSI that can be classified as NVC W8e with Ash and Field Maple over Dogs Mercury with Cranes Bill (*Geranium robertianum*). There are also areas of W10a and W10c of Oak over bramble and bracken (*Pteridium aquilinum*) with sub communities of Ivy. The site slopes north-westwards and there is a distinct rocky cliff ledge down to a shale beach bordering the Menai Straight. Between the site and the urban edge of Bangor to the east there is an area of farmland used for livestock grazing. The site has previously been used as a limestone quarry and spoil heaps and areas of bare rock still occur throughout. The west of the reserve also contains an access track to the University of Wales' Boathouse and as such means that the woodland has a high degree of human disturbance on a seasonal basis. Recent management activities involve glade clearance.

Prisk Wood

Prisk Wood (Figure 3.12.) is a 5.4ha ancient semi-natural woodland and SSSI. The wood is also a candidate for SAC (Special Area of Conservation) due to its location within the Wye Valley Area of Outstanding Natural Beauty. The wood is classified as NVC W8/W10. The site slopes eastwards down from 180 to 100m on a gradient towards the River Wye with a continuation of the woodland in different ownership between this site and the river. The woodland complex extends to the north and south of the site and to the east on the other side of the river. To the west of the site there is farmland that is used for grazing livestock, primarily sheep.

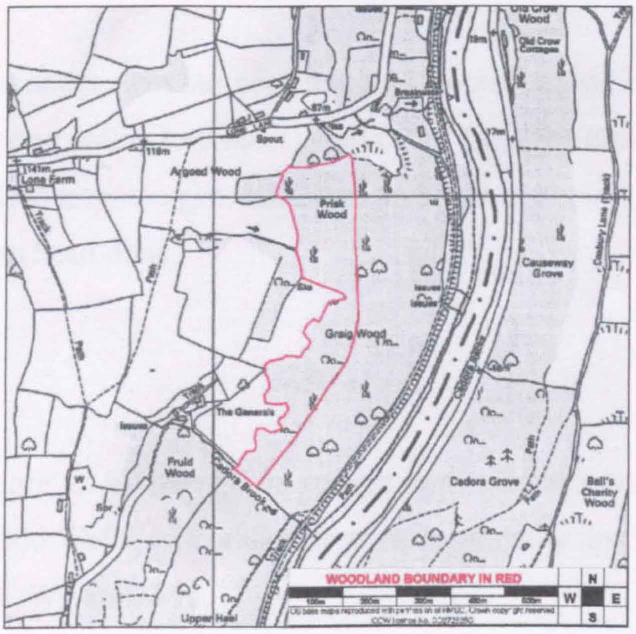


Figure 3.12 Map of Prisk Wood

Figure 3.13 Map of Pwll-y-Wrach

Although previous management has been minimal, coppicing has been carried out with the use of chestnut paling to protect small coups from the fallow deer known to be in the area. Work to improve general access and open canopy to encourage natural regeneration has also been done.

Pwll- y –Wrach

Pwll –y-Wrach (Figure 3.13) is an 8.5 ha ancient semi-natural woodland less than 1km from Llandrindod Wells, with a diverse plant community that includes NVC classification of W8, W9 and W10.

Vegetation includes Ash and Hazel over Dogs Mercury and Bluebells and Oak over bramble. The site is bordered on all sides by farmland used for grazing livestock, predominantly sheep. The site slopes down westwards and includes a small disused quarry site along half of its northern boundary. The site is bordered to the south by the River Ennig. Due to the close proximity of Llandrindod Wells the site is accessed on a daily basis by the public and the footpaths around the site reflect this.

The woodland was coppiced extensively in 1999 to improve dormouse habitat. Other management activities have recently included thinning to produce more un-even aged stands as well as the replacement of stock fence in 2004 to prevent sheep incursion.

Coed-y-Brenin

Coed –y-Brenin (Figure 3.14.) is a complex of 3000ha with 5 areas of oak woodland (*Quercus spp.*) surrounded by commercial conifer plantations managed by Forestry Commission Wales. The Oak pockets cover a total area of 3.7ha and are classified as NVC W11/W17 with Oak and Birch over wood sorrel (*Oxalis acetosella*).

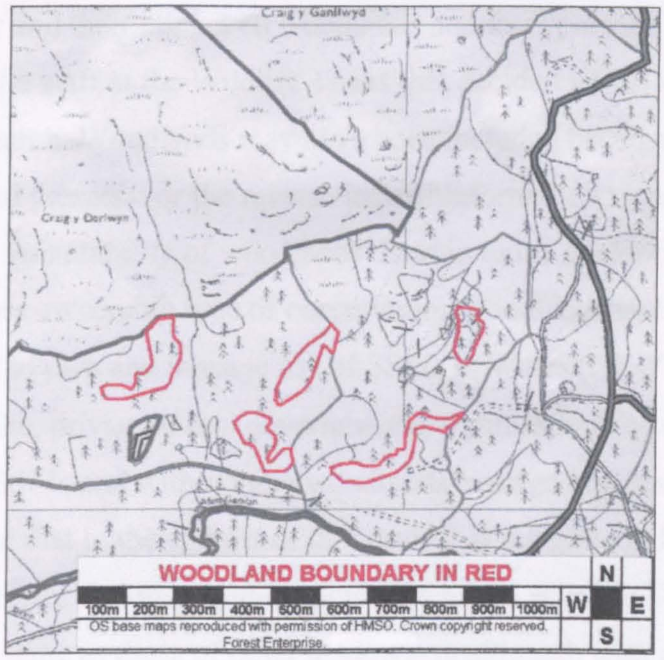


Figure 3.14. Map of Coed-y-Brenin

The woodland is managed commercially for both timber and also for tourism and recreation so the woodland area is covered in large areas of cyclic clearfell and has large visitor numbers using the forest tracks and pathways. The woodland is currently undergoing major transformation from being managed as a Plantation on Ancient Woodland Site (PAWS) with conifers to be a managed Continuous Cover Forestry (CCF) site with broadleaves. The forest has a large network of mountain bike tracks although rangers do not believe this affects the movement and utilisation by the large fallow herd that is known to inhabit the area (Lloyd pers comm, 2004).

3.4 Discussion

It is suggested that the woodlands selected for this research represent wider woodlands in Wales managed for conservation.

Firstly in terms of methodology whilst easier to allow the Wildlife Trust to select the woodlands they include in this research to promote ownership and inclusion in the study it does potentially create a bias within the sample selected. This self selected bias is difficult to quantify (Heckman 1979) as it potentially depends on the perception of deer and their impact on woodlands and their potential regional impact as interpreted by the staff at the Wildlife Trusts that decided which woodlands to include in the research. Woodlands may have been included because of known levels of deer damage and presence or the reverse lack of information regarding deer in the area and potential vulnerability of woodlands. Bias in terms of sample selection is likely to vary across ownership type of conservation woodlands and whilst Wildlife Trusts are thought to own and manage 1% of SSSIs in Wales (CCW 2006) there are a wide range of public, private or non governmental organisation and individuals that own and manage SSSIs and within them woodlands managed for conservation. It is therefore important that in the context of this study it is remembered that the conservation objectives and management activities of the Wildlife Trust may not necessarily be the same as those of other landowners although with respect to maintaining SSSIs in favourable condition they will be similar.

Woodland vegetation of the woodlands surveyed varied between four main National Vegetation Classification types (Whitbread & Kirby 1992) and was predominantly classed as W8, W10 or one of their sub-communities. These woodlands' key plant indicator species are Ash (*Fraxinus excelsior*), Oak (*Quercus rober*) and Maple (*Acer campestre*) over Dogs Mercury (*Mercurialis perennis*) and Bluebell (*Hyacinthoides non-scripta*) and dry oak (*Quercus rober*) over bramble *(Rubus fruiticosus*) respectively. W8 woodlands are found characteristically over alkaline, nutrient rich soils in areas of low rainfall and warm summers with birch and ash common in the understory. W10 woodlands are found characteristically over neutral soils in areas also experiencing low rainfall and warm summers with hazel (*Corylus avellana*) and hawthorn (*Crataegus monogyna*) common in the understory. The woodlands in this study represent 54.4 % of the woodland types found in Wales although of the five most common woodland types in Wales W7 (Wet woodland with Common Alder *Alnus gluinosa* over Yellow Pimpernel *Lysimachia nemorum*) and W11 (Upland Oak with Sessile Oak *Quercus petreae* over Common Woodsorrell *Oxalis acetosella*) which are not represented. The five most common woodland types in Wales are in order of descending percentage of total woodland coverage (W10 (22.1%), W7 (14%), W8 (13.8%), W17 (12.8%) and W11 (12.4%) (Hall 1997). In terms of conservation importance of the study woodlands, the woodlands in the study consist of two of the four woodland groups identified by CCW (CCW 1998) as priority conservation habitats and these are upland oak woodlands and upland mixed ash woodland that make up 74.8% of woodland types found in Wales. The two woodland groups not represented by this study sample cover lowland beech and wet woodlands that make up 10.75% of woodland types in wale. It could therefore be suggested that the woodlands in this survey represent the most common woodland types found in Wales and the woodland types in Wales that are important for habitat conservation in Wales.

In terms of size of study area the woodlands used in this study cover an area of 77ha with an average size of 6.4 ha. Data from the National Inventory of Woodland & Trees – Wales highlights that woodlands in Wales are predominately Coniferous (47.9%) that are mainly managed as part of the public estate by the Forestry Commission (64%). We have already identified that broadleaf woodlands are the most important woodland type in terms of conservation in Wales and of broadleaf woodlands in Wales but of the broadleaf woodland in Wales (104241ha) the 77ha covered by this researches sample is less than 0.1 % of broadleaf woodland Wales suggesting that sample size in either size or number of woodlands examined is inadequate to provide truly accurate estimate of what is occurring in woodlands in Wales. It is interesting to note that in terms of Sites of Special Scientific Interest (SSSI) in Wales the average size is 26ha and 41% are less than 10ha (CCW 2006) so the data may reflect are representative sample size in terms of SSSIs in Wales.

3.5. Conclusions

Whilst the woodlands selected provide a realistic sample of woodlands managed for conservation in Wales there is some bias. Ideally the woodlands used for the study and in any replication of the study should have been selected first to represent the most common woodland types found in Wales, then selected for geographical coverage of the whole of Wales and then finally selected for a range in size and number and then their ownership and status as conservation woodlands in Wales. The sites selected for this research do provide a realistic sample, if very small sample of woodlands managed for conservation in Wales, particularly taking into consideration the resources and constraints that occur on survey site selection in real terms. The data from these woodlands is likely to still potentially provide indicators of what may be occurring in conservation broadleaf woodlands in Wales.

CHAPTER 4

DEER SURVEY

INVESTIGATION INTO THE IMPACT OF WILD DEER ON WOODLAND VEGETATION DIVERSITY IN WOODLANDS MANAGED FOR CONSERVATION IN WALES

4.1. Introduction

There are a variety of methods designed to establish the size of a deer population and the species composition (Table 4.1.) and they vary in performance, technical operational requirements and cost. Very often the most accurate method is labour or equipment intensive and therefore expensive to carry out. Some methods also have a lengthy data collection period and following data analysis the timeline of results may not provide information in time to enable management decisions to be made and implemented effectively. Previous work in the UK suggests that reliance on a single method and/or use of an indirect population assessment technique for low deer densities can be lead to problems (Mayle 1999, Smart et al.2004). New methods are being continually assessed, developed and refined to improve efficacy and practical application (Mayle 1999, Daniels 2006) including the use of more technology such as digital geographical mapping to produce results that are easier to understand.

Whilst training in use of deer survey assessment techniques is essential it could be suggested that sometimes less experienced surveyors could be more accurate and provide better results as they are keen to obtain accurate data as opposed to 'experienced' surveyors who may rush their work and become complacent. Volunteers at Wytham Woods in Oxfordshire indicated this accuracy where volunteers were being trained to carry out faecal pellet counts and less experienced volunteers appeared to record more accurate results although this was not supported with formal data (Newman, pers comm. 2003).

Examples of other novel research in techniques for estimating population size include work applying roe deer vocalisations to capture-recapture models (Reby et al 1998) and using records of landscape characteristics and deer road traffic casualties (White et al. 2004).

The aim of the research in this chapter is to determine if wild deer are present in woodlands managed for conservation in Wales and where they are present to determine the species and density of the population.

Table.4.1. A comparison of survey methods to estimate deer population size (Mayle et al 1999). Methods 18-21 require information from previous culls.

Census count method	Performance as an estimate	Performance as an index	Equipment costs	Labour costs	Simple Data Analysis	Data Collection Period
1. Open Hill	*****	*****	***	*	*****	1-7 days
2. Drive counts	***	***	***	*	****	1-7 days
3. Static census	***	****	****	*	****	1-3 days
4. Vantage point counts	***	****	****	*****	****	1-7 days
5. Aerial counts	****	*****	*	****	***	1-2 days
6.Spotlight counts	**	***	***	****	***	1-7 days
7. Thermal imaging direct counts	*****	*****	**	****	*****	1-3 days
8. Thermal imaging distance sampling	*****	*****	**	****	*	3-5 days
9. Mark Re-sighting	****	****	*	*	**	3-24 months
10. Change in ratio counts	***	****	***	***	***	6-9 months
11. Impact levels	*	***	***	***	***	1-5 days (crop) 6-12 months (habitat)
12. Track/ slot counts	*	***	*****	****	*****	1-4 days
13. Faecal pellet index	*	****	*****	*****	****	1-4 days
14. Faecal pellet clearance	*****	*****	*****	**	****	2-3 months
15. Faecal pellet standing crop	****	*****	*****	***	***	4-12 months
16. Faecal pellet strip transects	***	****	*****	***	****	4-12 months
17. Faecal pellet line transects	****	*****	*****	***	*	4-12 months
18. Balance Sheet	**	***	***	**	***	6-9 months
19. Life Tables	***	****	****	**	**	5+ years
20. Cohort analysis	****	****	*****	**	**	5+ years
21. Population modelling	*****	*****	***	**	**	1+ years

Key ***** excellent, ****good, ***fair, **poor, * very poor

Visual counts are one of the easiest methods to identify deer presence and numbers. It involves repeated visits to particular viewing points using a specific route and method of travel on a regular basis to build up a record of species present and number and provided a breakdown of sex and age ratio in the population. A visual sighting of the deer also helps to give an indication of the health of the deer. Problems for example in fertility and infant mortality can quickly be identified. Over a number of years trends in the population can be monitored and individuals in the herd can also be identified and monitored. In terms of visual counts, spot counts are low cost and only require a basic knowledge of species identification whereas at the other end of the scale the use of thermal imaging equipment is expensive and although it gives a more accurate assessment of the population size it does not provide information regarding the health of the population.

Deer Counts can also be made from the air. Aerial counts are also of benefit if a landowner restricts access to an area if deer are being assessed at a landscape level as part of a wider management plan such as that done by a deer management group. The cost of the hire of a helicopter for half a day for example is also likely to be more cost effective than a labour intensive exercise such as thermal imaging and is just as accurate (Beasom et al 1986, Shupe and Beasom 1987). There is however evidence to suggest that there is a sex-specific bias in helicopter surveys with females more likely to be seen than males due to their use of cover (McCorquodale 2001).

Faecal Pellet Counts form the basis of the most regularly used methods of assessing deer abundance (Mayle et al 1999, Elwood 2001, Campbell et al. 2004, Marques et al 2001, Bailey and Putman 1981). A variety of assessment methods are available and these include standing crop counts, clearance plot counts, transect and line counts. Faecal pellet counts using 7x 7m square plots that estimate deer densities through faecal accumulation rates along a transect is one widely used method (Doney 2000) although more recent research suggests this method is less accurate (Smart et al. 2004). Deer species can also be identified through pellet size although with the variation in age and species sizes it is often very difficult to identify deer species from a faecal pellet sample. Faecal pellet counts require application of different correction factors depending on deer species as they produce faecal matter at different rates, and also on the time of the year, humidity and temperature, which affect decay rates (Mayle and Peace.1998). Depending on the ground cover such as type of agricultural crop (Doney 2000) and or slope also effects how easy the faecal pellets are to find and where the ground is steep the pellets may wash away with any rainfall. If woodland comprises several woodland types then a faecal pellet count must be carried out in each sector (Mayle et al.1999).

Through walking the perimeter of an area of woodland, track and slot counts can be carried out by counting the number of obvious deer pathways crossing the woodland edge or along line transects. Trackway counts can only provide basic indices of deer presence and movement as deer species and composition cannot be estimated (Mayle et al.2000). There are variations between deer species due to their behaviour and use of woodland habitat. This method is also open to inaccuracy as other mammals such as sheep, badgers and foxes also create thoroughfares and it may be difficult to establish the originator of the trackway. In an ideal situation the wood that is being assessed should be isolated. If the wood is in a matrix of connected woods and could be used as a movement corridor it does not allow the assessment of the deer that are actually utilising the area specifically for habitat.

4.2. Methods

In order to assess the level of deer presence in the survey woodlands and rank the woodlands in terms of deer density a full deer survey was carried out in 2002. Methods used were; faecal pellet counts, track way counts and visual spot counts of deer. These methods were selected as they could be carried out by one person easily and did not require any expensive equipment. Cull records to support deer presence or management were not available as no deer were managed on any of the reserves. Annual visual deer counts were carried out to confirm new deer presence in woodlands.

Through comparing the results of the three deer survey methods alongside historical evidence and additional deer presence indicators the deer density of each woodland can be classified as having a comparative nil, low, medium, or high deer presence 'Nil' is defined as 'no evidence of deer presence or activity on site'. 'Low' is defined as 1-5 deer/100ha. 'Medium' is defined as 'confirmed evidence of deer presence and negative impact' or potentially 6-9 deer/100ha. 'High' is defined as quantifiable evidence of deer presence and level of damage' or more than 10deer/100ha.

4.2.1 Visual deer counts.

In this research, species, sex and age-class of the deer observed were recorded as a main track or ride was walked along. Here observation was more likely and when repeated during daylight hours any incidents of browsing or movement of deer could also be recorded to provide an indication of woodland use. Where possible, deer were identified in enough detail to prevent being counted more than once during the observation time. These counts were supported by regular visits to the site during the research period of 200-2005 and in addition when received wildlife trust visitor sightings were added to deer presence information. Thermal imaging was not practical in terms of terrain, site access and availability of resources.

4.2.2 Faecal Pellet Count.

The method used was standing crop strip transect count based on the methodology found in Mayle et al.(1999) where transects of 1 metre width and of a total distance of between 800m and 1000m were selected on a bearing chosen using random numbers from a location chosen also using random numbers along the woodland boundary. Any bearing that ran parallel, along or close to a significant geographical feature was excluded as the presence of a ridge or contour, stream or fence line may have influence on deer movement and behaviour (Bauman et al. 1999). Each of the woodlands were treated as a single type as woodland type did not vary significantly within them.

Along each transect the number of deer faecal pellet groups were counted. Groups were only counted if the majority of pellets were found within the transect borders. Where a majority could not be decided they were alternated as either in or out alternatively to balance out any bias.

The minimum distance of 1250m covering an area of 0.125ha of transect per wood was selected and measured and were achieved by carrying out a smaller number of transects on the same bearing with a regular separation (approximately 50m) between them. Due to the small size of some of the woodlands if the transect area was not fulfilled in the first set of primary transects mid space transects were also surveyed. Where transects were interrupted or influenced significantly by a natural feature such as a stream the data for these transects were not collected. Transect selection is shown in Figure 4.1 which also illustrates how the primary transect on the right- hand side is excluded for data collection purposes due to the proximity of a stream. Secondary transects were only used if the total primary transect length was less than the minimum distance of 1250m.

To calculate the number of deer per ha (From Mayle et al. 1999)

$$\text{Number of animals per ha} = \frac{\text{Number of pellet groups per ha}}{\text{Defecation rate (pellet groups per day)} \times \text{Average decay time (days) for a pellet group}}$$

$$\text{The number of pellet groups per ha} = \text{no. of pellet groups found} \times \frac{1000\ (\text{m})}{\text{Transect length(m)}}$$

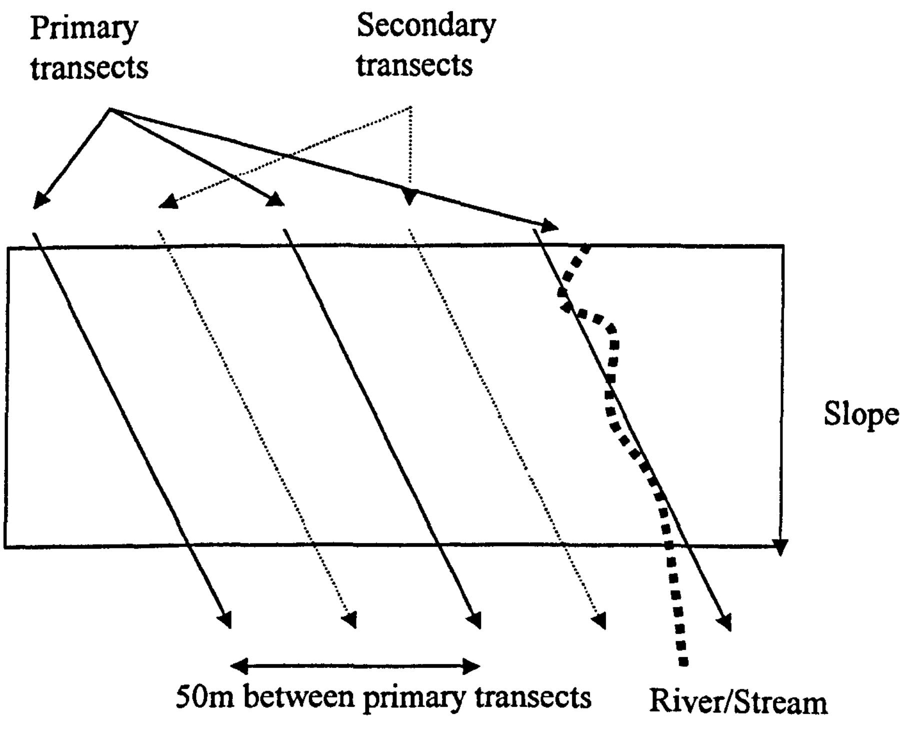


Figure 4.1. Diagram to show transect selection and location across a woodland reserve area.

The defecation rate was taken from literature and was species specific and for fallow this was 21 piles of dung per day (Mayle et al.1996). Where faecal pellets were found the deer species was identified through historical information of the site and results of spot counts where the species of deer could not be identified directly from faecal pellets. Marking a minimum of 3 pellet groups per woodland and monitoring their decay rate on a weekly basis for the first two months established the decay rate and then on a monthly basis until decay time could be identified. The faecal pellet count was only carried out once in 2002, mid-way through the data collection period.

4.2.3 Trackway Counts

For each woodland the perimeter was surveyed and the efficacy of fencing was classified as this has an influence on deer access and use. None of the sites had any deer-proof fencing. Fencing was classified as 'good' where it was livestock fencing or similar in good repair, 'poor' where fencing existed but was in bad condition or 'no fencing' where fence was non-existent. The percentage to which the woodland was fenced was assessed. Boundary features such as rivers or streams were assessed as crossable. Very steep banks or rock faces were assessed as a barrier.

For the perimeter of each woodland the number of track ways were counted and recorded and the likelihood of it having been used by deer assessed. The trackways were classed in three categories; Class 1: Currently being used by deer, with evidence of deer slots and deer sightings, Class 2: Trackways equal to or greater than 0.3m and Class 3: Trackways less than 0.3m in width. All footpath access was also assessed as a deer track way as they allowed access by deer (Class 2 or 3) and styles or gates were not classed as barriers.

4.3 Results

Of the 13 woodlands, 2 woodlands were known pre project to have deer in their vicinities. Coed –y Brenin also had a known population of 300 Fallow which were managed at a sustainable level by Forest Enterprise. Coed –y Brenin was used as a positive control for the deer survey methodologies used in this research. Prisk Wood and Croes Roberts Wood were the sites known to have a large number of Fallow in and around the area.

The results of the deer surveys (Table 4.2) confirmed that deer are present in woodlands managed for conservation in Wales and that the woodlands could be grouped in groups of comparative deer abundance (Table 4.3).

Table 4.2. Comparison of deer presence assessment methodologies.

	Survey methodology that recorded deer presence in survey sites			
	Deer Visual Counts	Faecal Pellet Counts	Trackway Counts	Adhoc information based on visual sightings by others
Bailey Einon				√
Big Pool Wood				
Coed Cilycroeslwyd				
Coed Drysiog				
Coed Pendugwm				
Croes Roberts		√	√	√
Cwm Byddog				
Cwm Oergwm				
Dyfnant				
Nantporth				
Prisk Wood	√	√	√	√
Pwll y Wrach				

Table 4.3. Woodland deer abundance classification of the woodlands following deer Survey.

Woodland	Deer Presence
Bailey Einon	Medium
Big Pool Wood	Nil
Coed Cilycroeslwyd	Low
Coed Drysiog	Low
Coed Pendugwm	Low
Croes Roberts	High
Cwm Byddog	Low
Cwm Oergwm	Nil
Dyfnant	Low
Nantporth	Low
Prisk Wood	High
Pwll y Wrach	Medium

4.3.1 Visual Deer Counts

In 2002, deer were only observed in one of the woodlands. In Prisk Wood a total of 7 fallow deer were seen during visits to the site between 2000 and 2005. Two females were seen on one visit and a group of 5 females in 2000 and 2003 respectively. In Pwll-y-Wrack deer slots that could be attributed to Roe deer were noted in 2001 but it was not until 2003 that 1 Roe was observed on site. One Roe deer was observed by Wildlife Trust staff at Bailey Einon in 2003.

4.3.2 Faecal Pellet Count

Deer faecal pellet groups were found in 2 of the 13 conservation woodlands surveyed: Prisk Wood and Croes Roberts Wood as well as Coed-y-Brenin. Faecal pellet samples found in Pwll –y-Wrach and Cwm Oergwm were identified as sheep faeces.

Pellet group sizes ranged from 6 to 134 pellets per group (Table 4.3). Average pellet group size in Prisk Wood was 28, in Croes Roberts 25 and in Coed-y- Brenin 22. Full transect data can be found at Appendix 4.1.

Table 4.3. Pellet group size survey results for woodlands with deer.

Prisk wood		Croes Robert wood		Coed-y-Brenin	
Group Size	Frequency	Group Size	Frequency	Group Size	Frequency
6	3	6	2	6	1
7	2	8	1	7	4
8	5	13	1	8	3
9	4	19	1	9	2
10	5	20	3	10	2
11	2	29	1	12	5
12	3	36	1	13	2
13	2	40	1	14	1
14	1	48	1	15	1
15	4	57	1	16	1
16	2			17	1
17	2			21	1
19	1			23	1
20	3			24	1
21	1			26	1
22	1			29	2
23	2			30	1
24	2			31	1
25	2			33	1
27	1			34	1
30	1			36	1
31	1			38	1
33	1			39	1
35	1			40	1
37	1			44	2
39	1			55	1
42	1			73	1
43	1				
47	1				
48	1				
49	2				
55	1				
62	1				
63	1				
67	1				
76	1				
92	1				
113	1				
121	1				
134	1				

The mean fallow deer density within Prisk Wood was calculated to be 69 per 100ha (SE = 4.723). In Croes Roberts the fallow deer density was calculated as 10 per 100ha (SE= 0.875). In order to calculate this density the defecation rate was given as 25 groups per day as this is the rate for Fallow deer, the species identified to be within these woods. The decay rate was calculated to be an average of 160 days. The fallow deer density in Coed-y-Brenin was calculated to be 43 deer per 100ha (SE = 2.149).

Pellet group sizes ranged from 6 to 134 pellets per group. Average pellet group size in Prisk Wood was 28, in Croes Roberts 25 and in Coed-y- Brenin 22. The difference in pellet groups sizes overall was not significant. There was no difference in pellet groups sizes between woodlands (Paired T-test, t=-10.305, df=76, P=0.51) and there were no differences between pellet group frequency between woodlands (Paired T-test, t=1.406, df=76, P=0.392).

4.3.3. Trackway Counts

Trackway counts were difficult to assess as few of the woodlands were isolated and several of the woodlands had regular incursions of different intensities by cattle and sheep. There were no areas of 'deer-proof' fencing preventing entry by deer although in some reserves geographical features such as steep rock faces were classed as a barrier. The trackway survey data can be found in Table 4.4.

For the twelve sites a total perimeter of 18,912m was measured with an average woodland perimeter of 1628m ($\pm$32m), (SD=427.89). Fencing that did occur was livestock fencing, and was present in varied condition from complete and well maintained to derelict where posts and wire were in-effective. 1,000m of the unfenced perimeter was stream or river sites which was not classed as a barrier in terms of deer movement (Figure 4.1).There were no significant difference between sites in terms of perimeter length or fence type (T-test perimeter t= 6.966, df=113, P=0.240, T-test fence type t=2.046, df=3, P=0.133).

Table 4.4. Trackway Survey Data

	Good Fence				Poor Fence				No Fence				River Crossable				River Barrier				Other Barrier			
	Length (m)	Trackway Class			Length (m)	Trackway Class			Length (m)	Trackway Class			Length (m)	Trackway Class			Length (m)	Trackway Class			Length (m)	Trackway Class		
		3	2	1		3	2	1		3	2	1		3	2	1		3	2	1		3	2	1
Bailey Einon	1670	0	3	4	0	0	0	0	0	0	0	0	0	0	0	0	90	0	0	0	0	0	0	0
Big Pool Wood	1040	0	0	0	110	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coed Cilygroeslwyd	870	0	1	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Coed Drysiog	350	0	5	0	50	0	1	0	440	0	2	0	0	0	0	0	370	0	0	0	0	0	0	0
Cores Roberts	1135	0	0	0	140	3	7	0	850	6	6	5	0	0	0	0	0	0	0	0	0	0	0	0
Cwm Byddog	1070	0	7	2	0	0	0	0	190	0	6	3	0	0	0	0	0	0	0	0	110	0	0	0
Cwm Oergwm	1510	0	16	18	0	0	0	0	0	0	0	0	463	0	0	0	927	0	0	0	0	0	0	0
Dyfnant	426	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Nantporth	1100	0	0	0	0	0	0	0	40	0	2	0	0	0	0	0	0	0	0	0	820	0	3	0
Pendugwm	105	0	0	2	354	0	3	0	300	0	2	0	300	0	0	0	0	0	0	0	0	0	0	0
Prisk	890	9	0	0	570	0	0	0	825	89	13	0	0	0	0	0	0	0	0	0	0	0	0	0
Pwll-y-wrach	890	0	1	2	50	0	6	0	0	0	0	0	1170	0	17	0	0	0	0	0	0	0	0	0

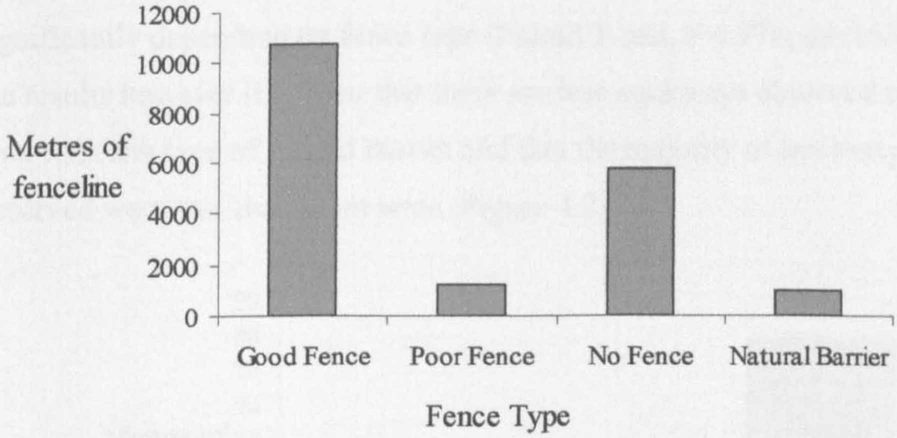


Figure 4.1. Woodland Perimeter Type (Good – well maintained livestock fence, Poor - poorly maintained livestock fence, No fence – no visible fence, Natural barrier - river or steep terrain.)

There was an average of 0.55 trackways per 100m (Table 4.5.). Of the eight woodlands where trackways were observed only in two woodlands could it be confirmed that trackways were as a result of deer movement. In both cases deer faecal pellets were found confirming deer use. The woodlands where deer trackways were positively identified were Prisk and Croes Roberts where five and one trackways respectively were identified as having been in use by deer.

Table 4.5. Woodland perimeter trackway observations.

Woodland	Tracks per 100m perimeter
Bailey Einon	0.40
Big Pool Wood	0
Coed Cilycroeslwyd	0.40
Coed Drysiog	0.66
Coed Pendugwm	0
Croes Roberts	1.06
Cwm Byddog	1.31
Cwm Oergwm	1.17
Dyfnant	0.38
Nantporth	0.10
Prisk Wood	6.47
Pwll y Wrach	0.43

There were significant differences between woodlands in terms of boundary length (Paired T-test, t=-4,323, df=143, P=0.004) and number of trackways observed (Paired T-test, t=16.537, df=143, P=0.003). The number of trackways observed also differed significantly depending on fence type (Paired T-test, t=4.776, df=143, P=0.011). From the results however it is clear that there are less trackways observed with river barriers than with any type of fenced barrier and that the majority of trackway widths observed were less than 0.3m wide (Figure 4.2)

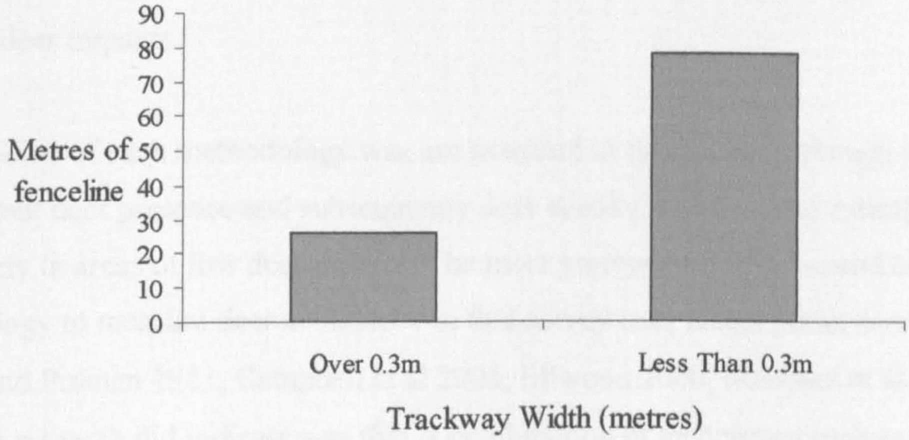


Figure 4.2. Trackway Width Class.

4.4. Discussion

In terms of usefulness of the deer survey methods used in this research no one method of deer population assessment appears to provide the full picture regarding deer population numbers or activity (Table 4.11) although it does provide an indication of potential deer presence and habitat use.

The most common and abundant species identified was fallow with indications that roe are also establishing themselves in conservation woodlands in Wales. In woodlands with well established, relatively high deer abundance (Prisk and Croes Roberts) it was possible to estimate mean deer densities (69 and 10 deer per/100ha respectively). Research has indicated that deer densities as low as 4 deer/100ha may prevent regeneration (Alverson 1988) although this is dependent on the plant species that is attempting to regenerate. At the start of the survey period only two woodlands appeared to have a deer presence. By the end of the survey period, 5 years later, it appeared that deer had a presence in four woodlands and this suggests that deer populations in Wales are expanding their range into woodlands managed for conservation.

In trying to assess ideal deer densities for woodlands and conservation Gill suggests that 4-7km² is an ideal deer density (Gill 2000).This suggests that woodlands classified as having up to a medium deer density in this study should not suffer any negative deer impacts.

The precision of each methodology was not assessed in this survey although results indicate that deer presence and subsequently deer density is difficult to estimate, particularly in areas of low deer density. The most precise and well researched methodology to measure deer abundance in this survey uses faecal pellet counts (Bailey and Putman 1981, Campbell et al 2004, Ellwood 2000, Marques et al 2001). What this research did indicate was that a combination of techniques such as using trackway counts (Bauman et al, 1999) or faecal pellet analysis is a useful took to look at habitat use (Guillet et al 1995, Mayle et al. 2000) although the validity of the assessment is time limited. The sites in this survey varied significantly in terms of boundary length and the number of trackways observed which also affects the ability to compare woodlands in a similar way.

4.5. Conclusions

Deer were found to be present in 4 of the 12 woodlands surveyed. Two woodlands were occupied by deer in 2000 and by 2005 this had increased to four woodlands. Fallow and Roe were the species of deer recorded. The woodlands with the highest deer abundance were for fallow in south-east Wales in the Wye Valley (Prisk and Croes Roberts). The other woodlands in Wales identified as having a lesser deer abundance were found in mid Wales (Bailey Einon and Pwll y wrach) and indicated a low presence of roe deer.

The survey highlighted that occasional deer presence in low deer density areas (< 5deer/100ha) is very difficult to identify and quantify accurately with the methods and effort used here. A combination of deer survey methods such as the indicators if deer presence measured in the Cooke survey could potentially provide a fast basic assessment of deer habitat use and potential deer density and confirm if deer are present in the first instance. Following basic deer presence being identified more complex methodologies such as faecal pellets counts or thermal imaging could then be utilised to confirm actual deer densities if required.

CHAPTER 5

IMPACT OF WILD DEER ON WOODLAND VEGETATION

INVESTIGATION INTO THE IMPACT OF WILD DEER ON WOODLAND VEGETATION DIVERSITY IN WOODLANDS MANAGED FOR CONSERVATION IN WALES

5.1 Introduction

Although evidence exists to demonstrate the impact of wild deer on biodiversity it is still at present difficult to monitor, quantify and evaluate (Gill 2000) as methods to investigate impacts have been based on perception and it is difficult to quantify the results. Research has not previously been carried out specifically in Wales to estimate wild deer impacts on biodiversity. In a survey of 162 English National Nature Reserves (Putman 1996), the data returns from 155 sites found that over a quarter (28%) of sites had no deer, 45% of sites with deer recorded a measurable impact and only 18% of reserve managers believed the current impacts would influence the outcome of the management objectives, particularly woodland plant regeneration. The report highlighted that deer presence in woodlands managed for conservation are not always a problem and that there is no one management prescription that fits all sites. Evidence from the JNCC Report Common Standards Monitoring Programme (JNCC 2006) that was discussed in Chapter 1 highlights the value of a monitoring programme to record positive progress in conservation of sites and identification of threats to be mitigated and the need to develop national monitoring of deer in Wales to support this.

Lessons learnt in England (DEFRA 2004) and Scotland (Hunt 2003) where deer damage has been recorded as widespread demonstrates the need for monitoring, development and implementation of sustainable deer management at as early a stage as possible when deer are detected to ensure damage is limited. Due to the regional differences between Welsh and the English countryside, species composition and management it is important to establish the impact of wild deer in Wales on woodland biodiversity. It has been widely documented that grazing is an important tool in enhancing woodland biodiversity (Mayle 1999). In woodlands managed for conservation it is often very difficult to assess what is occurring in terms of monitoring the impact of grazing, particularly by deer as it is difficult to quantify.

The aim of this chapter is to assess a practical method for monitoring wild deer impacts in woodland actively managed for conservation alone as well as assessing if wild deer have an impact on woodland biodiversity in Wales. We will investigate more specifically the impact of wild deer on ground flora species abundance and productivity. It is important to assess what the level of impact deer are having before we investigate future management options and objectives. When livestock grazing occurred historically in woodlands it is unlikely that there were significant deer populations or conflicts with wild deer presence in these areas (Guest pers comm.).

The socio – economic implications of deer and woodlands managed for conservation are also an important consideration for land managers as these may be the deciding factors when it comes to what level of impact of wild deer is tolerated and what subsequent deer management is carried out. We have briefly discussed the economics of deer impacts and management the importance of biodiversity and the influence of deer in Chapter 1. The true cost of wild deer to the environment and in particular biodiversity cannot be quantitatively evaluated easily at present as a financial value for biodiversity is difficult to assess although at a local level assessments can be made (White et al. 2004). We will debate further the value of biodiversity in Chapter 6 when we discuss the issue of risk assessments with regard to biodiversity loss.

Previous work that has been carried out to assess the impacts of deer on biodiversity through changes in vegetation has used permanent quadrats (Mason & MacDonald 2002, Peterken & Backmeroff, 1988) and exclosures

(Brinton 1996, Cooke 1997) as well as methodologies based on transect or cluster assessments (Pepper 1998). By looking at the efficacy of smaller, low cost deer exclosures that have been demonstrated as effective in assessing the impact of deer on margin woodland we can evaluate a potentially practical biodiversity monitoring tool (Brinton 1996). Evidence in recent years has also highlighted that plant species selection by deer allow the use of vegetation surveys to assess deer activities and impacts (Pepper 1998, Cooke et al.1995, Cooke 2006b, 2007, Tabor 2004, 2007). By trialling a number of deer population and vegetation impact assessment methods side by side we can examine the practicalities of the methods available and establish the impact of wild deer in Wales on woodland vegetation biodiversity.

The primary hypothesis of the research in this chapter is:

Wild deer have a significant impact on woodland vegetation biodiversity in Wales where the woodlands are managed for conservation.

Biodiversity or more specifically Biological Diversity is defined as 'the variability among living organisms from all sources, including, 'inter alia', terrestrial, marine, and other aquatic ecosystems, and the ecological complexes of which they are part: this includes diversity within species, between species and of ecosystems.' (UN 1992)

Additional hypotheses have been suggested as a result of knowledge gaps that have appeared as a result of the literature review to assess what is occurring with wild deer and biodiversity in Wales.

1. The absence of wild deer is just as detrimental to vegetation diversity and abundance as excessive numbers of wild deer.

2. Small exclosures provide a viable method to evaluate changes in vegetation changes in species richness as a result of deer grazing.
3. Wild deer impacts are as significant as other woodland characteristics in determining plant species diversity in Wales.

These hypotheses can be broken into more specific questions

1. Do wild deer create a significant threat to woodland biodiversity in Wales?
2. Is the issue national or regional?
3. What is likely to happen in the future?
4. Can we monitor or predict areas in Wales that are vulnerable to wild deer impacts?
5. What procedures and methods are applicable to be put in place to monitor and mitigate deer impacts in the future?

In chapter 6 we take the results of the research in this chapter and investigate through the mechanism of risk assessment how we can use the information to flag vulnerable sites and identify key areas to direct activities to reduce the risk of deer being the significant negative impact on the site.

Throughout the duration of the research project significant events including woodland management activities such as incursion by livestock into the woodland and tree felling and clearance as well as climate events such as flooding were also recorded as disturbance may influence deer habitat use as we have previously discussed in chapter 1. The Wildlife Trusts were provided with an annual update on research progress and this enabled new information regarding woodland management activities and events to be recorded regularly.

5.2. Methods

5.2.1. Exclosure Build

In order to assess the impact of wild deer on woodlands managed for conservation the vegetation in an exclosure can be compared with an unfenced plot in terms species composition and abundance. Prior to the erection of the exclosures permission was sought through the Wildlife Trusts from Countryside Council for Wales as all the sites were Sites of Special Scientific Interest or other reserves where disturbance is regulated through legislation.

In order to provide a data set with a large enough sample size to provide reliable results with the resources available, a minimum of three exclosure sites were selected per woodland. The size and build of the exclosure was chosen taking into consideration the need for exclosures to be small and unobtrusive enough to go relatively un-noticed in woodland where public access was a factor and not affect deer or other wildlife woodland utilisation but large enough to provide data on changes in vegetation composition. Previous work (Brinton 1996) suggested that 2x2x2m exclosures were a practical size to use in terms of time taken to survey, cost and the data that was provided through their survey.

A total of 36 exclosures were erected across the 12 woodland sites in the first quarter of 2002. The 2m x 2m x 2m exclosures were erected using timber and livestock fencing wire (Figures 5.1 and 5.2). The wire was left loose at the top of the exclosure to deter deer or other animals such as cattle form leaning over the top of the fence and browsing on vegetation that may be accessible in the exclosure.

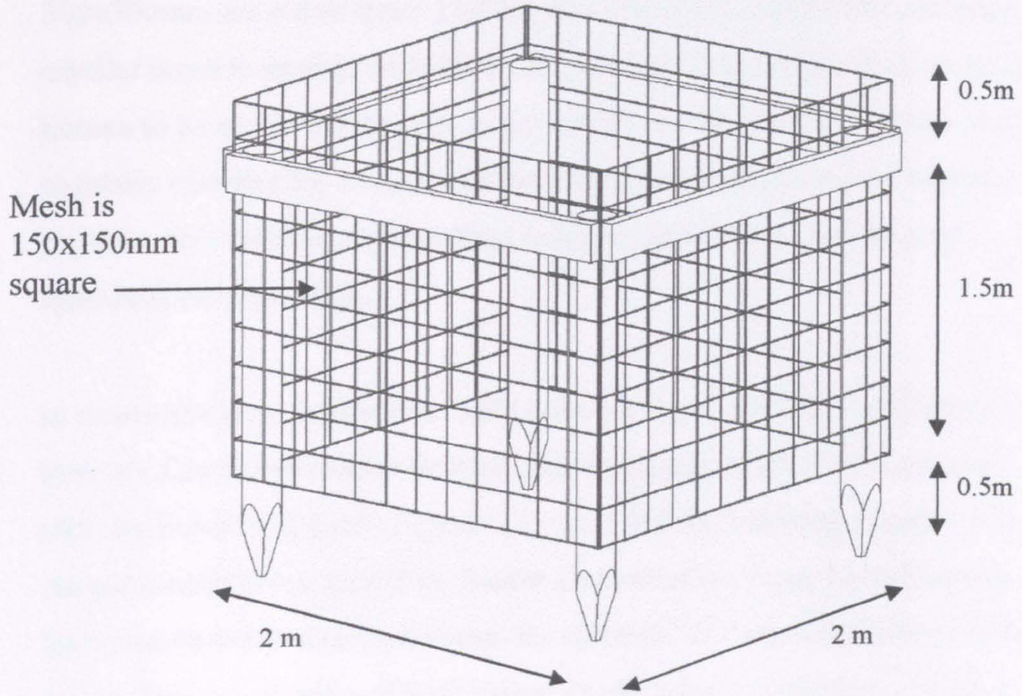


Figure 5.1. Diagram of a fence structure for exclosures used (2 x 2 x 2m)

Figure 5.2. An exclosure in Dyfnant

Livestock fencing specification (150x150mm) was selected instead of wire mesh size recommended for deer fencing (75 x 75 for muntjac to

300x300mm for red (Pepper 1999) due to costs and availability. Although smaller mesh is recommended with respect to Muntjac deer, there were not known to be any in the vicinity of any of the woodlands and the sites were regularly checked for evidence of exclosure disturbance such as muntjac presence that would be at risk from being caught in livestock fencing specification wire mesh.

In determining exclosure type build costs were a significant consideration. Forestry Commission specification deer fencing used on larger research plots by Forest Research (Figure 5.3) cost £250 for building supplies only per exclosure (Price quoted by British Conservation Trust for Volunteers 2000) whereas the total build costs for these smaller exclosures were £150 per exclosure, inclusive of both materials and labour. With 36 exclosures this cost saving amounted to set up costs of £5400 as opposed to £9000.

Figure 5.3. Diagram of fence structure for a 7 x 7 x 2m exclosure using Forestry Commission specification (Trout and Pepper 2006)

A smaller exclosure area of less than $2m^2$ was not used in order to ensure that vegetation growth was not influenced by the presence of the fence. With placing smaller structures on sites with unknown public access there was also the risk of theft, deliberate or accidental damage of the research plots which would reduce the data set recorded.

In each woodland the location of the exclosures (X) was selected using random numbers from a table to provide distance in metres along and then in from perimeter points at alternate and opposite corners of the reserve (A& B). (Table A7, Random Numbers Mead et al.1993). Location selection of exclosures is illustrated in Figure 5.4. Where an initial location was identified as unsuitable such as in a river, stream or on steep terrain (slope >45 degrees) another site was selected at random until all exclosures were sited.

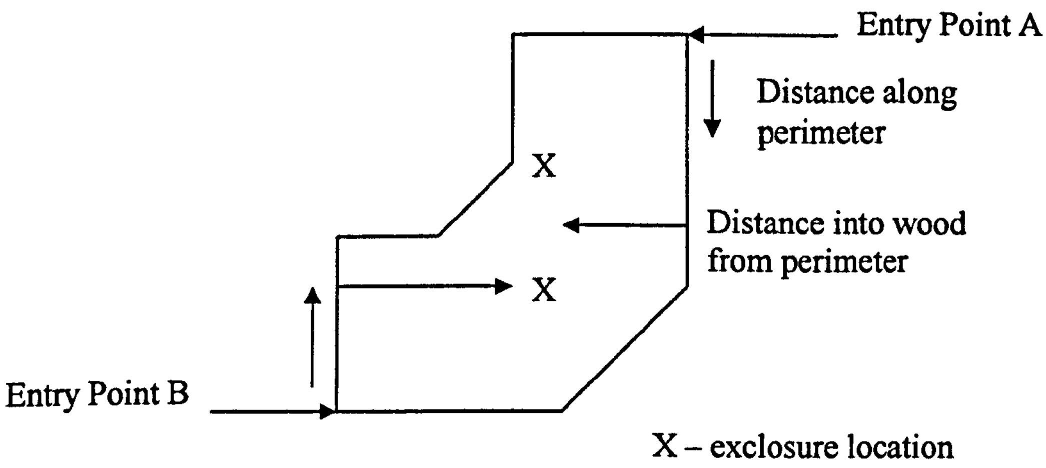


Figure 5.4. Diagram to illustrate how an exclosure location was selected

The corresponding unfenced plots for each exclosure were located 0.5m from and parallel to one of the four sides of the fenced plot and were allocated randomly unless crossing or adjacent to a track or pathway. The effect of siting exclosure sites where some are and some are not near paths that may be used as deer as a transit route was mitigated by placing the control plot (the unfenced plot) 0.5 m from one of the exclosure sides at the same distance from the path. Whilst forest paths may be used as transit routes by deer it is also important to note that they have been identified as potentially having a significant effect on surrounding vegetation up to ten metres away and affecting plant species and soil composition which could affect biodiversity (Godefroid & Koedam 2004) and this stresses the importance of the use of multiple sample sites placed randomly.

5.2.2. Exclosure Surveys

In each exclosure and corresponding unfenced plot a number of measurements were taken during the three year data collection period from 2003 to 2005. The plant species, number of plants, plant cover at 10cm height increments up to 2 metres were all measured. In 2005 the canopy cover and site gradient were also measured for each fenced and unfenced plot. Soil samples and biomass samples were also taken. In addition a fixed point photographic record of each site's fenced and unfenced plot was taken annually. By assessing the number of species present this can be used as a measure as species richness within the woodland. By recording measurements such as plant cover and biomass we can also assess effects by deer on woodland vegetative structure and productivity. Data analysis was carried out using SPSS 15.0 and CANOCO.

5.2.2.1 Species and number of plants.

The aim of this data collection was to test the hypothesis that deer have an impact on plant species richness and diversity.

For each unfenced and fenced plot vegetation was recorded in terms of species and number of plants of each species. The numbers of plants were the actual number of individual plants observed in the majority of cases but for plants such as ivy the number of plants was estimated by looking at overall local plant coverage and the number of separate plants and calculating an average per metre square. If plant browsing was observed this was recorded and the source if possible clarified (e.g. sheep as opposed to deer).

Plant cover (%) was measured at height increments 0-0.1m, 0.1-0.2m, 02-0.3m, 0.3-0.4m, 0.4-0.5m, 0.5-0.6m, 0.6-0.7m, 0.8-0.9m, 0.9-1.0m, 1.0-1.1m, 1.1-1.2m, 1.2-1.3m, 1.3 – 1.4m, 1.4-1.5m, 1.5-1.6m, 1.6m.

5.2.2.2 Vegetation Biomass

The aim of this data collection was to test the hypothesis that deer in Wales have an effect on under-story vegetation productivity in woodlands managed for conservation.

At the end of the three year data collection period a 50cm by 50cm area within the centre of each exclosure and adjacent unfenced plot was removed and analysed. For each plot plant type was recorded and dry weight calculated. The plants were grouped into similar plant species group types where possible in order to compare productivity of the different groups and if a specific plant species was particularly abundant across all plots this was placed in a separate category. The dry weight of vegetation per square metre was calculated by taking the vegetation collected and drying in an oven at 200°C overnight and then weighing.

5.2.2.3 Evidence of exclosure disturbance.

The aim of this data collection was to establish the reliability of the exclosure structure itself and assess if it provided benefit to flora and fauna that may influence the results of the research.
On each visit to the exclosure any evidence of disturbance was recorded. For example, had the wire mesh been lifted up? Were small mammals or birds nesting in or near to the exclosure? The exclosure structure itself was also examined for damage.

5.2.3 Site Characteristics

5.2.3.1 Gradient.

The aim of this data collection was to test the null hypothesis that the gradient of the exclosure and woodlands were not significantly different. If the exclosure gradient is significantly different to the average site gradient then the vegetation on the exclosure site may not be representative of the whole woodland and would affect the efficacy of exclosures as a method to assess deer impacts. In addition if there is significant variation between sites and exclosures then this may influence how deer move through that landscape and how they impact on that site.

The site gradient was calculated using a 1:10000 ordnance survey map of the site and along randomly allocated transect measurements were taken to determine change in height divided by transect length. Three transects were measured per woodland and an average calculated. For each fenced and unfenced pair of plots a clinometer was used to measure the gradient.

5.2.3.2 Soil Properties

The aim of this data collection was to test the null hypothesis that soil properties of the exclosure and woodlands were not significantly different. If the soil properties such as structure, moisture content or pH are significantly different this is likely to influence plant species growth and influence interpretation of differences in vegetation data.

To collect the soil sample from the centre of each fenced and unfenced plot leaf litter and the first 10cm of soil were removed first before a sample of 500g of soil was removed. The soil samples were collected over one 48 hour period in June 2005 during which there was no variation in weather that may have affected the properties of the soil. The soil samples were then tested for water content, organic matter content and pH.

Water content – approximately 100g of soil was weighed and then placed at 200°C overnight and the dry sample then re-weighed. The percentage water content was calculated as wet weight – dry-weight / wet weight x 100.

Organic matter content – approximately 100g of soil was weighed and placed at 200°C overnight and the dry sample was then placed in an oven at 400°C overnight and the dry sample re-weighed. The organic matter content was calculated as dryweight/ wet weight x 100.

pH – approximately 20g of oven dried soil was mixed with distilled water and the pH was read using an electronic pH meter.

5.2.3.3 Canopy cover

The aim of this data collection was to test the null hypothesis that canopy cover did not vary between exclosures and woodlands. If there is a significant difference in canopy cover then vegetation species richness and productivity may be influenced by light availability in addition to deer impacts. Canopy cover refers to 'the proportion of the forest floor covered by the vertical projection of tree crowns' and canopy closure or canopy density refers to 'the proportion of the sky hemisphere obscured by vegetation when viewed from a single point' (Jennings et al. 1999).

In this research canopy cover was estimated as a percentage of canopy closure in a skyward view of the canopy averaged over the four corners of the fenced and unfenced plots (total of eight points).

5.2.4 Woodland Vegetation Browsing Transect.

The aim of this data collection was to confirm that the source of any grazing or browsing could be confidently attributed to deer and no other form of wildlife or livestock species. Vegetation along transects were also examined. The data can also be used to provide an overall woodland assessment of browsing damage that can be compared with the results from the exclosure. This will indicate the efficacy of using exclosures to assess woodland browsing damage.

Through each wood a total length of a minimum of 250m of transects were walked using the method of transect selection as for those used for the faecal pellet counts (Section 4.4.2, Figure 4.1). Primary transects were surveyed and if the 250m transect length was not met by walking primary transects the secondary transects were then walked until 250m had been surveyed (Figure 5.5). Where browsing was observed the source of the browse was identified whether it is deer, livestock (particularly cattle or sheep) or other mammals. Identification was carried out by looking at bite marks and any other evidence such as tracks, presence of species specific faeces hair/wool nearby. Along three separate 100m transects in each woodland which were located using a random bearing (selected using a random number table (Mead et al. 1993) from a starting point at a randomly selected corner of woodland and the number of plants browsed and the number of plants present were recorded. Where browsing had occurred the species of plant browsed was also recorded. If several shoots from a stand of hazel occurred this was classed as one plant browse.

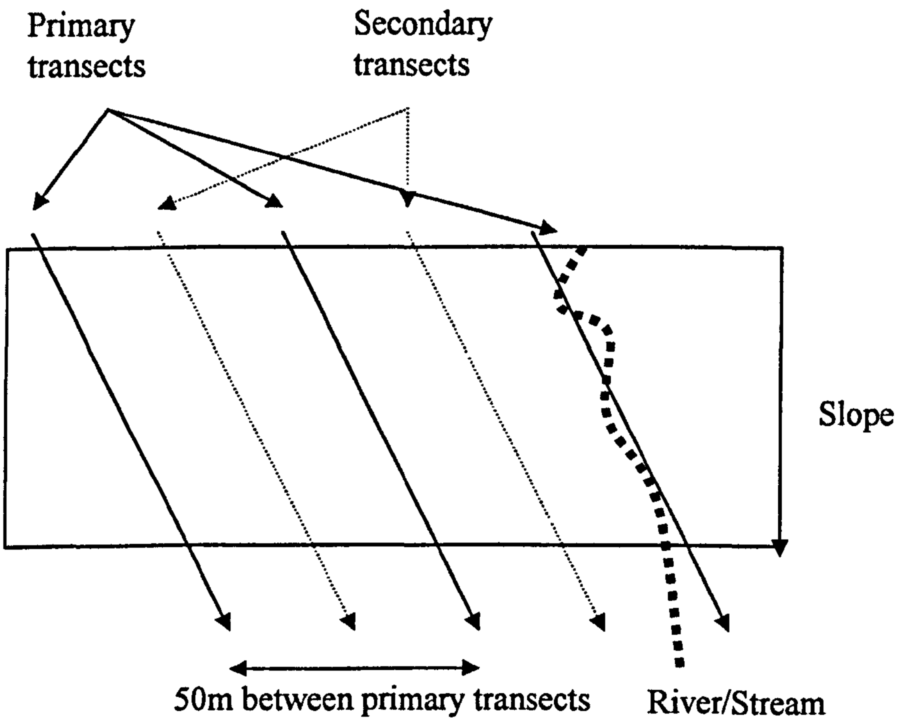


Figure 5.5. Diagram to show transect selection and location across a woodland reserve area.

The minimum transect length was chosen as it was a realistic length of transect to obtain representative sample data from the woodlands. This was The deer damage (%) was estimated as number of trees browsed, divided by the number of trees recorded (after Pepper 1998).

5.2.5 Deer Impact Survey.

The most recent methodology has been developed by Arnold Cooke to investigate the impact of muntjac in East Anglia (Cooke 1997, 2006b and 2007).

For this research the Cooke based assessment method was used and composed of observations regarding deer, impact and site in three sections (Table 5.1). The first assessed levels of deer presence to give a deer activity score through the presence of indicators that included deer sighting, observation of deer faecal pellets or slots and track-ways. In the second section levels of deer damage were assessed to give a deer damage score. Damage indicators measured were browsing of woody shoots or ground flora, bark-stripping and the presence of a browse-line. Each of the indicators was given a score of 0-3 where 0 indicates the factor was absent, 1 indicated rare, 2 indicated frequent sightings and 3 indicated abundant factor observation. The third section contained an adjustment for canopy cover and canopy closure by noting any differences in ground flora and tree seedlings in closed or open areas. Site characteristics are important as they can support the use of the site by deer and site characteristics that may influence deer impacts or vegetation growth separately. For each site notes were also taken on the distance walked to record data and specific details relating to deer and site use and specific plant browsing.

Table 5.1. Cooke Survey Deer Impact Measurements

Survey Indicator	Evidence	Score
Deer Presence For presence the score is an average based on assessment of all presence indicators across site.	Visual count	1 – Low 0-10 deer observed 2 - Medium 10-25 deer observed 3 - High 25+ deer observed
	Faecal pellets	1 – Low – rare 2 – Medium – frequent 3 – High – abundant
	Couches	1 – Low – rare 2 – Medium – frequent 3 – High – abundant
	Scrapes	1 – Low – rare 2 – Medium – frequent 3 – High – abundant
	Tracks	1 – Low – rare 2 – Medium – frequent 3 – High – abundant
Deer Impact For impact the score is an average based on assessment of all impacts across site More specifically browse to coppice<2m, coppice>2m, Hardwood seedlings and bramble if present was recorded.	Fraying	1 – Low – rare 2 – Medium – frequent 3 – High – abundant
	Browsing	1 – Low – 0-10% 2 – Medium – 10- 66% 3 – High – 67%+
	Browse line	1 – Low – not obvious 2 – Medium – 50% browse 3 – High – 100% browse
	Grazing	1 – Low – rare 2 – Medium – frequent (with/without height reduction) 3 – High – abundant (definite height reduction)
Adjustments	Canopy Closure	0-25% - zero 25-50% - minus 1 50-75% - minus 2 75-100% - minus 3
	Ground Flora in closed canopy	Is ground flora markedly higher in open canopy than closed canopy? Yes – zero No – plus 3
	Tree/shrub seedling	Are tree/shrub seedlings or bramble above 50cm, found within 5m of rides and of favoured species? Yes – plus 2 No – zero
	Non-palatable species	Yes – plus 1 No – zero

5.3 Results

5.3.1 Exclosure survey

5.3.1.1 Species and number of plants

During the exclosure survey 117 different plant species were identified (Table 5.2). The number of plants found per exclosure fenced or unfenced plot varied from zero to 18 different species (Table 5.3). The most common species identified were Ash (*Fraxinus excelsior*), Bluebell (*Hyacinthoides non-scripta*) Cleavers (*Gallium aparine*), Dogs Mercury (*Mercurialis perennis*), Ivy (*Hedera helix*) and Common Stinging Nettle (*Urtica diocia*). Data on vegetation species and abundance can be found at Appendix 5.1.

Plant species richness was not significantly different between fenced and unfenced plots (Paired T-test $t=-17.187$, $df=209$, P (2-tailed) $=0.227$). There was also no difference in plant species richness between woodland sites overall (T-test $t=3.513$, $df=209$, P (2-tailed) $=0.267$). Sites also showed no difference in vegetation species richness recorded from year to year over the three years of data collection (ANOVA $F=0.436$, $df=2$, $P=0.648$). However when General Linear Modelling was used to examine the difference in abundance of different individual plant species where the dependent variable was the number of plant species and the variables were woodland, exclosure and fenced or unfenced plot it found 30 of the 117 species varied significantly between either fenced or unfenced plots, between woodlands or between years of the survey (Table 5.4).

Table 5.2. Plant species identified in exclosure survey plots.

Number of plant species	Plant Family Classification
19	Poaceae (Graminaeae) - 3 Agrostis, 1 Ahrenathrum, 1 Anthoxanium, 1 Bromus, 1 Cynosaurus, 1 Dactylis, 3 Deschampsia, 1 Elytrigia, 2 Festuca, 2 Holcus, 1 Lolium, 1 Melica, 1 Poa
14	Rosaceae - 2 Geum, 2 Rosa, 2 Rubus, 2 Sorbus, 1 Cratageous, 1 Filipendula, 1 Fragaria, 1 Potentilla, 1 Prunus, 1 Tormentil
6	Moss species - 1 Euryncium, 1 Mnium, 1 Polytrichum, 1 Rhythdiadelphus, 1 Rhynchotegium, 1 Moss sp. (unidentified)
6	Asteraceae - 2 Leontodon,1 Asteracae, 1 Bellis, 1 Cirsium, 1 Taraxacum
5	Dryopteridaceae -4 Dryopteris, 1 Polystichum
5	Juncacae - 4 Juncus, 1 Luzula
5	Ranunculaceae - 1 Caltha, 4 Ranuncula,
4	Apiaceae - 1 Anthriscus, 1 Conopodium, 1 Heracleum, 1 Sanicle
4	Lamiaceae - 1 Ajuga, 1 Lamiastrum, 1 Prunella, 1 Teucrium
3	Fagaceae- 2 Quercus, 1 Fagus
3	Geraniaceae - 3 Geranium
3	Polygonaceae - 3 Rumex
3	Scrophulariaceae - 1 Digitalis, 1 Pedicularis, 1 Veronica,
2	Aceraceae - 2 Acer
2	Araliaceae - 2 Hedera
2	Brassicaceae - 1 Alliaria, 1 Cardamine
2	Caryophyllaceae - 1 Silene, 1 Stelliaria
2	Cyperaceae - 2 Carex
2	Fabaceae -1 Lotus, 1 Trifolium
2	Oleaceae - 1 Fraxinus, 1 Ligustrum,
2	Onagraceae - 1 Circaea, 1 Epilobium
2	Primulaceae - 1 Lysimachia, 1 Primula
2	Rubiaceae - 2 Gallium
1	Adoxaceae - 1 Adoxa
1	Aquifoliaceae - 1 Ilex
1	Aspeniaceae - 1 Phyllitis
1	Betulaceae - 1 Corylus
1	Caprifoliaceae - 1 Lonicera
1	Caprifoliaceae - 1 Sambucus
1	Cornaceae - 1 Cornus
1	Dennstaedtiaceae - 1 Pteridium
1	Dioscoreaceae - 1 Tamus
1	Euphorbiaceae - 1 Mercurialis
1	Liliaceae- 1 Hyacinthoides
1	Oxalidaceae - 1 Oxalis
1	Plantaginaceae - 1 Plantago
1	Saxifragaceae - 1 Chrysosplenium
1	Urticaceae - 1 Urtica
1	Violaceae - 1 Viola
1	Woodsiaceae - 1 Anthyrium

Table 5.3. Plant species richness in fenced and unfenced experimental plots. There were 3 plots of each treatment on each site (described here as exclosures 1, 2 & 3).

Woodland	Exclosure	No. Species 2003		No. Species 2004		No. Species 2005	
		Fenced	Unfenced	Fenced	Unfenced	Fenced	Unfenced
Bailey Einon	1	7	11	4	3	4	3
	2	5	5	6	8	8	5
	3	7	5	8	6	0	0
Big Pool Wood	1	4	7	6	6	6	6
	2	5	4	5	3	5	3
	3	5	6	5	7	5	7
Coed	1	2	2	4	3	4	3
Cilycroeslwyd	2	5	2	6	2	6	2
	3	14	9	12	6	12	6
Coed Drysiog	1	5	6	6	7	6	7
	2	3	5	6	4	4	6
	3	3	2	2	1	3	2
Croes Roberts	1	6	5	0	0	6	6
	2	3	5	6	4	6	4
	3	3	3	0	0	4	3
Cwm Byddog	1	5	4	7	5	7	5
	2	3	3	4	3	4	3
	3	1	2	5	3	5	3
Cwm Oergwm	1	5	4	8	6	8	6
	2	4	4	8	7	8	7
Dyfnant	1	14	11	18	9	17	10
	2	1	3	10	3	9	4
	3	11	11	13	11	12	10
Nantporth	1	5	4	7	6	7	6
	2	9	6	7	6	11	5
	3	12	9	11	5	8	5
Pendugwm	1	2	6	8	5	7	8
	2	3	2	6	7	6	7
	3	1	1	2	5	2	5
Prisk	1	6	6	10	5	10	6
	2	8	4	4	4	4	4
	3	6	4	4	4	4	4
Pwll-y-Wrach	1	3	6	5	6	5	5
	2	3	4	3	5	3	5
	3	8	10	8	10	8	10

Table 5.4. Results of GLM analysis individual species differences between fenced and unfenced plots, woodland site and date of survey.

Plant species	Difference overall fenced and unfenced plot	Difference overall between woodlands	Difference overall between year of survey
Acer campestre	F=12.067, df=1, P=0.001		
Ajuga reptans			F=9.551, df=1, P=0.042
Cynosurus cristatus	F= 4.067, df=1, P=0.046		
Deschampsia		F=2.080, df=10, P=0.03	
Leontodon hispidus	F=4.566, df=1, P=0.034		
Lolium perenne	F=6.062, df=1, P=0.015		
Lysimachia nummularia	F=4.147, df=1, P=0.044		
Mercurialis perennis	F=4.098, df=1, P=0.045		
Polystichum setiferum		F=2.190, df=10, P=0.022	
Asteracae millefolium		F=21717, df=1, P=0.05	
Bellis perenis			F=5.416, df=1, P=0.02
Cirsium arvense		F=2.945, df=10, P=0.002	
Dryopteris affinis			F=4.205, df=1, P=0.230
Filipendula ulmaria	F=4.279, df=1, P=0.041	F=1.959, df=10, P=0.043	F=4.111, df=1, P=0.045
Geranium spp.		F=2.546, df=10, P=0.008	
Heracleum sphondylium			F=4.146, df=1, P=0.04
Juncus articulatus		F=3.170, df=10, P=0.001	
Juncus conglomeratus	F=7.523, df=1, P=0.007		F=8.211, df=1, P=0.005
Lonicarea periclymenum			F=6.465, df=1, P=0.01
Luzula sylvatica			F=4.807, df=1, P=0.03
Melica uniflora	F=5.743, df=1, P=0.028		
Oxalis acetosella			F=6.433, P=0.012
Poa trivialis	F=5.021, df=1, P=0.027		
Quercus robur			F=7.210, df=1, P=0.08
Ranunculus repens		F=2.437, df=10, P=0.011	
Tamus communis		F=2.778, df=10, P=0.004	F=4.226, df=1, P=0.042
Teucrium scorodonia	F=5.896, df=1, P=0.017		
Trifolium repens			F=7.7170, df=1, P=0.08
Urtica diocia		F=2.292, df=10, P=0.016	
Viola riviniana		F=2.011, df=10, P=0.037	

There were no significant differences in plant species richness between woodlands with different relative deer densities (Table 5.5) (GLM, F=1.049, df=1, P=0.330). The number of plant species present in woodlands with no deer appears to be in a range similar to that of woodlands with a high deer presence (Figure 5.6). The woodlands with the most number of plant species appear to have deer present at a relatively low density. On analysis a correlation co-efficient of 0.169 also shows there is not a direct linear relationship between increasing plant species richness and deer abundance.

Table 5.5. Deer presence and plant species abundance.

Woodland	Geographical Region (according to ordnance survey northing)	Deer Presence	Mean number of plant species		Mean number of plant species
			Fenced plot	Unfenced plot	
Big Pool Wood	Mid Wales	Nil	5.56	5	5.28
Cwm Byddog	North Wales	Nil	6.17	6.33	6.25
Dyfnant	Mid Wales	Nil	6.11	6.78	6.45
Coed Pendugwm	South Wales	Low	4.22	2.89	3.55
Nantporth	North Wales	Low	4.22	3.56	3.89
Coed Drysiog	South Wales	Low	5.33	3.33	4.33
Coed Cilycroeslwyd	North Wales	Low	3.89	7.22	7.5
Cwm Oergwm	South Wales	Low	11	8.67	9.84
Bailey Einon	Mid Wales	Medium	5.67	4.89	5.28
Pwll y Wrack	Mid Wales	Medium	4.33	7.56	5.95
Prisk Wood	South Wales	High	6.56	2.44	4.5
Croes Roberts	South Wales	High	4.89	3.11	6.45

When woodlands are grouped together geographically in regions there is no significant difference between regions in terms of the vegetation species diversity (GLM F=2.069, df=1, P=0.155). When the woodlands are grouped according to level of deer abundance there is also no difference between regions in terms of vegetation species diversity (GLM F=0.116, df=1, P=0.740.

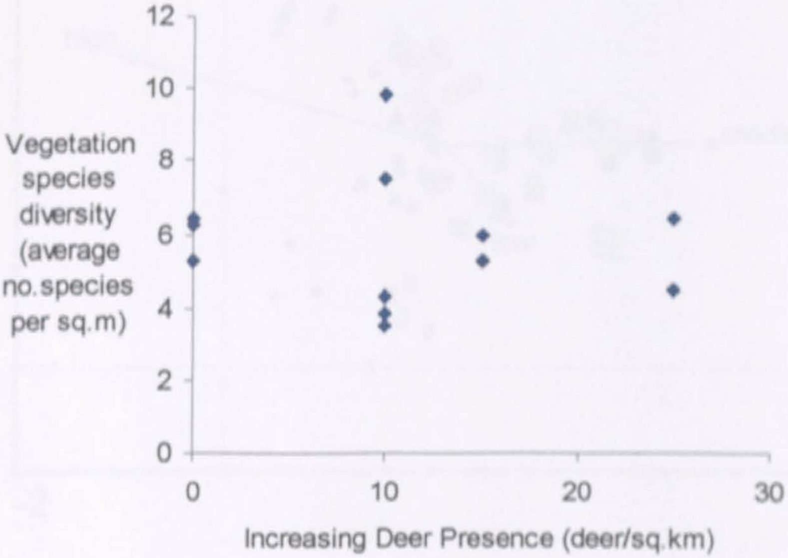


Figure 5.6. Relationship between plant species richness with deer abundance in woodland.

This variation in plant species number and deer density can also be illustrated using principal component analysis when we analysis all woodlands (Figure 5.7). If we compare a woodland with low deer density directly with a woodland with a high deer density, in this case Cwm Oergwm and Croes Roberts respectively (Figure 5.8 and 5.9)the results suggest a trend where there is a difference between vegetative species richness. This analysis however only indicates a trend and not the significance of a relationship.

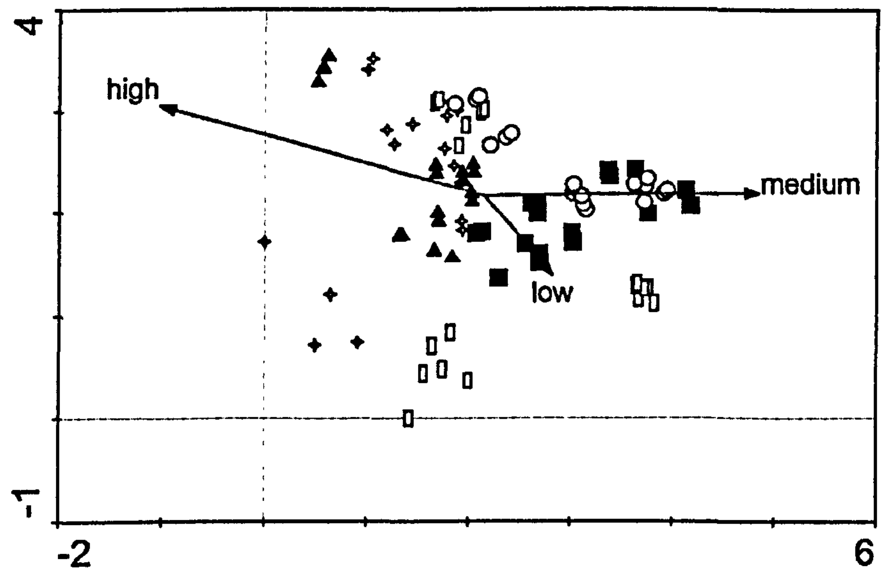


Figure 5.7. Comparison of woodland vegetation diversity and deer density. CANOCO Sample ordination by principal components analysis, axis 1 and 2, with deer density as supplementary variable (low, medium, high. Eigen values: axis 1=0.590, axis 2=0.476. Symbols represent woodlands

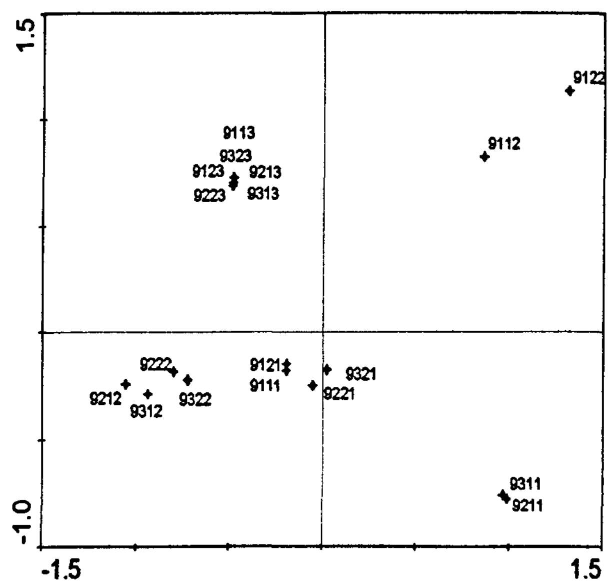


Figure 5.8. Vegetation diversity in woodland with low deer density. CANOCO Sample ordination by principal components analysis, axis 1 and 2. Eigen values: axis 1=0.378, axis 2=0.265. Numbers represent site number (1-12), Year (1-3), Exclosure (1-3), Fenced (1) Unfenced (2)

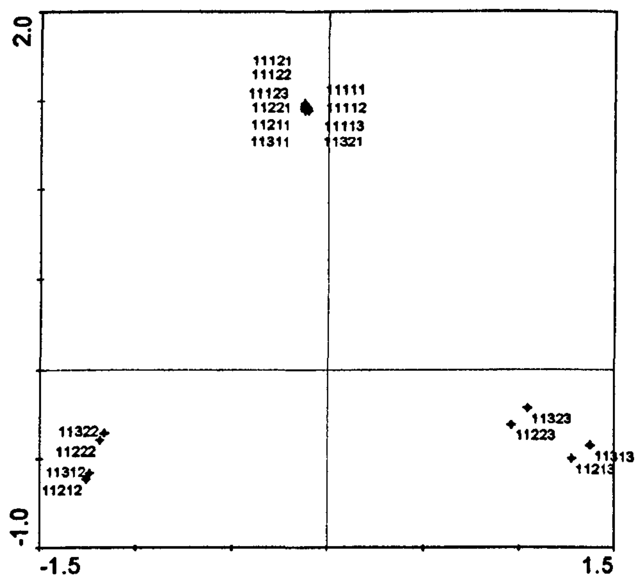


Figure 5.9. Vegetation diversity in woodland with high deer density. CANOCO Sample ordination by principal components analysis, axis 1 and 2. Eigen values: axis 1=0.528, axis 2=0.393. Numbers represent site number (1-12), Year (1-3), Exclosure (1-3), Fenced (1) Unfenced (2).

5.3.1.2 Vegetation Structure and Biomass.

There were no significant differences overall in heights of vegetation growth between fenced and unfenced plots (GLM F=2.390, df=20, P=0), between woods (GLM F=2.67, df=20, P=0) or between years (GLM F= 1.095, df=20, P=0.358) although there are differences between exclosures overall (GLM, F=2.121, df=20, P=0.05). Overall when looking a vegetation height cover there were significant differences overall at certain vegetation height. Significant differences in vegetation at specific height variables could also be observed when comparing fenced and unfenced plots, exclosures and woods individually, particularly at the 1.5m height variable (Table 5.6). Data on vegetation structure and biomass can be found in Appendix 5.2.

Table 5.6. Differences overall in vegetation cover at height increments from 0.1 to 2m above ground level (GLM).

Vegetation height (m)	Overall	Between woodlands	Between exclosures	Between fenced an unfenced plots
0.1	F=5.271, df=14, P=0	F=6.172, df=11, P=0	F=1.876, df=1, P=0.172	F=0.323, df=1, P=0.328
0.2	F=3.24, df=14, P=0	F=3.785, df=11, P=0	F=0.708, df=1, P=0.401	F=1.209, df=1, P=0.273
0.3	F=5.762. df=14, P=0	F=7.083, df=11, P=0	F=0.004, df=1, P=0.949	F=2.445, df=1, P=0.120
0.4	F=4.152, df=14, P=0	F=4.897, df=11, P=0	F=0.951, df=1, P=0.331	F=0.481, df=1, P=0.489
0.5	F=4.985, df=14, P=0	F=6.299, df=11, P=0	F=0.015, df=1, P=0.903	F=0.020, df=1, P=0.887
0.6	F=1.903, df=14, P=0.280	*F=2.145, df=11, P=0.019*	F=0.266, df=1, P=0.607	F=2.464, df=1, P=0.118
0.7	F=2.216, df=14, P=0.090	F=1.763, df=11, P=0.063	F=0.906, df=1, P=0.342	*F=9.566, df=1, P=0.002*
0.8	F=3.257, df=14, P=0	F=4.076, df=11, P=0	F=0.000, df=1, P=0.990	F=0.659, df=1, P=0.418
0.9	F=4.049, df=14, P=0	F=4.594, df=11, P=0	F=2.275, df=1, P=0.133	*F=4.748, df=1, P=0.031*
1.0	F=4.581, df=14, P=0	F=4.655, df=11, P=0	*F=4.426, df=1, P=0.037*	*F=9.384, df=1, P=0.02*
1.1	*F=2.727, df=14, P=0.001*	*F=3.047, df=11, P=0.01*	F=0.029, df=1, P=0.864	F=4.325, df=1, P=0.39
1.2	F=5.271, df=14, P=0	F=3.997, df=11, P=0	F=2.368, df=1, P=0.126	F=1.177, df=1, P=0.279
1.3	F=5.271, df=14, P=0	*F=3.071, df=11, P=0.01*	F=13.335, df=1, P=0.000	F=0.665, df=1, P=0.416
1.4	F=5.271, df=14, P=0	F=3.316, df=11, P=0	F=8.345, df=1, P=0.004	F=0.012, df=1, P=0.915
1.5	*F=2.71, df=14, P=0.001*	*F=2.710, df=11, P=0.003*	*F=2.687, df=1, P=0.103*	*F=3.405, df=1, P=0.670*
1.6	F=5.271, df=14, P=0	F=3.737, df=11, P=0	F=0.996, df=1, P=0.319	F=0.320, df=1, P=0.572
1.7	*F=2.569, df=14, P=0.020*	F=3.211, df=11, P=0	F=0.000, df=1, P=0.986	F=0.270, df=1, P=0.604
1.8	F=1.999, df=14, P=0.200	F=2.350, df=11, P=0.10	F=2.125, df=1, P=0.147	F=0.003, df=1, P=0.956
1.9	F=2.069, df=14, P=0.150	*F=2.239, df=11, P=0.014*	F=3.469, df=1, P=0.640	F=0.134, df=1, P=0.715
2.0	*F=2.357, df=14, P=0.05*	*F=2.513, df=11, P=0.06*	*F=4.232, df=1, P=0.041*	F=1.712, df=1, P=0.192

In terms of biomass and dry matter weight of vegetation produced there were no significant differences between fenced and unfenced plots (Paired T-test, t=-10.551, df=69, P(2-tailed)= 0.384) or overall between different woodlands (Figure 5.10). Nantporth had the lowest biomass production and Cwm Oergwm the highest although there were no significant differences in biomass production between these two woodlands (T-test, t=-10.304, df=69, P (2-tailed) =0.272.

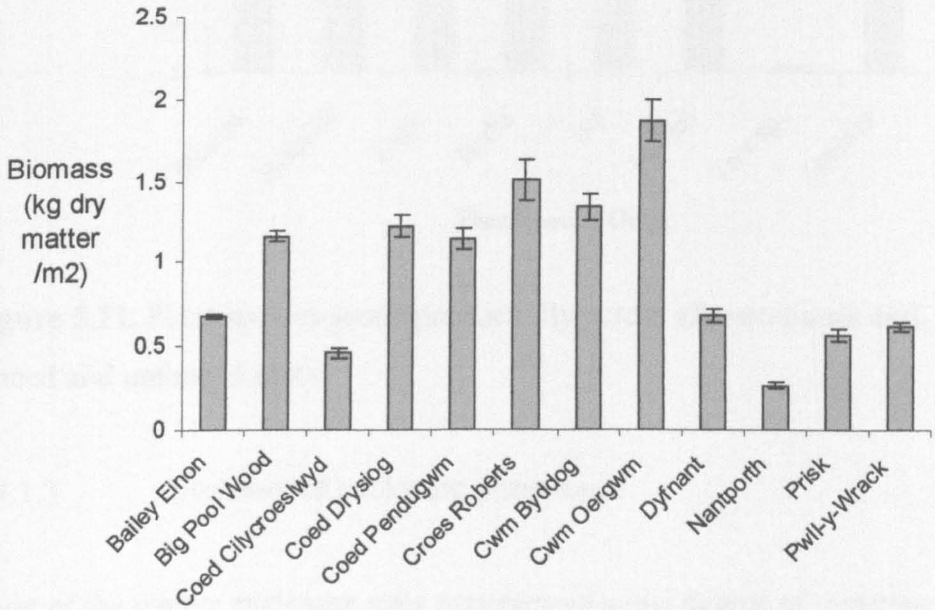


Figure 5.10. Average Biomass production across sites

In terms of variability of different plant species productivity eight different groups were identified (Fig 5.11) and whilst there were no significant differences in biomass productivity between fenced and unfenced plots (Paired T-test, t= -10.304, df=69, P (2-tailed) =0.384) some species groups showed some significant differences. Ivy showed the most difference in productivity between sites overall compared to other plant species groups (GLM F=4.651, df=1, P=0.350). Trees species showed the most difference in productivity between exclosures within woodlands (GLM, F=4.572, df=1, P=0.360). Data for plant species survey, vegetation structure and biomass can be found in Appendix 5.1 and 5.2.

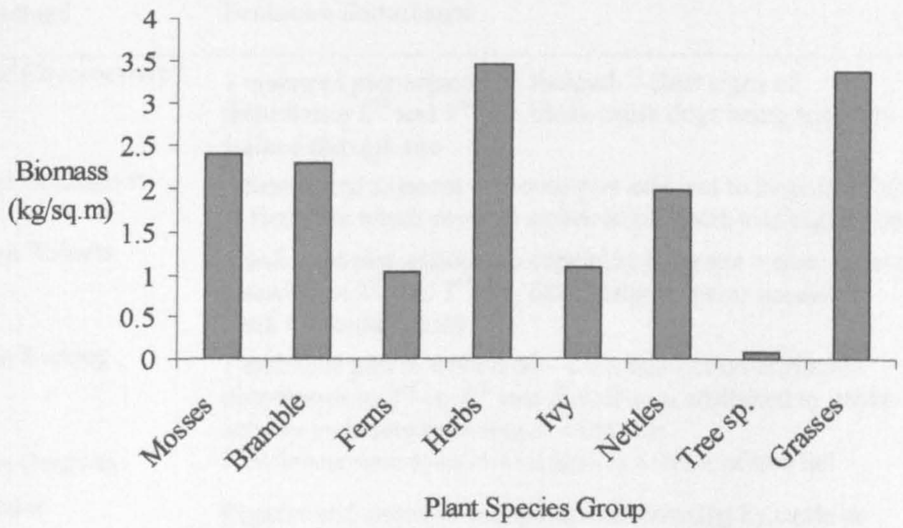


Figure 5.11. Plant species group productivity across all woodlands and fenced and unfenced plots

5.3.1.3 Evidence of exclosure disturbance.

Eight of the twelve exclosure sites experienced some degree of disturbance, primarily in the unfenced plot adjacent to the fenced plot (Table 5.7.). The disturbance ranged from obvious trampling by pedestrians to damage from tree fall and whilst some rabbit and mole activity was noted, there was no disturbance that could be attributed to deer. During the survey period one exclosure was destroyed by tree fall.

Table 5.7. Observed disturbance on experimental exclosures.

Woodland	Exclosure Disturbance
Coed Cilycroeslwyd	1 unfenced plot adjacent to footpath – clear signs of disturbance 2nd and 3rd yr – likely cause dogs being regularly walked through site
Coed Pendugwm	1 fenced and adjacent unfenced plot adjacent to large tree fall in first year which covered unfenced plot with tree vegetation
Croes Roberts	1 unfenced plot adjacent to coppicing coup site – clear signs of disturbance 2nd and 3rd yr – likely cause persons accessing work on coppice coup.
Cwm Byddog	1 unfenced plot in woodland – clear signs of un-attributed disturbance in 2nd yr, 3rd year disturbance attributed to rabbit activity including browsing in other site
Cwm Oergwm	1 exclosure destroyed in first year as a result of tree fall
Dyfnant	Regular and intensive trampling and browsing by cattle on unfenced plots adjacent to all exclosure with edge effect on vegetation inside fenced plots noted.
Nantporth	1 unfenced plot in woodland - clear signs of un-attributed disturbance in 2nd yr
Prisk	2 unfenced plots in woodland - clear signs of disturbances in 2nd yr, one un-attributed, the second attributed to mole activity
Pwll-y-Wrach	1 unfenced plot adjacent to footpath - clear signs of un-attributable disturbance in 2nd yr.

5.3.2 Site Characteristics

5.3.2.1 Gradient.

Mean gradients of exclosures and woodlands ranged in increasing steepness from level to 1 in 33 up to 1 in 2 (Table 5.8, Figure 5.12). Gradients of woodlands varied between 0 to 1 in 1. Gradients of fenced and unfenced plots varied between 0 to 1 in 3. Exclosure site gradients of more than 1 in 1 (45°) had been excluded during research exclosure location.

Table 5.8. Exclosure and woodland exclosure gradients

Woodland	Gradient	
	Wood	Exclosure
Bailey Einon	1 in 20	1 in 10
		1 in 3
		1 in 4
Big Pool Wood	0	0
		0
		0
Coed Cilycroeslwyd	1 in 4	1 in 10
		1 in 10
		1 in 4
Coed Drysiog	1 in 2	1 in 4
		1 in 4
		1 in 4
Croes Roberts	1 in 3	0
		1 in 20
		1 in 20
Cwm Byddog	1 in 4	1 in 50
		0
		1 in 50
cwm oergwm	1 in 1	1 in 3
		1 in 3
		1 in 3
Dyfnant	1 in 8	1 in 20
		1 in 8
		1 in 20
Nantporth	1 in 1	1 in 3
		1 in 3
		1 in 3
Pendugwm	1 in 3	1 in 5
		0
		1 in 8
Prisk	1 in 3	1 in 10
		1 in 8
		1 in 8
Pwll-y-Wrach	1 in 3	1 in 4
		1 in 10
		1 in 4

There were no significant differences in slope gradients between plots (T-test, $t=3.568$, $df=35$, $P=0.945$) or between woodlands (GLM, $F=0.96$, $df=1$, $P=0.759$).

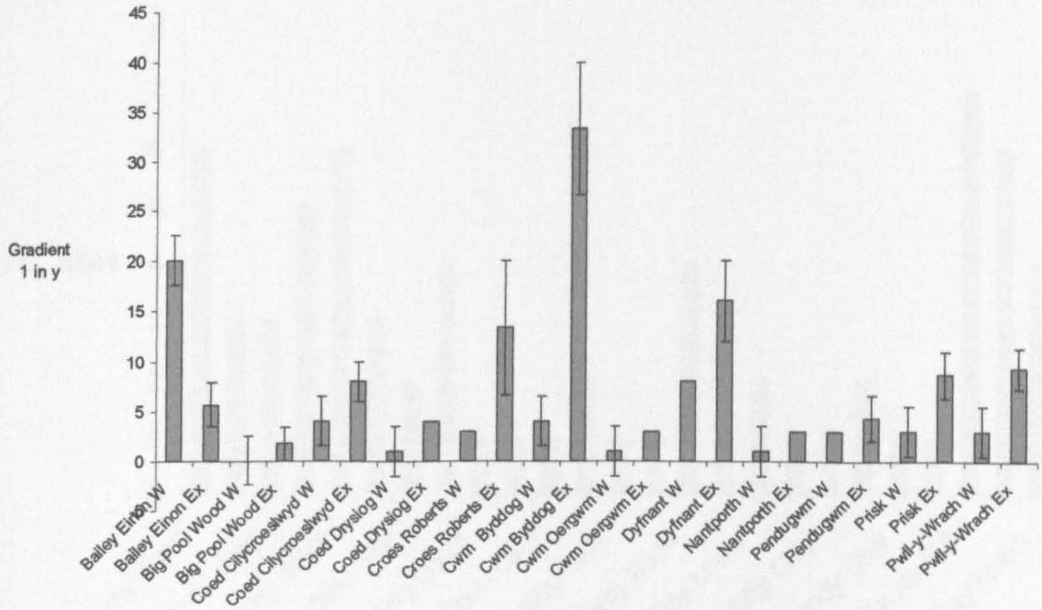


Figure 5.12. Exclosure and woodland site gradients

Data for exclosure and woodland gradients can be found at Appendix 5.3.

5.3.2.2 Soil Properties

Twenty-six different soil classifications were identified with the most frequent soil types occurring being brown sandy soils (Figure 5.13.). Red/brown silty soils also occurred in some areas. There was no significant differences in soil types between fenced and unfenced plots (GLM F=1.614, df=1, P=0.209), between exlcoures (GLM F=2.143, df=1, P=0.148) or between woodlands GLM F=1.434, df=1, P=0.236).

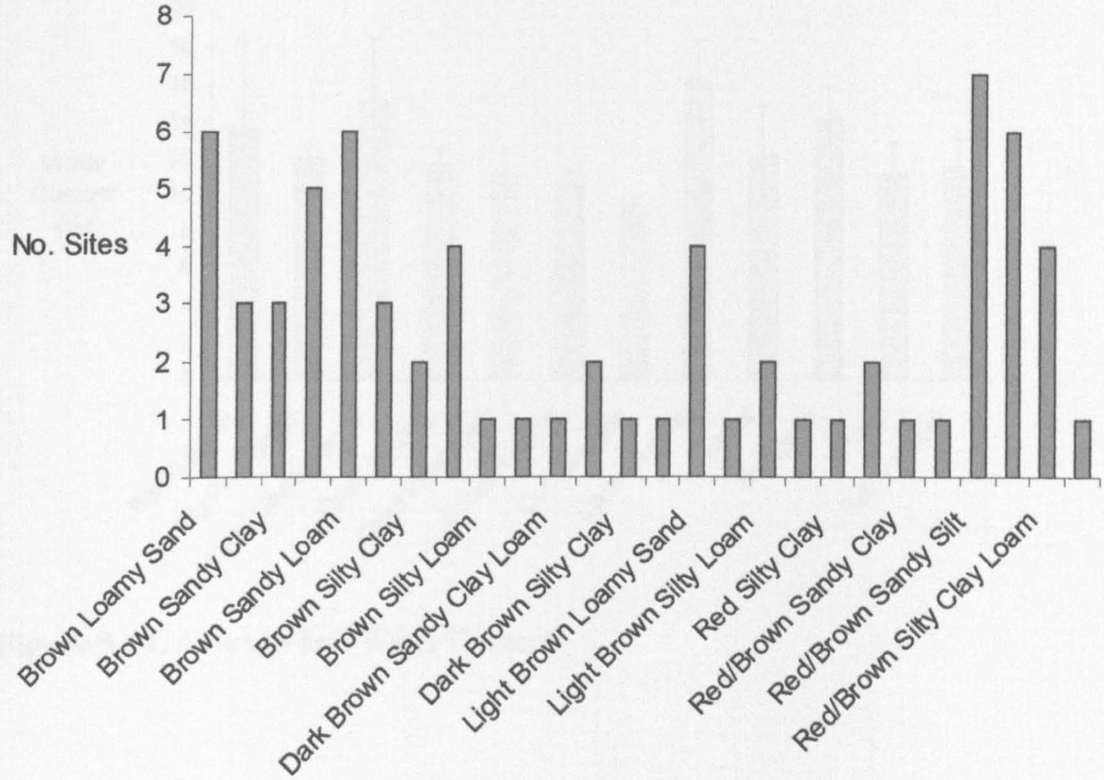


Figure 5.13. Breakdown of soil types identified in research exclosures

Soil water content from samples varied between 5.86% in Pwll-y-Wrach to 37.33% Bailey Einon (Figure 5.14).There was no significant difference in water content between fenced and unfenced plots (Paired T-test t=-16.157, df=69, P (2-tailed) =0.629) or between woodlands (Paired T-test t=-7.318, df=69, P(2-tailed)= 0.937.

Soil pH values from samples varied from 3.94 to 7.8 (Figure 5.15). There were no significant differences between fenced and unfenced plots within woodlands (Paired T-test t=-32.169, df=69, P (2-tailed=0.610) There was a significant difference between woodlands for soil pH (GLM F=4.116, df=1, 0.047). Data for soil analysis can be found at Appendix 5.3.

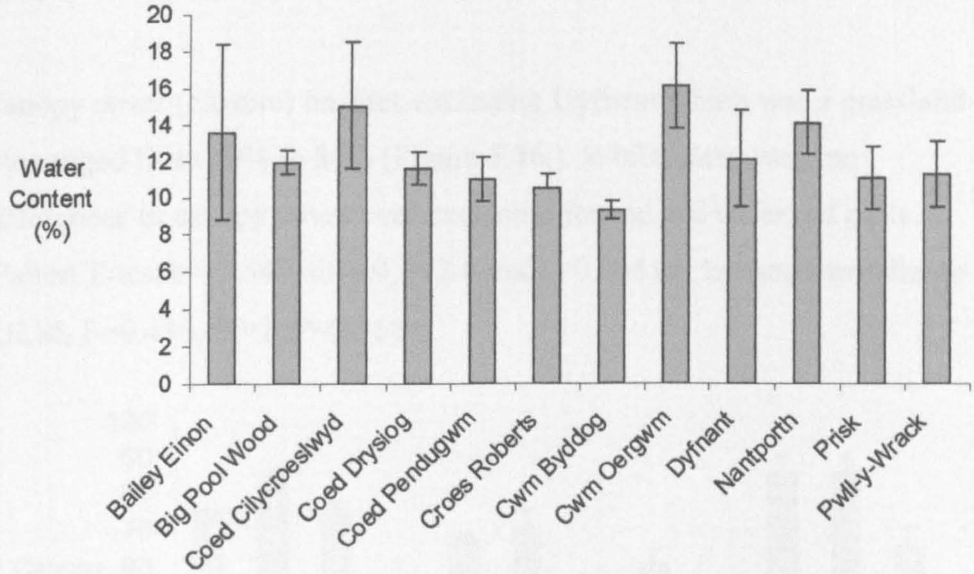


Figure 5.14. Average Soil Water Content

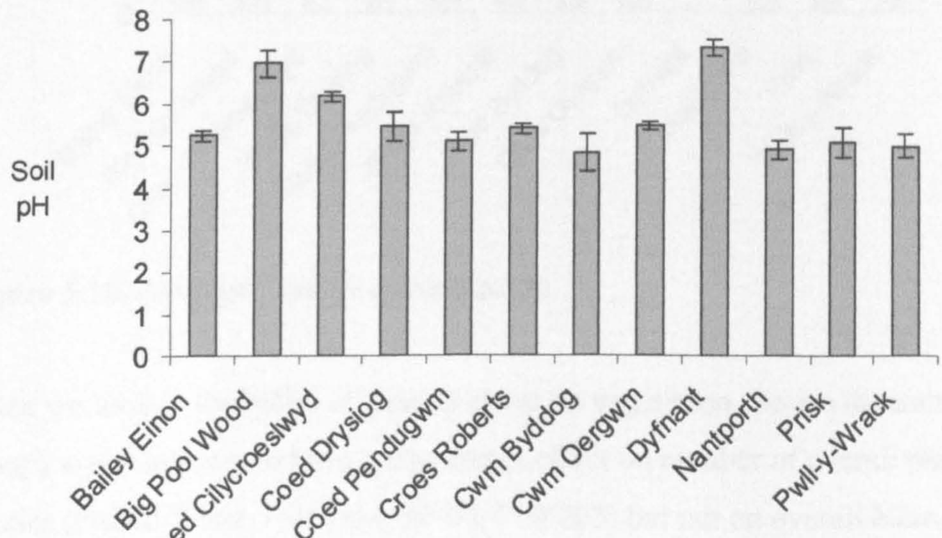


Figure 5.15. Average Soil pH.

5.3.2.3. Canopy cover

Canopy cover (closure) on sites excluding Dyfnant which was a grassland site ranged from 50% to 86% (Figure 5.16.). Whilst there were no differences in canopy cover over exclosure fenced and unfenced plots (Paired T-test t=17.540, df=69, P(2-tailed) =0.446) or between woodlands (GLM, F=0.430, df=1, P=0.514).

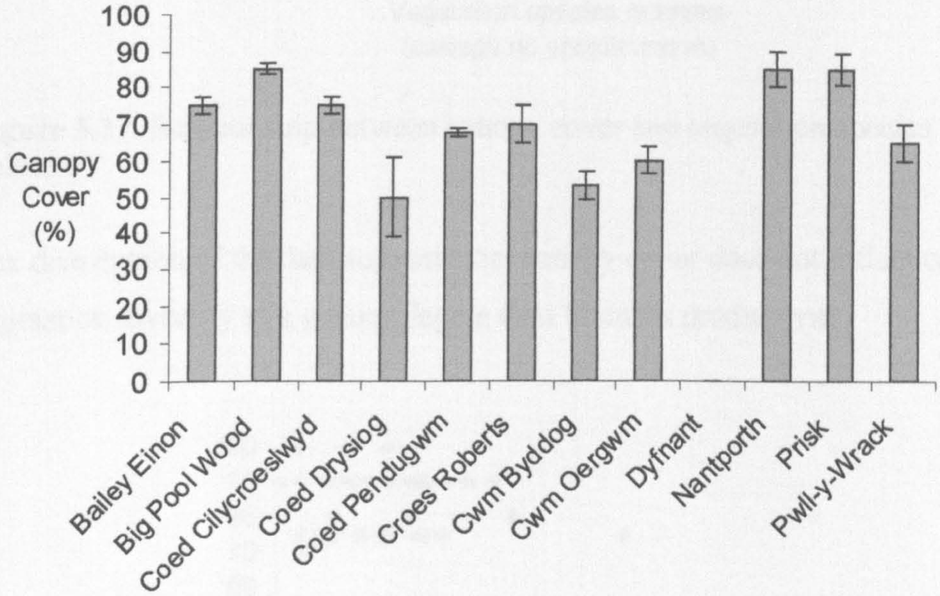


Figure 5.16. Average Canopy cover closure

When we look at the effect of canopy cover on vegetation species diversity, canopy cover appears to have a significant effect on number of overall plant species (Paired T-test, t=16.064, df=69, P=0.005) but not on overall biomass productivity (Paired T-test, t=-9785, df=69, (P = 0.240) (Figures 5.17 and 5.18). When comparing plant species vegetation and canopy the correlation coefficient calculated (-0.270) suggests that there is a weak relationship between increasing canopy cover and decreasing plant species diversity. Data for canopy cover is shown in Appendix 5.4.

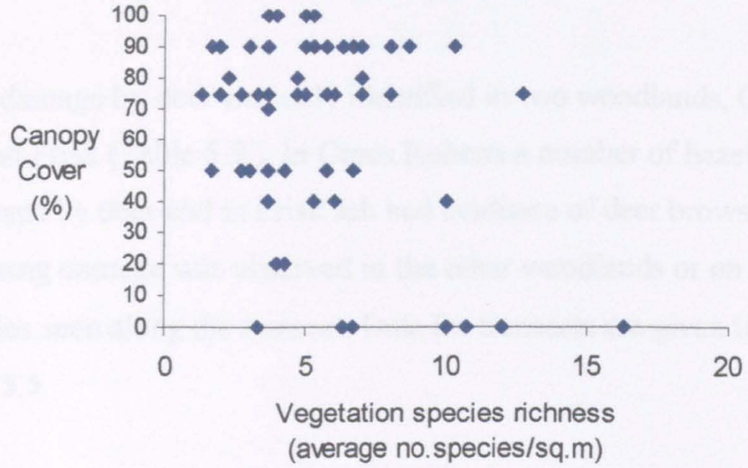


Figure 5.17. Relationship between canopy cover and vegetation species richness

The distribution of the data suggests that canopy cover does not influences vegetation diversity to a greater degree than biomass productivity.

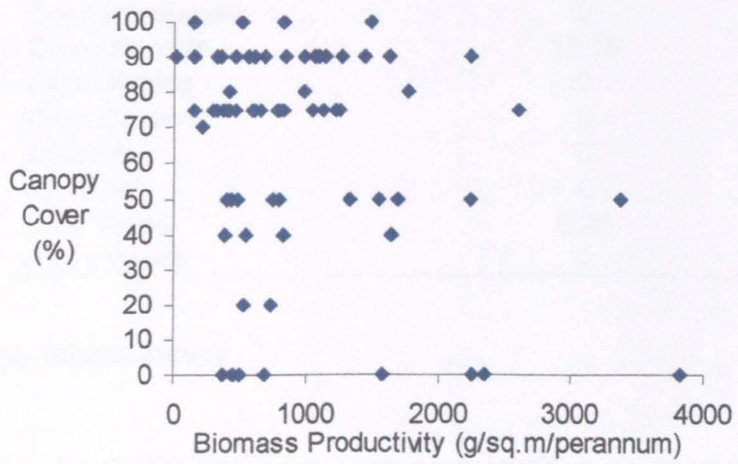


Figure 5.18. Relationship between canopy cover and vegetation biomass productivity.

5.3.3. Woodland Vegetation browsing transect.

Browsing damage by deer was only identified in two woodlands, Croes Roberts and Prisk (Table 5.9.). In Croes Roberts a number of hazel saplings were browsed by deer and in Prisk ash had evidence of deer browsing. No deer browsing damage was observed in the other woodlands or on any other plant species seen along the transect. Data for transects are given in Appendix 5.5.

Table 5.9. Observed browsing damage in each woodland. Damage was assessed by transect methodology.

Woodland	Vegetation browsing damage (%)
Bailey Einon	0
Big Pool Wood	0
Coed Cilycroeslwyd	0
Coed Drysiog	0
Coed Pendugwm	0
Croes Roberts	18.18
Cwm Byddog	0
Cwm Oergwm	0
Dyfnant	0
Nantporth	0
Prisk Wood	6.25
Pwll y Wrach	0

5.3.4 Deer Impact survey

The results indicate that deer have a presence or effect on vegetation in 6 of the twelve woodlands and Cooke scores range from -4/12 and 8/12 (Table 5.10.). Where the score is a negative figure this indicates that the woodland structure itself is also having a negative effect on vegetation such as the effects of shading on plant regeneration levels. In six out of 12 of the woodlands the Cooke score was negative indicating that the presence of deer and their activity may have had less of an impact on the woodland than other internal factors such as canopy cover and natural regeneration as well as management related issues. Data can be found at Appendix 5.6.

Table 5.10. Cooke scores for research woodlands.

Woodland	Cooke Score
Bailey Einon	3
Big Pool Wood	-1
Coed Cilycroeslwyd	-3
Coed Drysiog	1
Coed Pendugwm	2
Croes Roberts	8
Cwm Byddog	-4
Cwm Oergwm	-3
Dyfnant	-1
Nantporth	-3
Prisk Wood	4
Pwll y Wrach	2

There was differences between the 12 sites in terms of Cooke score with those in south Wales appearing to have a higher cooke score than those in mid Wales with North Wales having the lowest cooke scores overall. This could suggest that south wales is currently being impacted by deer, in mid wales the impact of deer is minimal but lower than in areas of higher deer abundance. In North Wales the cooke scores are not only low but negative suggesting that site characteristics such as dense canopy cover and lack of intervention is the main influence on plant species diversity compared to other sites with deer present.

5.4 Discussion

5.4.1 Experimental methodology.

5.4.1.1. Use of exclosures as a browsing research methodology

One of the objectives of this study was to assess the efficacy of the use of small exclosures to assess browsing impacts alongside other methodologies. The results indicate that whilst there were no significant differences in vegetation diversity between fenced and unfenced plots or between exclosures within woodlands, there were significant differences in exclosures between woodlands. These differences were not due to deer browsing as there were no incidents of deer browsing recorded in the plots, even in woodlands with a known deer presence, and differences were most probably due to site characteristics such as canopy cover. The use of exclosures to assess grazing impacts has been widely used although there has been no formal qualitative or quantitative research done to assess ideal size or structural design (Gill pers com.2004). Statistical analysis and the importance of producing a viable data set to increase sample representation suggests that greater the number and greater the size of the structures the better although different plot sizes were not used in this research from which any conclusions could be drawn.. Comparison of exclosure vegetation with an unfenced plot has been shown to be a useful monitoring method that can determine deer impacts and can also assess the success of any subsequent deer management activities (Koh et al, 1996 and Cooke, 1997).

Assuming increased deer numbers result in increased negative deer impacts (Gill 1992a) and as was suggested in the results of landowner questionnaires reported in chapter 2 the results suggest that currently deer abundance is not high enough to easily enable assessment of their impact at these sites surveyed through the broad use of a relatively low number of small exclosures as browsing impacts are not frequently observed. Previous use of exclosures or quadrat vegetation assessment research indicated that smaller exclosures or quadrat surveys (<5x5m) are potentially of more use in the short term (5-10years) as they can indicate quickly vegetation potential to recover from deer exclusions (Bobek et al, 1979, Brinton 2004). Larger exclosures (>10x10m) are more of a permanent, long-term (>10years) monitoring tool to assess decline or recovery of a site in response to deer management of a known deer population (Kirby 1998, Kraft et al. 2004, Putman 1996, Webster et al, 2005, Virtanen et al, 2002).

An advantage of smaller, more temporary exclosures are that they cost much less to build and maintain than larger more permanent exclosures. In this research exclosures had to be excluded from the research as a result of damage to their structure and as this affects the number of sample sites it could affect statistical power when analysing the results. Whilst there was a high level of exclosure disturbance particularly through human activity (25%) the exclosures themselves had no apparent physical effect on vegetation growth and allowed other small mammals to use the site without interruption which may have affected results. Larger, more accessible exclosures would however allow easier concurrent data recording of other important faunal conservation species such as ground nesting birds (Gill and Fuller, 2007) or invertebrates (Pollard and Cooke 1994) alongside vegetation surveys.

5.4.1.2. Browsing Transect

The browsing transect survey did indicate in some woodlands that there was deer browsing occurring (Croes Roberts and Prisk) and suggested habitat use by deer was such that the exclosures did not provide a true picture of deer impacts within these woodlands as their exclosures did not have any incidents of deer browsing within them. However comparing the methodology with other research suggests that the effectiveness of the method is not just influenced by deer density (Palmer et al.2003) but also requires repeated surveys over time and is best done in conjunctions with other deer impact assessments (Fletcher et al 2001.).

5.4.1.3. Cooke Impact Survey

The Cooke survey allowed each woodland to be assessed in terms of deer habitat use and general impact and in comparison with other deer population assessments used in Chapter 4 recorded the presence of deer in the highest number of woodlands. There is however the need to separate out deer densities and impact assessments where identified for more specific assessment of either population abundance (eg. Faecal pellets analysis) or impact assessment (eg Exclosures). The survey is also very subjective depending on the experience of the surveyor and what would be considered high or low scores will vary although its rapid use would suit initial site visits to determine the next stage of deer and deer impact assessment required if any. The use of different plant species as deer impact indicator species is discussed later.

5.4.1.4. Site Characteristics.

It can be suggested from the lack of significance in the difference between site characteristics that it is not necessary to survey site soil characteristics as a factor when looking at plant species richness as a result of negative deer impacts. There is however a site characteristic that has been shown to significantly influence plant regeneration and this is canopy cover. There is debate as to the most effective method to assess canopy cover or rather canopy closure (Jennings et al, 1999 and Brown et al 2000).

5.4.2. Assessment of deer impact

The overall results suggest that wild deer do not have a significant impact across the selection of woodlands surveyed for this research. It could be suggested from the results of the different impact surveys that deer impact a show regional variation but as there was no difference in impact results between years over the three year data collection period it cannot be suggested that impacts are increasing, decreasing or remain static. Regional differences that occur suggesting higher deer impacts in south wales compared to mid Wales with north wales demonstrating the least deer impact correspond with recent data from CCW (CCW 2009 unpub) where the number of deer impacted Special Areas of Conservation (SAC) are highest in south wales (32) and lowest in mid north Wales (14) although there are localised hotspots (Figure 5.19) and the sites vary in size significantly.

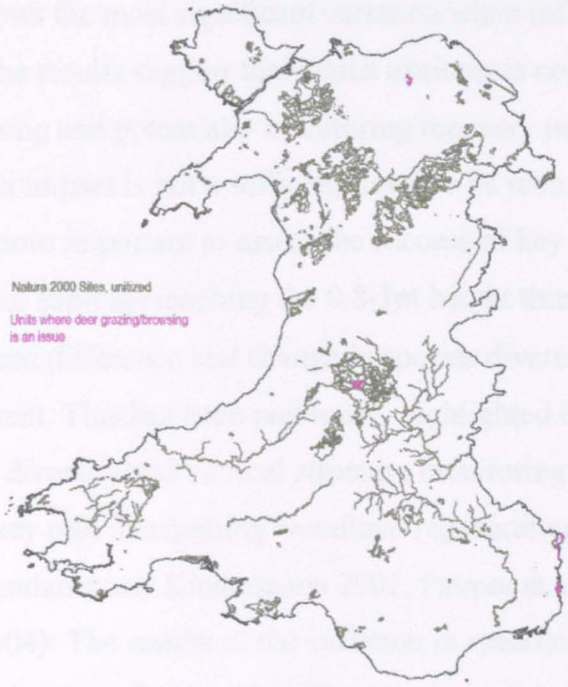


Figure 5.19. Deer Impacted Special Areas of Conservation as recorded by CCW 2009 (CCW unpublished)

Only further monitoring is likely to provide evidence of changes in impacts in the future although trends are not visible over the short term (3 years). The results also suggest that plant species richness in woodlands without deer is as low as in woodlands with high deer densities. Comparisons of a woodland without deer (Cwm Oergwm) and a woodland with deer (Prisk) the results suggest that vegetation diversity is more similar in woodlands without deer compared to woodlands with deer. It is important to recognise that on a number of sites in Wales deer at low levels could be a positive influence on woodland vegetation diversity and productivity.

There were no significant differences in vegetation species richness between the 12 sites surveyed although no woodland demonstrated significant levels of deer damage. Plant species composition of woodland understory vegetation appears to be at its most diverse in the ground layer from the woodland floor up to 1m in height and that it is the mid layer of vegetation at the 1m that shows the most significant variation when influenced by habitat factors. The results suggest that whilst exclosures could be used to assess deer browsing and potentially monitoring recovery in this research deer browsing and impact is not a sufficient level to be recorded using exclosures. It is more important to assess the success of key indicator plant species such as tree saplings reaching the 0.8-1m height threshold where there is a significant difference and change in species diversity above the 1m height increment. This has been previously highlighted in research where vegetation diversity and vertical structure monitoring of tree species in particular is a key tool in assessing woodland regeneration and forest disturbance (Hasendauer and Kindermann 2002, Palmer et al 2001, Onaindia et al. 2004). The results of the variation in specific plant species between woodlands where there were differences between vegetation species and sites showed there to be differences in species composition between woodlands of the same woodland NVC classification. Species such as ash, bramble and dogs mercury which have all be used as indicator species to assess deer browsing all showed significant variation between NVC classifications. Also when looking a the use of indicator species to assess the success of understory regeneration and species diversity and from these results in woodlands classified as similar in woodland vegetation type (e.g. with an understory of Dogs Mercury) can show significant natural variation in abundance of indicator species (Peterken 1974). Species such as Dogs mercury and bluebells have also been used as indicator species to assess deer browsing impact (Cooke 1995, Cooke 1997). The results shown suggest that depending on the indicator species chosen natural variation in plant species abundance across woodlands may not potentially enable the species to be used to as a reliable indicator species for wild deer browsing and suggests that a number of indicator species should be used together.

The difficulties in the use of indicator species and assessment of browsing damage in woodlands subject to an unpredictable deer use are highlighted by the results of the browsing transect survey where the transects results did not record any significant level of deer browsing on any of the woodland sites including those with a higher deer presence. The results suggest that deer presence may have to be above a certain threshold before deer impacts can be detected using transect surveys at the effort expended here. Transect surveys have previously been used successfully to assess deer damage (Bows 1999, Gotmark et al 2005) and vegetation species diversity (Forbis et al 2007).

The variability of plant species diversity and productivity at the ground layer as a result of site based factors must be examined before the influence of deer can be assessed. The relationship between overall woodland canopy cover and plant diversity and biomass productivity has already been discussed and the results indicate the importance of changes in plant species diversity at structural height increments up to 2m. Whilst the relationship between overall woodland canopy cover and vegetation diversity was not found to be statistically significant, as canopy cover reduced, plant biomass productivity increased proportionally. Woodland light profiles have been shown to have a significant influence on under-story plant species composition (Beaudet et al, 2004, Rennie 1995) and recovery from disturbance. Vegetation biomass as an indicator of woodland productivity fluctuates in response to tree cover (Ford and Newbould 1977) and as such the assessment of plant biomass and is its measurement is potentially of a limited use in determining the effect of deer browsing on under-story vegetation.

Site Characteristics

The relationship between canopy cover, vegetation diversity and productivity and ungulate impact has also been highlighted by other research (Barnes 2003, Ishii et al. 2004, Pedersen and Howard 2004, Rennie, 1995) and is an important relationship that can influence woodland management decisions. Soil properties have been shown to affect plant species composition and as a result of this are key features influencing National Vegetation and Ecological Site Classification (Watkins 1995) on which the site can be evaluated in terms of conservation value.

Site characteristics such as soil properties, canopy cover and gradient clearly affect woodland vegetation species diversity. Research has shown (Naaf and Wulf, 2007) that understory vegetation production increases with an increase in canopy gap size and the quantity of light that reaches the ground layer. The influence of herbivores particularly ungulates in these areas has controlled the rate of growth and species composition of the gap vegetation both positively through seed dispersal and low level browsing and negatively through seed dispersal and high level selective browsing. The influence of canopy cover can significantly affect the assessment of ground layer herbivory (Lowman 1995). Woodland canopy cover has been shown to influence deer habitat use significantly in previous research (Cimino and Lovari 2003). The results of this research illustrate that canopy cover affects vegetation productivity and diversity more than any other site characteristic but when deer are present deer influence productivity and diversity more. However the apparent density of wild deer in Wales overall suggests that canopy cover in general currently influences ground flora vegetation growth to a greater extend than deer browsing. It could be suggested that deer presence indirectly increases the influence of site characteristics and canopy cover on vegetation as well as directly through browsing by affecting the long term regeneration of certain plant species types such as oak, ash and sitka spruce (Gill and Beardall 2001). Other site characteristics such as gradient and soil type do not affect in the impact of deer on woodland vegetation significantly and in future research these measurement are not necessary although gradient assessment as part of deer habitat use may indicate if deer show a preference for impact levels related to habitat use.

5.6 Conclusions

From the sites surveyed wild deer do not appear to have a nationally important influence on woodland vegetation biodiversity in woodlands managed for conservation in Wales. Deer also do not currently have a significant presence in woodlands managed for conservation. It is important to note that in many woodlands with no deer, plant species diversity is similar to that in woodlands with deer impacts. This should inform future management decisions by demonstrating that a low level of deer in woodlands managed for conservation is acceptable.

The lack of more specific data on deer distribution in terms of number of deer per hectare does not make it possible at this stage to predict threshold deer numbers that cause significant damage. With future likely changes in the woodland environments through both human intervention and natural succession including as a result of climate change it is also prudent to suggest that changes in physical site conditions will also play a part in the development of deer and woodland interaction.

Survivability of plants at and above the 1m height level such as broadleaf saplings show the greatest response to deer impacts. Monitoring plant species at a lower ground level is more suited to monitoring floral recovery after deer exclusion. Impact assessments can be achieved by using an impact monitoring methodology such as the Cooke scoring or browsing transect assessment. Monitoring the survivability of key woodland species such as tree samplings as they emerge from the herb layer and reach the 1m height also appears to reflect woodland productivity. This is likely to be largely due to there being low deer densities and also specific landscape level use by deer of woodland habitats. Choice of assessment methodology should depend on what information regarding deer is required whether it be habitat use or deer abundance. Availability of monitoring resources is also important as some methodologies take more time and more labour and knowledge of exactly what information is required with regard to the woodland and whether the deer impact is unknown and likely to be in decline or known and being managed and likely to be in recovery. Only a site characteristic such as canopy cover affects vegetation growth in a similar way to deer although other site characteristics such as gradient may provide an indication of habitat use but again this links to what information is required.

The research highlights the need for further investigation in to woodland utilisation by wild deer at a landscape level as this would identify in more details the physical, topographical and behavioural factors that influence deer habitat utilisation and impacts. It would explain why some woodland that at first appear unattractive to deer are subject to severe deer impacts as they are frequented more by deer as they migrate and transit through areas. The research could then inform woodland and deer mangers in the area of woodland design to improve habitat connectivity and where possible reduce deer impacts and improve access to deer for their management if required.

The results of this research provide a sample measurement of the impact of wild deer on a small sample of woodland vegetation biodiversity in woodlands managed for conservation in Wales.

Chapter 6 explores how the likely impact of an evolving deer population could be estimated. The risk assessment methodology examined takes into consideration the factors that affect the likelihood of deer having a negative impact on woodlands for conservation. Using the results of the research in this chapter to identify key components of habitats and deer characteristics a conceptual model to assess the risk of wild deer becoming a problem in woodlands managed for conservation in Wales can be investigated.

CHAPTER 6

RISK ASSESSMENT TO DETERMINE FUTURE IMPACT OF WILD DEER ON BIODIVERSITY IN WOODLANDS MANAGED FOR CONSERVATION

INVESTIGATION INTO THE IMPACT OF WILD DEER ON WOODLAND VEGETATION DIVERSITY IN WOODLANDS MANAGED FOR CONSERVATION IN WALES

6.1 Introduction

In recent years with the ever increasing demand on resources to monitor, assess and manage the impact of animals on the landscape, increasing efforts have been made to model population dynamics and predict changes in deer abundance (Brown 2001, Armstrong et al 2003 and Ward et al. 2004.) By using models to predict future trends areas for further research and development can be identified and in an ideal situation, decisions relating to future management can be made and resourced.

The definition and function of biodiversity is widely debated (Thompson & Starzomski, 2007) and we have discussed the difficulties surrounding determining importance of species and habitat biodiversity and conservation priorities in earlier chapters. There are widespread difficulties measuring and conserving biodiversity (Danielson et al. 2005) but long term monitoring programmes has estimated changes in flora and faunal populations and environmental impact assessments have helped to identify the risks posed to these populations by land management activities. Some floral and faunal populations are monitored as their populations are endangered and they are protected through legislation. With deer impacts it is the reverse. Deer populations in the UK are not endangered and deer abundance and associated damage is increasing to a level in certain areas where the impact on the environment is significant. In order consider the conservation of vegetation biodiversity it is important to consider deer alongside other factors that may affect vegetation biodiversity and the wider environment as well as the factors that influence deer habitat use. In woodlands where the conservation management regime is based on non-intervention the ground flora may be dense and of limited diversity, comprised mainly of dominant species, and the outcome of disturbance by deer may be positive for biodiversity, so the risk (i.e. likelihood of deer being a problem) is not applicable.

The woodland environment is affected by a wide variety of factors, of which browsing herbivores are just one component. Previous discussion in this thesis has considered the influence of woodland type, topography, geology and the climate as well as how human factors influence the woodland landscape. The modelling of the influence of activities such as large herbivorous grazing has enabled a greater understanding of the management of woodlands for conservation (Kirby, 2004).

In 2007, a scoping study assessed that the economic value per annum of the Wildlife in Wales provided a direct output value of £1,426 millions to the Welsh Economy, contributing 2.9% of the Welsh national output (Environment Agency Wales, 2007). The income was outlined as the income provided as an outcome of activities in relation to conservation management, activities dependent on wildlife species and habitats for recreation such as photography and activities indirectly related to wildlife such as education and research. The industry provided employment for 31,766 full time and equivalent people and accounted for 3% of National employment. The gross added value of the industry and its related work was assessed as £894.9 million and provided 2.6% of the income in Wales. The survey did not consider deer or game in terms of their value but it could be suggested that deer are a potential asset to the economy (Conover 1997).

Against this background it is interesting to consider the role of wild deer as a risk factor which could influence the overall value derived from the environment. The remainder of this chapter discusses the assessment of the potential for fallow deer to negatively impacting on vegetation biodiversity and conservation. By assessing deer and their management and examining current ecological and environmental conceptual models we will look to assess the risk of deer having a negative impact on biodiversity in Wales. The assessment outlined in this chapter could then be used to identify the most significant variables affecting the overall risk and establish a scoring system to compare the vulnerability of sites to deer damage. This scoring system can then be used to direct users to features that require research in more detail. This model draws together a number of previously identified features of both habitat and deer that potentially affect the impact of wild deer on vegetation. These features and justification for their inclusion will be discussed later.

6.1.1 Risk and Impact Assessments

There is great debate over the definition of 'Risk', particularly in terms of perception and subsequent measurement (Green 2005) Most recently risk has been interpreted as Hazard multiplied by Exposure where the 'Hazard' is defined as 'the way in which a thing or situation can cause harm' and 'Exposure' is defined as 'the extent to which the likely recipient of the harm can be influenced by the hazard' (Chicken & Posner 1998). The Royal Society views risk in terms of potential and probability 'that a particular adverse event occurs during a stated period of time, or results from a particular challenge' (Royal Society 1983).

6.1.2 Modelling and Assessing Risk and Impacts in Conservation

The ability to predict the increase or decrease in abundance of wildlife populations has been facilitated by more accurate information from monitoring and recording schemes. Population biology, particularly the use of modelling species populations has enabled the identification of trends in species abundance and identifying the effect of management (Kerns and Ager, 2007). Often expert opinion on the presence of a species is divided, in simple terms some believing presence is positive for the ecosystem and some believing presence is negative (Simberloff and Alexander 1998) and as such it is important to balance the effects of a species' presence realistically. Conservation planning relies on a wide variety of measurements to meet criteria set out to evaluate biodiversity. For example, criteria to meet the conservation needs of a specific 'flagship' species can conflict with the criteria to meet the conservation needs of a specific habitat that it is associated with (Simberloff and Alexander 1998). It is often the conflict in prioritising between species and habitat that result in inequalities in conservation planning (Regan et al. 2007) and the selection of priority areas for the development of species or habitat management programmes (Bonn & Gaston, 2004). Figure 6.1 shows an example of a conceptual framework of an integrated ecological-economical model that is currently under research and development at The Centre for Strategic and International Studies (CSIS) in the USA that integrates deer and their management into a landscape management model. This highlights the scope of an ecological model and the complexities of running a land-based model alongside an economic model when considering deer and their impacts. It also highlights the need to understand a complex series of variables and where possible simplify them.

	Harvest Scenario Landscape integrity Harvest method Stand size Landscape	
INPUT	**Ecological Impact** ▪ Land cover, stand boundary and eco-region maps ▪ Landscape context of grid cells and patches ▪ Harvest history ▪ Vegetation composition and structure ▪ Deer distribution ▪ Bird distribution and diversity ▪ Climate factors	**Economic Impact** Market values ▪ Harvesting costs ▪ Wood product prices ▪ Discount rates Non-market Values ▪ Aesthetics ▪ Recreation ▪ Deer and deer impacts ▪ Bird diversity
SUBMODELS	**Ecological Submodel** • Vegetation - Initial vegetation composition and structure across landscape, forest dynamics. • Deer - Functions of local vegetation landscape, regional climate etc. • Birds - Functions of vegetation composition, structure, patch matrices etc	**Economic Submodel** • Market Value Analysis - Patch level budgeting based on forest dynamics, Net Present Value of timber products. • Non-market Evaluation - Association of non-market values with ecosystem attributes at the patch and landscape level. Deer hunting.
SUBMODEL INTEGRATION	▪ Ecological-economic integration (remainder of information between the ecological and economic submodels) ▪ Aggregation processes (scaling from grid cell and patch to landscape level) ▪ Spatial- temporal interactions among grid cells and patches	
OUTPUT	Ecological output (from grid to landscape level) ▪ Land-cover map, forest structure and composition ▪ Species richness ▪ Deer and bird distribution ▪ Deer browse intensity Economic output (patch and landscape level) ▪ Market value and non-market value	
	Applications Hypothesis tests Management Education	

Figure 6.1. Conceptual framework of an integrated ecological model (Centre for Strategic International Studies, Montana, USA, unpub.)

With trends towards the use of digital mapping in spatial data visualisation and interpretation of species abundance it has also been possible to model the effect of landscape variables and these have led to an understanding of habitat connectivity and woodland management requirements at a landscape level to support species conservation including deer (Millington et al. 2010). It is acknowledged that unmanaged grazing by wild ungulates cannot produce the same effect as controlled livestock grazing in certain circumstances and as such cannot be always assumed to be a negative or positive effect on plant species diversity (Kirby, 2004).

6.2. Development of deer impact risk assessments based on a scoring system.

Although computer modelling can provide an effective way of modelling population dynamics and factoring in risk it is only as good as the information that it is input into the model. In this research project a number of methodologies (Chapters 2, 4 and 5) have been used to collect accurate and timely information that can be used to assess and predict future deer abundance and impacts. It is with this in mind and as a result of the research that has been done that a very simple risk assessment scoring template has been outlined. This scoring system can then be used as a tool to determine the risk of a negative deer impact on vegetation in woodland being managed for conservation and the ease with which deer can then be managed to reduce the impact.

6.2.1 Assessment of deer related risk type

There appear to be six key features of a site that should be estimated to assess the risk of deer becoming a significant issue. We cannot limit the issue to impact on biodiversity as deer have influence over a wide variety of landscape types from woodlands to agricultural land and urban areas. Most landowners prioritise the need of the land-use instead of actually looking at the deer themselves as an issue within the landscape. There has been some work done to develop knowledge based systems for deer where a top down' strategy has been used to divide the deer management decision making process into four subtasks evaluating deer population, habitat, social carrying capacity and environmental evaluation (Xie et al. 2001). If we interpret these subtasks in more detail to simplify the assessment we can identify six key features

The key features are:

- Type of adjacent land-use
- Deer presence
- Deer activity (habitat use and measurable impact)
- Level of land management activities
- Level of deer management activities
- Stakeholder Interest

The selection of these features is also supported by practical experience previous research on the factors affecting deer impacts that we have previously discussed in chapter 1 and have also been highlighted by research in Wales in Chapters 2 to 5. We will discuss the features selected in more detail later in this chapter. The influence of physical site characteristics in terms of their effect on the impact of wild deer on woodlands managed for conservation are long term influences and any changes are reflected in terms of evolution of woodland and species types. Physical geological site characteristics as a factor influencing deer impacts in this system are being excluded as results reported in chapter 6 suggest that site characteristics such as soil type do not influence deer impacts significantly although canopy cover can effect regeneration alongside deer. Topography can also influence deer habitat use and subsequent impact but this is reflected in the inclusion of deer activity as a risk measurement. However as deer habitat use and deer impacts are incorporated into deer activity there is no need to include a separate landscape characteristics category that would consider the influence of topography as a factor affecting deer impacts.

Within each feature it is possible to score and weight the risk of deer as 'an issue of importance'. In this case the risk of deer is assessed as the risk of wild deer impacting negatively on the biodiversity of woodland vegetation in woodlands managed in Wales. The maximum and minimum risk scores and risk categories are outlined in further detail later. Whilst in this chapter we will use six feature categories affecting risk these factors in themselves could be added to or broken down into more complex features. However, it is important not to focus on just one feature and its intricacies in order to ensure the risk assessment remains as simple, realistic and user-friendly as possible. In this chapter the risk of deer also requires a timescale (Frankham and Brook 2004) and we will assume that the risk calculated is the risk of deer having a negative impact in the next five years. This timeline is based on the results of work in previous chapters and discussions made regarding the frequency of monitoring deer populations discussed in chapter 1 and highlighted in work by Ward 2005 and Smart et al. 2003). The timescale could be reduced or increased according to size of area and species of deer as individual species habitat use and population dynamics as discussed in chapter 1 may identify the need to adjust the timescale for the risk (Wilson et al. 2009).

Very often perception and knowledge of the landowner are the key factors when reconciling the need for deer management alongside other land management practices (Purdy et al. 1987). Considering deer management in a model to reduce deer damage involves the interpretation of human decision processes in addition to interpreting the physical effect of deer as it is the landowners' management objectives that will ultimately determine at what level if any that deer will be managed. Figure 6.2 illustrates an example of an innovation adoption -process adapted to depict primary variables influencing orchard managers deer control decisions. It illustrates the need to provide evidence to establish accuracy of landowner perceptions and the importance of simplifying the decision process to support the needs of the landowner. The flow chart also highlights the importance of communication at every stage and enabling monitoring, review and revision of the planning-operational cycle to meet changes in the situation. In the scoring system developed in this chapter the use of a specific number of feature categories focus the user on knowledge areas required to enable the user to make informed decisions about which feature is the greatest risk. It also signposts the user to where activities to mitigate deer impact should be focused depending on land management activities. The scoring system can also then be re-run in order to monitor the progress of the activities and changes in deer impacts in order to revise decisions in the future if required. The flow chart also illustrates the stages involved in influencing stakeholder perception of deer and deer management along side the use of practical trials to provide evidence to inform stakeholders'

final management decisions. As more deer management occurs in Wales this could provide further evidence to develop and validate the scoring system in the future.

A decision led process for the deer management planning; the selection and use of deer population assessment techniques and the use of fencing to limit deer damage have been discussed in previous chapters. It is important to note however that there is still a lot of uncertainty when relying on predicted species distribution (Wilson et al 2005). This makes proactive decision making difficult. A greater knowledge of the bigger picture in terms of ecological relationships (and associated policies) increases the likely success of the implementation of different land-use strategies (McCracken and Bignal 1998). Land management strategies and the ecological processes that occur within them both naturally and as a result land manager intervention vary considerably and as we discussed in chapter 1 the variation in land-use policy and conservation strategies are also complex. By increasing the knowledge of significant ecological components such as deer or other flora and fauna and their interaction with the environment increases the evidence base from which decisions can be made to enhance activities the landowner is planning to pursue.

Type of land-use of site and adjacent site land use.

The type of land-use can be given a risk weighting as research has identified deer preferences for land-use type. For example Smith and Mayle (1994) estimated land-use selection by fallow in two sites in Wales. Fallow appeared to have a higher selection for broadleaf woodland (<5yrs old) compared with agricultural land on which livestock grazed. This selection suggests that the risk to broadleaf by deer is greater than to agricultural land and this is supported by the results of research carried out in Chapter 2 where deer were observed to have a greater impact on private forestry in Wales than agriculture.

If the site is of a particular type but surrounded by other habitats of a lesser deer preference the impact is likely to be greater on a site selected by deer and sensitive to deer impacts (Smith and Mayle 1994). Habitat connectivity also increases deer utilisation across an area and may divert deer away or attract deer too more vulnerable areas. This was previously discussed in Chapter 1 in terms of predictive modelling of habitat complexities and the use of spatial modelling to predict landscape use.

The use of models to predict the consequence of change on ecological landscapes in terms of forestry has already been shown to allow decisions to be made in terms of site suitability for woodland restoration or improvements in vegetation to provide connectivity within a landscape (Linden et al 1998). These models can easily integrate the implications of this landscape level land-use change on wildlife species and present the risk of changes in land-use in a clear format such as mapping provided through geographical information systems (McDonald and McDonald 2002) which have been shown to be a very useful tool in the development of conservation strategy maps (Holloway et al. 2003).

Deer Presence

Deer presence and impact as future risk factors that can be relatively easily assessed in terms of identifying current levels and identifying how management decisions may influence their future development and change in importance as a risk factor compared with other categories. In chapter 1 we discussed the increase in deer abundance and that this is likely to increase impacts on vegetation including woodlands (Gill 1992) and agriculture (Putman and Moore 1998). This is supported by more recent evidence in Wales obtained through survey work in chapters 2, 4 and 5. It is however evident that modelling of deer numbers with respect to specific habitats based on local information allows the development of sustainable deer – habitat management plans (Trembley et al. 2004). For conservation purposes models to estimate wildlife habitat use and range are widespread (Kirby 1995, Estrada et al.2008) and could be easily used to investigate the increase in spread of wild deer in Wales if data were available (Symmons 2007, Ward 2007). Under management, deer numbers can now be very effectively modelled (Figure 6.3) with data such as cull data to indicate deer management requirements where deer have become an issue and the population needs to be reduced (Armstrong and Bathgate 2006).

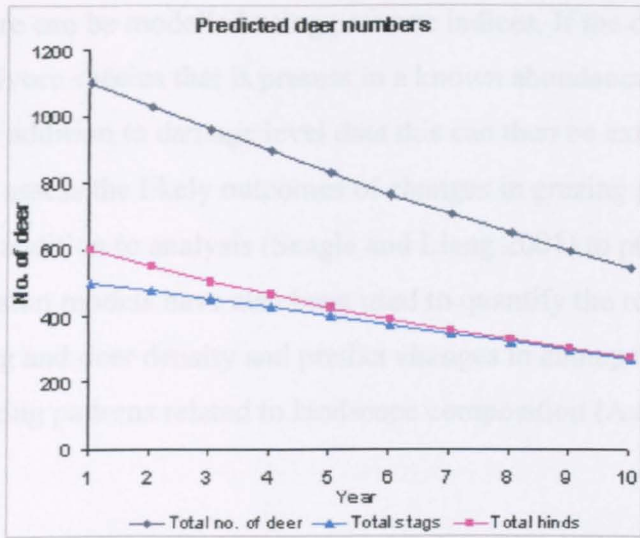


Figure 6.3. Illustration using Forestry Commission Model showing effect of reduction in deer numbers and overall deer population as a result of a cull programme (Armstrong and Bathgate 2006).

Deer Activity and Impact

A key question is: how do the deer utilise the site? If deer do utilise the site at what frequency do they do this? Is it daily, seasonal or occasional? This links to site characteristics (discussed in chapter 3) and can be looked at in isolation from deer presence (chapter 4). Deer activity could be defined as the level of deer related behaviour related to habitat use linked to impacts within a site and can be estimated by a number of indices. Indices of deer activity include presence of trackways, faecal pellets, ground disturbance and browsing damage (Cooke 2007). Occurrence of deer and vehicle collisions near the site could also illustrate deer activity.

Grazing pressure can be modelled using pressure indices. If the duration of use by a large herbivore species that is present in a known abundance in an area can be measured in addition to damage level data this can then be extrapolated and manipulated to assess the likely outcomes of changes in grazing pressure (Pitt et al, 1998). In addition to analysis (Seagle and Liang 2001) to predict browsing damage, regression models have also been used to quantify the relationship between grazing and deer density and predict changes in damage related to changes in grazing patterns related to landscape composition (Augustine & Jordan 1998).

Land Management Activity

Land management activities also affect the risk of deer becoming an issue and whether these are important. For example woodland that is proactively managed for conservation with regular forestry groundwork will be more accessible for deer. It could be debated that a non-managed site without deer disturbance is preferred although most acknowledge that some disturbance from whatever source to woodland is essential to maintain the diversity and defining vegetation features of the ecosystem. Estimating and modelling the cost of deer damage has already been discussed and whilst the value of damage to commercial crops can be easily assessed (White et al.2004, Ward et al, 2004) the number of variables in the model make it difficult to compare areas. There has also been progress in estimating the value of biodiversity where the value of the ecosystem has been established by assessing the use and non-use values of the landscape and integral wildlife components (Edwards and Abivardi 1998).

Activity that is being carried out as part of woodland management also affects the impact of deer as they can influence the habitat use by deer or the importance of the damage to the landowner. Deer are more likely to forage in managed woodland and woodland edges such as along track sides (Alverson et al 1998, Edwards et al 2004) as the under-story vegetation is likely to be less dense and more diverse. If the site is extensively managed deer are also more likely to increase range and movement between sites (Rempel et al. 1997). Spatial models that also assess the movement of deer around the landscape are also available (Brooks 1997, Millington et al. 2010) and could be used to identify hotpots within a landscape where if the land use or habitats changed the likely effects on the movement of the deer population could be predicted.

Deer Management Activity

Deer management activities are clearly an important tool in assessing the risk of deer becoming an issue in the future and the risk is likely to reduce as management increases in effectiveness. Over-management of deer such as complete removal or over-culling of deer on a site creates its own problems. Some work has shown that not only are high culling rates not cost-effective (Latham et al. 1998) but there appears to be a sex bias towards culling males which reduces effectiveness of culling to reduce deer population numbers overall (Xie et al. 1999). Over-culling can increase migration off and on to adjacent sites when culling occurs at a level that reduces the stability of the population (Milner-Guillard et al 200).

Complete exclusion of deer by the use of fences creates problems that we have previously discussed regarding sites with no large mammal disturbance in chapter 1. The use of fencing and total exclusion of deer also creates a high risk of deer becoming a problem on the site if the fence is breached and deer get into the site as future management is usually difficult due to dense ground flora and accessibility for culling. Fencing can also be a risk to the deer themselves and where fencing is wrongly placed it can change the movement of deer through a landscape and potentially put the deer at risk from threats such as deer and vehicle collisions (Feldhamer et al. 1986). Models exist to determine the cost effectiveness of using fencing (Vercauteren et al. 2006) or other deer management methods and this could be compared to the cost of employing deer managers to cull deer or using other physical methods of deer management.

Risks of deer becoming a problem can be reduced as deer and their impacts are monitored and an effective deer management plan is brought into use that allows deer to co-exist with other woodland activities at a sustainable level. The risk of not carrying out deer management can be established by looking initially at the cost-effectiveness of deer management methods. For a model that is looking at the risk of not doing any deer management alongside using varying degrees of deer management we need to reassess the decisions that lead to this choice. The main reason for the decision to carry out deer management is for economic reasons and this is where managing deer in woodlands becomes difficult as it leads us back to the question of what is the value of biodiversity which was discussed in chapter 1. Research in chapter 2 suggests that perceived deer impact levels play a key role in determining levels of deer management activity so it is therefore important that the risk of ineffective deer management is considered alongside the lack of any deer management activities.

Stakeholder Interests

The last factor that must be considered when looking at the risk of deer becoming an issue and the ease with which deer can be managed sustainably involves the human population and their interaction with the site. Stakeholder interests can vary greatly from the owner with an economic interest to the user with conservation or recreational interests. In particular there appear to be greater conflicts in land management objectives between conservation and other land-use such as forestry (Spash and Hanley 1995, Gotmark 2009). The perception of deer within woodland managed for conservation can vary greatly depending on stakeholder perception and as a result the management of wild deer is influenced through development of opinion and deer and woodland management policy.

It is also necessary to consider the perceived value of deer and deer management to stakeholders in order to assess if their perceptions of the value of deer are likely to influence deer presence and deer management. Deer may be valued as a natural resource that creates income through tourism value or income from stalking and in reverse deer may not be valued as they may be perceived as a pest species causing damage to crops. Cluster analysis has been used to understand and rank deer impacts with regard to landowner/public perception (Leong and Decker 2005) and assess stakeholder perception of the negative impacts of deer (Figure 6.4) and highlights the difficulties in classifying risk categories and levels of risk.

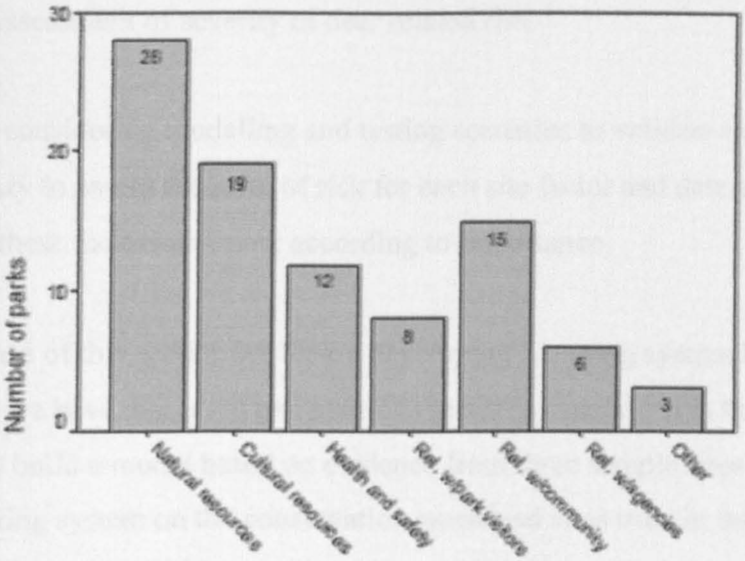


Figure 6.4 Perceived negative impacts from wild deer on national park management from different land management groups (Leong and Decker 2005).

Public perception may be a key deciding factor into initiating deer management in certain scenarios and the choice of deer management options were discussed in more detail in chapter 1. Stakeholders such as commercial foresters who perceive negative deer impacts as the most significant issue related to wild deer often hold very different and opposing views to those of stakeholders who perceive positive impacts of deer as the most important issue. Stakeholder groups such as recreational stalkers and wildlife conservation groups may evaluate deer within the landscape potentially differently, the first group valuing the sporting value and the second valuing the aesthetic and ecological value (Macmillan and Phillip 2008).

6.2.2 Assessment of severity of deer related risk

Before considering modelling and testing scenarios to validate the model it is necessary to assess the level of risk for each site factor and determine options within these factors and rank according to importance.

In the rest of this section we look a developing a scoring system based on the models we have discussed and previous research carried out in these subject areas to build a model based on evidence from three sample sites. We then test the scoring system on the conservation woodland sites used in the research in chapter 5 and detailed in chapter 4. The risk was scored using numerical values to rank a risk level based on information regarding deer and deer impact that is already available. Zero was assessed as no risk and level of risk increased to a maximum that equated to the number of different risk classifications. The risk of negative deer effects increasing increases as the value and number of variables increases.

Type of Land-Use

The ranking of risk scores in this case (Table 6.1.) is based on there being a greater risk to habitat preferred by deer. In this case evidence for Wales specific habitats is taken from Mayle and Smith (1992).

Table 6.1. Risk scoring of Land-use category.

Feature Category	Risk Score	Notes
Forestry & Woodland	3	• Mature Ancient and Semi-natural woodland relying on natural regeneration to produce high quality timber • Newly planted woodland • Mature conifer
Agriculture Arable/Grassland	2	• Grassland and vulnerable cereal, fruit and vegetable crops
Conservation	1	• Sites that are specifically managed for conservation whether they be forest or grassland. Sites potentially with BAP species or habitat
Urban	0	• Urban areas including brown field sites • Road and rail network including associated soft estate such as verges • Park or community woodland with high public access likely to be within urban areas

Land-use types could be grouped in a wider number of risk categories but however this would increase the bias of the scoring system towards land-use type. By clustering similar groups of land-use type this enables the risk of differing land-use type to be compared against the other risk categories. This grouping of land-use types can be supported by research and practical evidence that identifies land-use potentially as the most important factor that was discussed in Chapter 1 including species habitat and feeding preferences. Differences in deer presence and impact between agriculture and forestry land-use in Wales have also been recorded in the results of work done in previous chapters 2 and 5 which illustrates the importance of different land use types. The land use of the adjacent landscape could also be taken into consideration but in this case adjacent land-use would influence deer abundance and activity locally so it could be suggested that landscape level characteristics of land use that effected deer would be reflected in the deer abundance, deer activity, land management and deer management scores.

Relative Deer Abundance

In this case feature categories were ranked such that the more deer the greater the risk of the likely impact they are likely to have on the site (Table 6.2.). In this assessment deer abundance is as discussed in chapter 4 with low deer abundance being less than 10deer/100ha, medium 10-25deer/100ha and high deer densities being higher than 25 deer/100ha.

Table 6.2. Risk scoring of deer abundance category

Feature Category	Risk Score	Notes
Yes – High or unknown	3	>25deer/100ha or an unknown number of deer. In the worst case scenario the highest risk is that the unknown deer number could be >25deer/100ha
Yes – Medium	2	10-25deer/100ha
Yes – Low	1	1-10deer/100ha
No – No deer present	0	0 deer/100ha

Unknown relative abundance of deer has been ranked with the highest risk score of a high deer density as if there is no data available on which to provide a baseline from which to make deer or land management decisions a risk-averse approach may be most appropriate. This conservative approach may over-estimate risk for some sites. It would be up to the user of the model to define the deer population size that would be assessed as low, medium or high as there is great debate over how many deer can be tolerated on a site (Benner 2000, DeCalesta and Stout

1997). What may be considered a low population density in one area may be considered high in another and the risk of them creating an impact could also vary.

Deer Activity

Here factor features were scored such that the more deer activity the greater the risk of the impact they are likely to have in the future (Table 6.3.).

Table 6.3. Risk scoring for deer activity category.

Feature Category	Risk Score	Notes
Unknown	3	Deer are known to be in the area but there is no evidence of deer movement or deer impacts (either positive or negative)
Yes - High	2	Regular evidence of deer presence and high levels of negative impact
Yes - Medium	1	Occasional evidence of deer presence and negative deer impacts
Yes - Low	0	No or rare evidence of deer presence and no recorded evidence of negative deer impacts

We have scored an unknown level of deer activity in a similar way to knowledge of deer presence as the highest risk as the key to risk minimisation. Activity could be measured in different ways but in this case is we use the 'Cooke Method' we are already using a scoring system to assess deer activity whose results are easily transferable across to this scoring system.

Land Management Activity

In this case the more management activity that occurs on site the more likely the site is likely to become vulnerable to deer impacts (Table 6.4.).

Table 6.4. Risk scoring for land management category.

Feature Category	Risk Score	Notes
Unknown	3	Surveyor does not have access to determine to what extent the site is managed
Yes - High	2	Intensive land management, use of equipment, high user presence on a regular basis
Yes - Medium	1	Regular land management, use of equipment on an occasional basis. This category also includes non intervention strategy as a site that is deliberately not managed has an increased risk of deer impacts occurring and being unrecorded in a similar way to 'Unknown'
Yes - Low	0	Low intensity management on an occasional basis

Management activities such as coppicing or timber harvesting can increase disturbance to deer and encourage migratory behaviour (Linnel and Anderson 1995). Recreational access and associated works are also a land management activity and it has been shown that activities related to this can create stresses on the ecosystem (Getz 1978).

Management is likely to increase access for deer and is likely to include increased areas of natural regeneration of broadleaf species for which deer have shown a positive selection compared with other land-uses. No management activity such as non-intervention removes disturbance effects and the characteristics of the undisturbed woodland may provide a habitat for deer where deer can live without coming into conflict with the management objectives of the site.

Deer Management Activity

If a site is monitored and deer management is carried out the risk of deer becoming a negative influence on the woodland can be minimised (Table 6.5.). The greatest risk for a site is likely to be where no deer management is carried out and there may be none at one extreme which allows deer activity to increase or there may be excessive or incorrect deer management carried out at the other extreme. Deer management activities include not just fencing, culling and other methods discussed in chapter 1 but also monitoring to determine deer presence and impacts. Incorrect or excessive deer management could potentially disturb the stability of the deer population increasing migration and the likely impact of the deer in the woodland and adjacent areas and it is important that factors affecting the efficacy of current and future deer management strategies are understood (Getz 1978, Starfield 1997).

Stakeholder Interests

The effect of stakeholder perceptions and factors that influence decision making are difficult to interpret. As we discussed in chapter 1 commercial land managers growing timber or crops perceive the presence of deer (and the risk they may present to land management objectives) differently to non commercial land managers such as conservationists as we have previously discussed in chapter 1. High public access whether for recreation or management purposes may increase deer disturbance and where deer abundance is higher there is an increased likelihood of deer causing negative impacts (Table 6.6.). It could also be suggested that there is an assumption that greater public access can also increase the importance of public perception of deer when assessing their impact and future management choices.

Table 6.5. Risk scoring for deer management category.

Feature Category	Risk Score	Notes
Unknown	3	No information is known about this site in terms of deer management activities.
Yes - High	2	A deer problem exists and either there is no deer management or the deer management that is occurring is ineffective
Yes - Medium	1	and Deer management is occurring but there are still negative deer impacts but these have reduced since deer management implemented
Yes - Low	0	A known deer problem exists and as a result of the deer management deer do not have a negative impact

It could also be assumed that not knowing what is occurring on a site with regard to public access creates an increased likelihood of it becoming an issue with regard to deer presence and their impacts as if public do not go on site they are unlikely to know or have any perceptions regarding deer on site. The assumption made in this category is any human activity on site would not affect deer management or land management activity scores and as such is based on recreational use of the site by people not directly involved in management on site.

Table 6.6. Risk scoring of Stakeholder Interests category

Feature Category	Risk Score	Notes
Unknown	3	The surveyor does not know if the site it accessible to the public and it is not known who the ownership is and as such management objectives and perceptions of deer unknown
Yes - High	2	The site has regular and intensive use by the public
Yes - Medium	1	The site has frequent public access
Yes - Low	0	The site has limited occasional public access

6.2.3. Assessment of deer related risk score

As a means to assessing the scoring system if we retrospectively assess the risk of deer becoming an issue in four different scenarios in which the results are predictable by those with an expert opinion on deer who have the knowledge to fill gaps in the assessment, the results illustrate that a multi criteria risk assessment can be developed for land-managers and policy makers. For each example a situation overview is suggested followed by an analysis of the risk for deer in that site. It could be suggested that the score could be based on just one assessment of whether or not deer impacts were tolerable to the landowner or manager but this only identifies the current situation and does not assess the future risk or identify how future risk could be reduced or increased.

A simple risk assessment that does not require complex computer analysis using complex data sets is potentially easier for wider application as it does not go into the complexities of data collection or knowledge of deer. Where the risk highlights an area for further investigation this is the point at which more complex modelling and use of subject matter experts can be introduced to address specific issues.

Whilst the maximum risk score is 18 in reality it would be the responsibility of the site manager, guided by policy and site management objectives, to decide at what level the risk score reached a threshold that was significant enough to instigate action. It is important to define parameters of the scoring system (Pressey & Nicholls 1985) If we assume that in this assessment a value of 0 to 6 would be considered a low risk of deer overall, 7-12 would be considered a medium risk from deer and 13-18 would be considered at a high risk from negative deer impacts. The score at which the risk of deer is considered more than the risk of deer not becoming an issue should be assumed to be mid-point of 9. In this assessment this is the threshold that equals the decision point where a score of 9 or above requires action to mitigate the risk of deer in the future

Example 1. Broadleaf woodland managed for timber.

In this example the site is a lowland broadleaf woodland managed for timber (including extensive hazel coppicing). There has never been an accurate assessment of deer numbers although deer have been regularly seen on site and some deer browsing has been observed. The site is surrounded by grassland grazed by livestock with in a complex of other woodlands and hedgerows. The site is utilised by a small number of the local public through a footpath. This example highlights that the site is likely to be impacted by deer as a result of its woodland type (Table 6.7.). Whilst the site is managed and the manager is aware of the presence of deer and deer activity there is still a high risk from the impact of wild deer in the future.

Table 6. 7. Risk scoring for deer in broadleaf woodland.

Risk Category	Risk Score	Notes
Type of Land-Use	3 (Mixed age broadleaf)	Combination of Mature Ancient and Semi-natural woodland relying on natural regeneration to produce high quality timber and new planted broadleaf scoring 3 Table 6.1
Deer Presence	2	>25deer/100ha scoring 2 from Table 6.2
Deer Activity	2	Regular evidence of deer presence and high levels of negative impact scoring 2 from Table 6.3
Land Management Activities	2	Intensive land management, use of equipment, high user presence on a regular basis scoring 2 from Table 6.4
Deer Management Activities	2	A known deer problem exists and either there is no deer management or the deer management that is occurring is ineffective and there are still negative deer impacts scoring 2 from Table 6.5
Stakeholder Interests	1	The site has frequent public access scoring 1 from Table 6.6
Total Risk Score	12	

A key recommendation for this site would be to carry out an accurate deer impact assessment and implement deer management as required such as the use of coups to protect regeneration of coppice coups and initial culling of low numbers of deer. Additional work could be done to adapt woodland management activities eg reduce intensity of coppicing. If the model was then re-run (Table 6.8) the score would be 9 suggesting that the risk to the woodland posed by deer had been reduced but still exists and any change in the score in the future would key in determining whether further action is required.

Table 6.8. Risk scoring for deer in broadleaf conservation under effective site and deer management.

Risk Category	Risk Score	Notes
Type of Land-Use	3 (Mixed age broadleaf)	No change
Deer Presence	2	No change
Deer Activity	1	Following a more detailed deer presence and impact survey it can be confirmed that A known deer problem exists and deer management is occurring but there are still negative deer impacts but these have reduced since deer management implemented. This moves the score to 1 from Table 6.3
Land Management Activities	1	Following a reduction in coppicing intensity there is now regular land management, use of equipment on an occasional basis reduced the score to 1 from Table 6.4
Deer Management Activities	1	A known deer problem now exists and deer management is occurring but there are still negative deer impacts but these have reduced since deer management implemented reducing score to 1 from Table 6.5
Stakeholder Interests	1	No change
Total Risk Score	9	

The risk could further be reduced with work in the areas of deer management or land management activities sympathetic to deer presence although recommendations made by the deer risk assessor may be rejected by the landowner or manager as reduction in land management activities potentially conflicts with the land owner's objectives so any re-run of the model would need to prioritise land or deer management priorities.

Example 2. Commercial conifer plantation.

Lowland commercial conifer plantation with high deer numbers with high activity. There is deer management in progress. Deer damage is recorded to new plantations and there is no public access. This risk assessment (Table 6.9.) is similar to the first example although it illustrates the reduction in risk of deer impacts when the site is has an effective deer management plan in operation that reduces deer abundance.

Table 6.9. Risk scoring for deer in a commercial conifer plantation.

Risk Category	Risk Score	Notes
Type of Land-Use	3	Combination of mature and newly planted conifer scoring 3 in Table 6.1
Deer Presence	2	>25deer/100ha scoring 2 from Table 6.2
Deer Activity	2	Regular evidence of deer presence and high levels of negative impact scoring 2 from Table 6.3
Land Management Activities	1	Regular land management, use of equipment on an occasional basis from Table 6.4.
Deer Management Activities	0	A known deer problem exists and as a result of the deer management deer do not have a negative impact from Table 6.5
Stakeholder Interests	0	The site has limited occasional public access scoring 0 from Table 6.6
Total Risk Score	11.5	

Example 3. Unmanaged broadleaf woodland.

This site is an isolated lowland mixed broadleaf woodland that is unmanaged with no deer seen by owner on site and with no visible indicators of deer presence (Table 6.10.) There is no public access. In this case which is a common example of many private woodlands in Wales the risk of deer becoming an issue for the woodland is well below the threshold decision point and could tolerate deer presence and activity with current management requirements.

Table 6.10. Risk scoring for deer of isolated unmanaged woodland.

Risk Category	Risk Score	
Type of Land-Use	3	Combination of Mature Ancient and Semi-natural woodland relying on natural regeneration to produce high quality timber and new planted broadleaf scoring 3 in Table 6.1
Deer Abundance	0	0-10deer/100ha scoring 0 in Table 6.2
Deer Activity	0	No or rare evidence of deer presence and no recorded evidence of negative deer impacts scoring 0 in Table 6.3
Land Management Activities	0	Low intensity management on an occasional basis scoring 0 in Table 6.4
Deer Management Activities	0	As a result of effective deer management deer do not have a negative impact scoring 0 in Table 6.5
Stakeholder Interests	0	The site has limited occasional public access scoring 0 from Table 6.6
Total Risk Score	3	

If management objectives were altered (Table 6.11.) and the woodland came into active commercial or conservation management and/or deer were seen on site the likelihood that the risk of deer becoming an issue would increase.

Table 6.11. Risk scoring for deer in isolated broadleaf woodland that comes into management.

Risk Category	Risk Score	
Type of Land-Use	3	Combination of Mature Ancient and Semi-natural woodland relying on natural regeneration to produce high quality timber and new planted broadleaf scoring 3 in Table 6.1
Deer Abundance	3	No knowledge of deer presence on site or in local area is known increasing risk to 3 from Table 6.2
Deer Activity	3	Deer are now known to be in the area but there is no evidence of deer movement or deer impacts (either positive or negative) increasing risk to 3 from Table 6.3
Land Management Activities	1	Regular land management, use of equipment on an occasional basis moves score to 1 from Table 6.4
Deer Management Activities	0	No change
Stakeholder Interests	0	No change
Total Risk Score	10	

Example 4. Lowland Community Parkland.

A lowland amenity parkland or community woodland. Unknown deer numbers but individual deer seen occasionally. The site has no deer management although high levels of management including grassland maintenance. There is a high level of public access as the site is in semi-urban environment. In this case the risk score for deer is considerably lower than threshold value to instigate remedial work (Table 6.12).

Table 6.12. Risk scoring for deer for amenity parkland.

Risk Category	Risk Score	
Type of Land-Use	0	Park or community woodland with high public access likely to be within urban areas scoring 0 from Table 6.1
Deer Abundance	1	10-25deer/100ha scoring 1 from Table 6.2
Deer Activity	0	No or rare evidence of deer presence and no recorded evidence of negative deer impacts scoring 0 in Table 6.3
Land Management Activities	2	Intensive land management, use of equipment, high user presence on a regular basis scoring 2 from Table 6.4
Deer Management Activities	0	A known deer problem exists and as a result of the deer management deer do not have a negative impact scoring 0 in Table 6.5
Stakeholder Interests	2	The site has regular and intensive use by the public
Total Risk Score	5	

If the management of the park were to include a significant restocking of broadleaf woodland and as a result more deer were present the risk score would increase significantly (Table 6.12) and remedial action such as a deer management assessment and an effective deer management plan would be required. The restocking activity may be only intensive in the short term and deer presence and activity changes may take time to occur so in this case it would be useful to consider a time frame for the risk assessment.

Table 6.13. Risk scoring for deer for amenity parkland with actively managed woodland.

Risk Category	Risk Score	
Type of Land-Use	3	Combination of Mature Ancient and Semi-natural woodland relying on natural regeneration to produce high quality timber and new planted broadleaf scoring 3 in Table 6.1
Deer Abundance	3	No knowledge of deer presence on site or in local area is known
Deer Activity	3	Deer are known to be in the area but there is no evidence of deer movement or deer impacts (either positive or negative)
Land Management Activities	2	No change
Deer Management Activities	0	No change
Stakeholder Interests	2	No Change
Total Risk Score	13	

6.3. Results for the risk assessment of wild deer having a significant negative impact on woodlands managed for conservation in Wales.

The four hypothetical scenarios discussed are based on four common scenarios that occur in Wales where deer and deer management advice is sought. In all four of the scenarios that we examined to assess the validity of the model the risk used was from fallow as this is the most common deer species in Wales found to be a potential threat and it is important to consider where appropriate individual deer species separately. In an ideal situation these four scenarios would not have been retrospectively assessed (Suter II 1985) as it is not possible to suggest a timeline within which the factors may influence the scenario which is important to consider when looking at future risk. With further debate regarding the risk involved in each of the factors affecting deer being an issue that must be addressed, the development of a risk assessment at both local landholding and strategic landscape levels could be developed to identify the potential need for future deer management plans. It is essential to determine an end-point for the application of the risk assessment (King 1985) whether it is a date target and or a physical benchmark such as level of regeneration or presence of a particular conservation species.

Having developed a basis for a risk assessment scoring system it is now potentially possible to assess the risk of deer potentially becoming a problem on the 12 field sites considered in Chapters 4 and 5. When undertaking the assessment scores the work carried out to assess deer populations and impacts as part of the research in Chapter 5 have been excluded and scores are based on the current work of the managing Wildlife Trust as outlined during site selection in chapter 3. This allows us to carry out a subjective assessment of the risk of deer to the sites if the research carried out in chapter 5 had not been carried out.

As the field sites are all woodland and the deer species being considered is primarily fallow it is possible to compare risk of deer between different woodland types as discussed previously and recalibrate the land-
consider this. In the assessment of the 12 research sites taking evidence as discussed earlier (including Smith and Mayle 1994) future risk of deer to broadleaf woodland <5yrs can be given as 3, broadleaf woodland >5yrs can be given as 2, conifer woodland<5yrs can be given as 1 and conifer>5yrs can be given as 0. Where the woodland is mixed age an average of the risk scores is used.

Bailey Einon

The output of this model (Table 6.14.) assesses that deer are may present a risk to the site in the future and that this requires action to minimise risk.

Table 6.14. Risk assessment of deer in Bailey Einon.

Risk Category	Risk Score
Type of Land-Use	2.5
Deer Presence	3
Deer Activity	3
Land Management Activities	2
Deer Management Activities	2
Stakeholder Interests	2
Total Risk Score	14.5

The key area to address is the lack of knowledge about deer presence and activity and it should be recommended that the site is regularly monitored for deer presence and impacts and management introduced as necessary. With stakeholder interest such as high visitor usage it is also suggested that visitors to the site are made aware of the likelihood of deer being on site and the impacts they have in order to reduce risk or purpose and methods used to manage deer are not misunderstood.

Big Pool Wood

The output of this model (Table 6.15.) suggests that the likelihood of this site being at risk from deer impacts in the future is low and as a result no further action is recommended with regard to deer on site.

Table 6.16. Risk assessment of deer to Big Pool Wood.

Risk Category	Risk Score
Type of Land-Use	0
Deer Presence	0
Deer Activity	0
Land Management Activities	0
Deer Management Activities	2
Stakeholder Interests	0
Total Risk Score	2

However, it would be prudent to monitor deer activity in the local area and adjacent land-use in order to ensure any developments that could increase the vulnerability of the site to deer were assessed. Currently disturbance on adjacent land, as it is used for horse grazing, might act as a deterrent to deer colonisation.

Coed Cilycroeslwyd

The output of this model suggests that the woodland is at high risk from the impact of wild deer in the future (Table 6.16). Key areas that should be addressed include assessment and monitoring of deer presence and activity in order to inform the landowner of development of deer population on site.

Table 6.16. Risk assessment of deer to Coed Cilycroeslwyd.

Risk Category	Risk Score
Type of Land-Use	2
Deer Presence	3
Deer Activity	3
Land Management Activities	0
Deer Management Activities	2
Stakeholder Interests	2
Total Risk Score	12

The risk of deer becoming a factor will also increase if woodland management on site is increased as indicated by the increase in glade clearance on site.

Coed Drysiog

The output from this model (Table 6.17) highlights that the risk of the woodland to wild deer requires addressing by introducing a monitoring programme to assess deer presence and activity. Monitoring will reduce the risk of deer in the future as early indications of deer presence will allow impacts to be minimised through deer management and potentially a reduction in deer abundance.

Table 6.17. Risk assessment of deer to Coed Drysiog.

Risk Category	Risk Score
Type of Land-Use	3
Deer Presence	3
Deer Activity	3
Land Management Activities	0
Deer Management Activities	2
Stakeholder Interests	0
Total Risk Score	11

Coed Pendugwm

The output from the model (Table 6.18) indicates that this woodland is at high risk from deer impacts in the future and the key area for remedial work is to establish monitoring and assessment of deer on site and for damage levels to be estimated and deer management activities carried out as required.

Table 6.18. Risk assessment of deer to Coed Pendugwm.

Risk Category	Risk Score
Type of Land-Use	2
Deer Presence	3
Deer Activity	3
Land Management Activities	2
Deer Management Activities	2
Stakeholder Interests	1
Total Risk Score	12

Croes Roberts

The results of this model (Table 6.19.) indicate that the site is at risk from future impacts of wild deer and deer management activities should be increased to reduce deer abundance and activity in the area. Measures to manage deer and reduce deer damage through the use of brash fencing have reduced the risk slightly but more work must be done to reduce deer on site if the current level of coppicing is to continue successfully.

Table 6.19. Risk assessment of deer to Croes Roberts.

Risk Category	Risk Score
Type of Land-Use	3
Deer Presence	2
Deer Activity	2
Land Management Activities	2
Deer Management Activities	2
Stakeholder Interests	1
Total Risk Score	12

Cwm Byddog

The model (Table 6.20) indicates that the woodland is currently at medium risk from deer in the future and that the introduction of deer presence and activity monitoring would greatly reduce the risk.

Table 6.20. Risk assessment of deer to Cwm Byddog.

Risk Category	Risk Score
Type of Land-Use	2
Deer Presence	3
Deer Activity	3
Land Management Activities	1
Deer Management Activities	0
Stakeholder Interests	0
Total Risk Score	11

Cwm Oergwm

The model (Table 6.21.) indicates that the woodland is currently at medium risk from deer in the future and that the introduction of deer presence and activity monitoring would greatly reduce the risk. Similar to the previous woodland Cwm Byddog the lack of knowledge regarding deer presence has increased the risk of the woodland being vulnerable to deer and regular monitoring will reduce this.

Table 6.21. Risk assessment of deer to Cwm Oergwm

Risk Category	Risk Score
Type of Land-Use	3
Deer Presence	3
Deer Activity	3
Land Management Activities	0
Deer Management Activities	0
Stakeholder Interests	0
Total Risk Score	9

Dyfnant Meadows

The model (Table 6.22.) indicates that the woodland is currently at medium risk from deer in the future and that the introduction of deer presence and activity monitoring would greatly reduce the risk. It is however worth noting the presence of cattle on the site brings its own implications and if the site was managed primarily as a grassland as opposed to a woodland site the overall risk of deer would reduce further. Reductions in cattle numbers or increasing deer numbers may increase the likelihood of deer entering site more frequently.

Table 6.22. Risk assessment of deer to Dyfnant Meadows

Risk Category	Risk Score
Type of Land-Use	2
Deer Presence	3
Deer Activity	3
Land Management Activities	2
Deer Management Activities	2
Stakeholder Interests	0
Total Risk Score	10

Nantporth

The model (Table 6.23) indicates that the woodland is currently at high risk from deer in the future and that the introduction of deer presence and activity monitoring would greatly reduce the risk. Public access at one end of the site may deter deer activity but there are still areas that could be accessed by deer where they could remain relatively undisturbed.

Table 6.23. Risk assessment of deer to Nantporth.

Risk Category	Risk Score
Type of Land-Use	2.5
Deer Presence	3
Deer Activity	3
Land Management Activities	2
Deer Management Activities	2
Stakeholder Interests	2
Total Risk Score	14.5

Prisk Wood

The results of this model (Table 6.24) indicate that the site is at medium risk from future impacts of wild deer and current deer management activities should be increased to reduce deer presence and activity in the area. The wood is situated with a series of contiguous woodland within the Wye Valley and it is important that the site is considered for deer management at the landscape level due to its position.

Table 6.24. Risk assessment of deer to Prisk Wood.

Risk Category	Risk Score
Type of Land-Use	3
Deer Presence	2
Deer Activity	2
Land Management Activities	0
Deer Management Activities	2
Stakeholder Interests	0
Total Risk Score	9

Pwll-y-Wrack

The results of this model (Table 6.26) indicate that this woodland is at high risk from wild deer in the future and the key area that needs to be introduced is the assessment and monitoring of deer presence and activity in order that a management plan can be introduced in the future when required.

Table 6.25. Risk assessment of deer to Pwll-y-Wrack

Risk Category	Risk Score
Type of Land-Use	2
Deer Presence	3
Deer Activity	3
Land Management Activities	2
Deer Management Activities	2
Stakeholder Interests	2
Total Risk Score	14

6.4. Discussion

It is important that in order to support future deer and the land management activities they affect that any risk assessment includes key factors affecting deer abundance and impact. From experience in the field it is much easier initially to use a basic scoring system such as that on which the 'Cooke' methodology (used in Chapter 5) is based than immediately robustly survey deer numbers. Scoring systems such as these are however open to variation in results between users. There is the potential to develop more complex risk assessment modelling using geographical information systems that can link landscape features with the six factors discussed here. The use of this scoring system at a local level may be limited and be more appropriate for more landscape level strategic assessments or as a basic decision support tool. The reason for the limitations are that variability increases as the number of landholdings and individual landowner management activities vary and deer management activities to manage herding species such as fallow are more effective at a landscape level. Managers with more knowledge of the factors that affect deer impacts may also not feel the need to use such as simple scoring system and require more detailed analysis on which to base deer management decisions.

The assessment also assumes that the six factors are equally important to all deer species in Wales although this is unlikely to be the case. For example research carried out in chapter 2 suggests that agricultural crops in Wales may be more at risk from red deer than muntjac and other research (Cooke 2001) suggests muntjac may be more of a risk to woodlands managed for conservation where they are present compared to other species. The assessment also draws on data collected over a short period of time so the predictions that can be made have only a limited timescale or must be used in more general terms to predict long-term risk with any accuracy. The work by Smith and Mayle (1994) also illustrates that by clustering land-use types to prevent bias in the scoring system towards land-use the complexities of the risk of deer to different land-use types is not fully considered.

Site Land-use Classification risk could be more specifically modelled and could be based around other ecological classification systems such as the NVC Woodland classification system which would look in more depth at specific woodland characteristics and may be important when it comes to assessing risk for different deer species which could potentially affect different woodlands in different ways.

This would only work if the sites were all of a similar type such as woodlands in this case so that the land-use risk category could be adjusted to compare more similar sites. It would also monitor the risk of woodlands increasing in vulnerability to deer impacts as a result of policy change. For example the Woodlands for Wales's strategy supports the conversion of coniferous woodland to broadleaf thus increasing vulnerability of sites to deer impacts. A loss of conservation areas may increase the preference of deer to move into less favourable areas such as amenity and urban areas which could then lead to another set of unique problems with regard to deer impacts.

6.5. Conclusions

There are a wide variety of techniques to establish the current impact of deer populations in a given area and there are also a variety of predictive tools to determine future risk. Through the use of a simple risk scoring system it is potentially possible to guide a landowner of limited deer knowledge towards the areas that must be investigated further that are likely to have the most effect on the likely impact of deer in the future.

If we look at the 12 woodlands managed for conservation across Wales we have studied we can see that there are currently only two sites classified as being at high risk of negative deer impacts, nine are at medium risk and only one is at low risk. Two of the sites classified as medium risk would be reclassified as high risk if they did not already have deer monitoring and management activities ongoing on site. Linking these sites geographically these sites are in mid Wales where information regarding deer abundance, impacts and management is particularly scarce. In order to validate the risk assessments of these woodlands it would have been useful to get input from the landowners to ensure that reducing deer risk does not conflict with land management priorities and in reality this risk assessment should always have landowner input to provide non deer related risk scores including human activity.

A recurring factor in determining the risk of deer becoming a significant impact on woodlands managed for conservation is the level of deer presence and impact and whether there has been a quantitative assessment. Woodland management and adjacent land use also play key roles as this affects disturbance and connectivity of woodland sites in the landscape which influences deer habitat use. In this chapter the risk assessment score calculated for the research woodlands ranks the woodlands in a different order of risk to negative deer impacts than when ranked in comparison for solely deer abundance (chapter 4) or deer impacts (chapter 5). It illustrates that to accurately assess the likely risk of deer on woodlands managed for conservation over a five year period taking deer abundance or deer impacts alone as an assessment of risk is potentially not adequate to predict the vulnerability of woodlands to deer impacts.

In order to minimise the risk of deer becoming a factor affecting the biodiversity in woodlands managed for conservation in Wales key areas of work for managers include the monitoring of sites as they become occupied by deer and then that subsequent woodland and landscape management does not increase the vulnerability of the woodland. It is unlikely that public access will influence the risk of wild deer affecting sites managed for conservation although it could be suggested that educating and informing stakeholders about wild deer and the need for management will assist deer management in the future.

CHAPTER 7

DISCUSSION & CONCLUSIONS

INVESTIGATION INTO THE IMPACT OF WILD DEER ON WOODLAND VEGETATION DIVERSITY IN WOODLANDS MANAGED FOR CONSERVATION IN WALES

7.1. Introduction.

During the research carried out in this thesis the literature review highlighted research into increasing deer populations and associated impacts in the UK and how deer biology and knowledge of deer management techniques enabled the problems associated with negative deer impacts to be mitigated. Information and research into the presence and impact of wild deer in Wales was shown to be limited although evidence from the rest of the UK and other regions such as the US indicated deer impacts are likely to increase with increasing deer abundance and there is a clear need to understand the risks associated with an increasing deer popualtion so that they can be managed satisfactorily.

The practical research element of this thesis investigated the gaps in knowledge regarding the impacts of wild deer in Wales particularly in areas highlighted as being of key importance and these were impacts in agriculture, private forestry and in woodlands managed for conservation. Here we review the methodologies used and the results obtained before drawing a general conclusion into the impacts of wild deer in Wales.

7.2. Experimental methodology

A wide range of techiques were used to establish the abundance and impact of wild deer in this work. In agriculture and private forestry where large survey areas could be covered the most effective techniques involved landowner surveys carried out in person and field work where a variety of deer and vegetation survey techniques were used.

With the landowner questionnaires used in chapter 2 the results were based on landowner perception and a difficulty with this is the validation of results to assess the level of actual damage compared to perceived damage. In order to validate the results site specific impacts surveys could have been carried out to quantify the perceived damage although this would have been time consuming and with one surveyor it would not have been possible to cover the area that the responses from the questionnaires cover. As a result of the format of the questionnaires it was also highlighted that a timescale for landowner observations should be provided in order to put the results in context and enable comparison with later results.

There are a wide variety of methods available to estimate deer abundance and impacts, as discussed in chapters 1, 4 and 5. A number of methodologies did not provide positive deer presence data in areas where deer density is thought to be low, and indicators of deer presence were limited. In the sites surveyed in Wales visual sightings of either deer or signs of their activity appear to currently be the most reliable form of determining deer presence. Intensive deer density estimating techniques such as faecal pellet counts may only be practical in woodlands where deer densities are abovea certain minimum (Daniels 2006, Mayle et al 1999, Smart et al 2003, Smart et al 2004) . At low-density sites a combination of techniques such as visual counts supported by using trackway counts (Bauman et al, 1999) or faecal pellet counts (Guillet et al 1995, Mayle 2000) may be more suitable to measure density and abundance as they use a combination of direct and indirect methods to establish deer numbers.

In terms of estimating impacts of deer the results of the research in chapter 5 suggest that the use of vegetation surveys to assess deer impacts whilst very important in terms of determining the influence of deer on a woodland, were insufficient to reliably measure impacts at the aites studied here. Vegetation surveys are more likely to produce clear results when deer are present at high densities. In this research browsing transect and exclosures surveys did not produce significant evidence of negative deer impacts in the woodlands surveyed even where deer were known to be present and browsing vegetation. The denisties of deer in the woodland surveyed in this research were not high enough to produce evidence of a significant negative deer impacts. The lack of evidence suggests that whislt this may have been as a result of lower deer densities the results also suggest that a larger number of plots and/or of a larger size would increase the likelihood of recording deer impacts in low deer densities areas. In looking at the efficacy of vegetation survey data for deer browsing the use of indicator species (eg.Dogs Mercury for muntjac impact) may show significant natural variation in abundance in fenced and unfenced plots overall but also between woodlands classed in similar woodland National Vegetation Classifications. For NVC Woodland Classification W8 Dogs Mercury is a key indicator species and natural variation may account for differences in plant abundance more than do deer.

7.3. Wild Deer Abundance in Wales

Landowner surveys in addition to field work surveys indicate that wild deer abundance in Wales is increasing. In this research evidence of the five species of wild deer recorded in wales were confirmed (Ward 2005). Landowner surveys indicated that fallow were the most abundant followed by roe, muntjac and then red and red/sika hybrids. Landowner surveys identified the largest number of species and widest range of abundance whilst field work on a small sample of sites enabled the estimation of deer densities in areas where deer were found to be present.

The data obtained and presented in chapters 2 and 4 in 2000 and 2005 through both landowner questionnaires and woodland site surveys suggested that deer abundance was increasing in both number of obervations and number of species observed. Data suggested local variation in the abundance of deer overall and between deer species abundance with south east wales having the highest deer presence and mid wales having the least. Deer abundance in southeast and north wales, which was primarily comprised by fallow, appeared to be static in terms of population growth. In mid wales between 2000 and 2005 deer abundance appeared to be increasing and this area appeared to have a higher roe population.

When estimating deer abundance levels using surveys it is difficult to compare landowner deer sighting reports as it is difficult to assess how accurate the reports are based on the assumed knowledge and experience. Landowner surveys however does provide an indication of the perceived importance of deer compared across differenct land management activites by the level of responses. Agricultural landowners observed few deer and had the least knowledge of deer identification whereas private foresters showed a clear understanding of not just deer identification but also subsequent deer management requirements.

7.4. Impacts of wild deer in Wales

The results of the impact survey work across a sample of woodlands managed for conservation reflect findings in Chapter 2 where the impact of wild deer on agriculture and private forestry were assessed and suggests that whilst there are negative deer impacts in Wales they are not perceived as significant. South Wales currently has a certain degree of negative deer impact as a result of fallow whilst the situation in mid Wales is a developing issue.

The level of deer presence and impacts in woodlands managed for conservation in Wales are lower than those recorded in England where a survey of 162 English National Nature Reserves (Putman 1996), the found that over a quarter (28%) of 155 sites had no deer whereas in this welsh research 67% of sites had no deer although this was a much smaller sample size of 12 reserves. In England only 45% of sites with deer recorded a measurable impact and only 18% of reserve managers believed the current impacts would influence the outcome of management objectives, particularly woodland plant regeneration. In this research less than 17% of sites recorded measurable deer impacts and whilst reserve managers were not questioned on their perception of current and future deer management only one site had any active deer damage mitigation activities suggesting less than 10% of reserve managers believed current impacts would influence the outcome of woodland management.

The negative deer impacts were not perceived as significant and the woodland vegetation surveys in this research illustrated that a managed low increase in deer (or ungulate browsing generally) across woodlands managed for conservation in Wales may potentially improve the vegetation diversity across woodlands. In chapter 6 however, the risk of increasing deer abundance in the future has been discussed at length and highlighted the need for early intervention to reduce or maintain deer at a low level to prevent impacts increasing in the future. Wilson (2003) suggested a threshold deer density of 0.219 fallow/km^2 or 0.486 roe/km^2 over which deer can potentially cause damage. Current deer densities of fallow and roe in Wales (forestry and agriculture combined) are lower at 0.03 fallow/km^2 and 0.008 roe/km^2 respectively suggesting that in the short term deer damage to agriculture and private forestry is unlikely to be an issue nationally. Approximately 70% of English agricultural holdings were estimated to have deer present (Wilson 2003) compared to the 4.3% of surveyed farms in Wales .In trying to assess ideal deer densities for woodlands and conservation Gill suggests that 4-7km^2 is an ideal deer density (Gill 2000).

The impact of fallow does show regional influences on woodlands where they are present in significant numbers. Current deer influence occurs in South Wales; there is an evolving influence occurring in mid Wales and future influences will potentially occur at a later date in north Wales.

7.5 Management of wild deer in Wales

Landowner surveys suggest that deer management in Wales is currently carried out at very low levels and varies between landuse. The most frequently used management technique involves culling deer and occurs most frequently in private forestry. Deer management on agricultural or in woodlands managed for conservation was rare. In conservation woodlands limited use of brash fencing where the brash was a byproduct of woodland management activities was made in areas of relatively high deer impact. Most deer management was carried out in south east wales and results suggest a move from expensive short term mitigation methods such as the use of fencing towards the use of an integrated culling programme which required less landowner investment. Overall deer management expenditure did not appear to be porportional to deer impacts. Private foresters who carried out the majority of deer management appeared to tolerate low levels of deer damage, then introduced expensive mitigation measures such as fencing before adapting to use less expensive methods such as culling. No landowners accepted income from recreational stlkaing as part of their deer management activities.

7.6 Risk of negative deer impacts in the future in Wales.

As the research higlights there are a wide number of variables that can inflence the impact of wild deer on agriculture, private forestry and conservation woodland. Whilst increasing deer sightings implied increasing deer damage, perception of the importance of this by landowners varied. Importance of deer impacts was particularly determined by landuse and the percieved value (either economic or percieved conservation value) of the land holding. In Wales wild deer presence is relatively low and as a result many landowners did not percieve deer as a negative feature. Landowner knowledge about wild deer, their impacts and subsequent management appears to be increasing and a key feature of reducing risk of negative deer impacts appears to be the correct identification of deer presence and then introduction of effective deer management. As landowner experience has developed deer management strategies appear to be coming more complex moving away from mitigation and use of fencing to prevention and use of culling strategies. Landowners particularly in the private forestry sector appear to have a flexible approach to deer management and accept the risk of a low level of deer presence and associated impacts.

The key to minimizing future risk appears to be educating landowners on identification of deer presence, density assessments and understanding of how to identify and quantify negative deer impacts and introduce deer management activities early to ensure the problem does not evolve to a level that is detrimental to the success of the land manager's objectives.

One area that was not investigated during this research were the positive impacts an increasing deer population in Wales could have. From landowner surveys there was an acknowledgement of the importance of deer presence and evidence from the vegetation survey suggests that the presence of deer through their disturbance and low level browsing has potential to improve vegetation diversity in woodlands managed for conservation Wales.

7.7 Conclusions

Wild deer do not currently have a significant negative impact on agriculture, private forestry or the vegetation diversity in woodlands managed for conservation in Wales. Assessing deer impacts can be problematic as in areas where deer populations are low deer activity may be noticable, but measuring deer impacts and assessing its significance may require considerable effort in terms of labour and technique used as perceved damage may not be easily quantifiable through vegetation survey. The results suggest that deer populations are increasing and there is evidence of limited deer impacts in private forestry, agriculture and in woodlands managed for conservation. In Wales relatively high levels of deer presence and impact can be found in the south-east compared to other regions. Whilst mid Wales recorded the lowest levels of deer presence and impacts compared to north Wales it could be suggested from landowner reports and increases in abundance discussed in chapter 1 that mid-Wales is the region where deer impacts are likely to increase more as the deer presence appears to be increasing at a higher rate (particulrly roe deer) compared to other regions. West Wales appeared to have the lowest deer presence and landowner surveys recorded little in terms of damage and there were no woodlands managed for conservation assessed in this region. The abundance and negative impacts of deer in Wales are very much lower than those recorded in many other parts of the UK.

Deer presence through visual counts in the first instance are the most reliable technique for assessing deer relative abundance and these can subsequently be supported by trackway and feacel pellet counts to establish deer population size when the deer population has increased further. Techniques to assess impact can either be indirect or direct. Indirect methods such as landowner surveys whislt providing an indication of impacts relies on landowner perception of what deer damage is and where possible these perceptions should be validated by assessing actual damage through direct impact assessments. The benefit of landowner surveys however is that they can provide a large data set covering a large area at a relatively low investment of resources. Direct assessments such as the use of vegetation surveys provide direct evidence of deer impacts. Techniques such as the use of exclosures, browsing transects or activity scoring all provide an indication of levels of negative deer damage but sufficient replicates relative to local deer density are necessary to reliably measure deer impacts. Activity and impact scoring methods such as the 'Cooke Method' (Cooke 2007) can provide a fast and easy way to assess a site in terms of deer presence and impact although the scoring is open to interpretation as each surveyor has a different set of skills and experience on which to base scores which may cause variation in results. The use of plant indicator species may also be of limited use as natural variation in woodlands classed as similar may create natural differences as opposed to differences in plant species presence as a result of deer impacts. Methods such as browsing transects and exclosures whilst potentially more accurate may not be sited in areas of woodland that deer may utilise and if the deer popualtion is relatively low, and insufficient survey effort is expended deer impacts may not be recorded despite damage across the woodland being casually evident. The use of fenced excloures can provide clear visual and recordable evidence of deer damage but may be more useful as a tool to monitor woodland recovery followin the introduction of structured deer management. It is important to recognise that by assessing deer abundance and or deer impact as to estimate of risk of negative deer impacts in the future does not regonise all the risk factors present and that a wider risk assessment taking into consideration other issues such as landuse type, managment and stakeholder interests are esssential.

Deer abundance and distribution is increasing in Wales. Fallow are the most commonly observed species and the majority of negative deer impacts recorded can be attributed to them, particularly damage to woodlands. Roe have increased in presence and are potentially the species that is likely to cause new damage in the future as fallow population are being managed. Roe damage could be a significant issue for agriculture and woodlands managed for conservation. Red and muntjac deer are relatively scarce and in areas where red and red/sika hybrids occur there is damage to agriculture and forestry locally.

Finally landowners should also be encouraged to understand the benefits and opportunities associated with deer presence and not just the negative issues. The value of deer as part of the landscape both physically and aesthetically are likely to benefit conservation land managers and the commercial value of deer for recreational stalking and venison are likely to benefit agriculture and forestry land managers in the future and this will help to balance the risk of negative deer impacts.

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APPENDICES

Appendix 2.1.
Landowner questionnaire

FARM REF NO.

WDI Wild Deer in Wales Questionnaire

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1. Are deer known to be in the vicinity of your property? Yes ☐ No ☐ Don't know ☐

2. Are deer ever seen on you land? Yes ☐ No ☐ Don't know ☐

If yes, please complete remaining questions. If no or don't know, go to Question 5

3. Please indicate which species of deer have been seen on your land

Species not known ☐ Roe deer ☐ Fallow deer ☐
Muntjac deer ☐ Red deer ☐

If Other, please specify ☐

4. Do the deer cause damage to your land?

	Yes	No	If yes, please give details Eg Fraying, scraping, Damage to fences etc	Estimated Cost of damage in past year (£)
Species not known	☐	☐		
Roe deer	☐	☐		
Fallow deer	☐	☐		
Muntjac deer	☐	☐		
Red deer	☐	☐		
Other	☐	☐		

5. Have you taken any measures to prevent deer gaining access or causing damage Yes ☐ No ☐

If yes, please provide details of measures taken and cost incurred

	Details of measures taken	Estimated cost of measures taken in past year (£)
Wire fencing		
Electric fencing		
Repellants		
Scarers		
Annual Culling		
Occasional Culling		
Other (specify)		

Area of property(ha)......................Area of Woodland..............................
County in which property is located...
Name & Address (Optional)..
Would you like to receive further information from the WDI? Yes/No

County	Total area (ha)	Total woodland area (ha)	Deer observed	Species	Deer Damage Detail	Deer Management Detail	Estimated Economic Cost (£)
2000							
carmarthen	20	20	no	no	no	no	no
carmarthen	40	40	no	no	no	no	no
carmarthen	63	63	yes	fall	y - brows, fray, grazing	y -cull	600 dam
carmarthen	38.5	38.5	no	no	no	no	no
carmarthen	106	106	yes	fall	y - brows	y - cull,	400 dam
carmarthen	75	75	no	no	no	no	no
ceredigion	76	76	no	no	no	no	no
ceredigion	565	30	no	no	no	no	no
ceredigion	50	15	no	no	no	no	no
ceredigion	8	8	no	no	no	no	no
ceredigion	300	300	yes	roe, fall	y - brows	no	no
ceredigion	80	80	no	no	no	no	no
ceredigion	4	4	yes	red	y - brows	y - fence	1.5k dam, 4k mgt
ceredigion	4	4	yes	red	y - brows	y - fence	3.5k dam, 3.7k mgt
clwyd	700	150	no	no	no	no	no
clwyd	5	5	yes	roe	y - brows	no	no
clwyd	25	25	no	no	no	no	no
clwyd	445	73	yes	fall, munt	no	y -occas cull	no
denbigh	1	1	no	no	no	no	no
denbigh	121	30	no	no	no	no	no
denbigh	250	50	yes	fall	no	no	no
denbigh	540	50	yes	roe	no	no	no
denbigh	21	21	no	no	no	no	no
denbigh	1012	186	yes	fall	y - brows	y -cull, guards	10K dam, 6kmgt
denbigh	500	60	no	no	no	no	no
dyfed	22	22	no	no	no	no	no
flintshire	1053	221	no	no	no	no	no
flintshire	400	55	no	no	no	no	no
flintshire	1012	202	yes	fall	no	no	no
gwent	7	7	no	no	no	no	no
gwent	300	300	no	no	no	no	no
gwent	3237	809	yes	fall	no	no	no
gwent	485	66	yes	unok	y - brows	no	no
gwent	2000	300	no	no	no	no	no
gwynedd	700	325	no	no	no	no	no
gwynedd	3	3	no	no	no	no	no

County	Total area (ha)	Total woodland area (ha)	Deer observed	Species	Deer Damage Detail	Deer Management Detail	Estimated Economic Cost (£)
2000(cont.)							
pembs	500	120	no	no	no	no	no
powys	500	100	no	no	no	no	no
powys	158.2	12.8	yes	fall	y - brows	no	0
powys	400	400	no	no	no	no	no
powys	160	80	no	no	no	no	no
powys	1000	300	y	roe	no	no	no
powys	320	320	no	no	no	no	no
powys	750	33	no	no	no	no	no
powys	130	26	no	no	no	no	no
powys	2300	2300	yes	roe, fall	y - brows	no	no
powys	434	434	no	no	no	no	no
powys	330	330	yes	unok	y - fray	no	no
powys	2500	350	yes	fall	y - brows	y - cull, guards	2.5k dam, 2.5kmgt
powys	300	60	no	no	no	no	no
powys	6	6	no	no	no	no	no

County	Total area (ha)	Total woodland area (ha)	Deer observed	Species	Deer Damage Detail	Deer Management Detail	Estimated Economic Cost (£)
2005							
carmarthen	85	85	no	no	no	no	no
carmarthen	30	30	yes	fall	brows, fence damage	y -8 cull	200 dam, 800 mgt
carmarthen	142	142	no	no	no	no	no
carmarthen	70	5	yes	roe and fall	grazing, fence damage	y -culling	500 dam
carmarthen	4	4	no	no	no	no	no
carmarthen	3	1	no	no	no	no	no
carmarthen	1500	1500	yes	fall	0	y culling	no
ceredigion	109	109	no	no	no	no	no
ceredigion	8	8	no	no	no	no	no
ceredigion	4	4	no	no	no	no	no
clwyd	80	80	no	no	no	no	no
conwy	13	13	yes	fall	browsing, fraying	y treeguards	700 dam
conwy	250	50	yes	fall	no	no	no
conwy	120	25	no	no	no	no	no
conwy	500	100	no	no	no	no	no
flin	202	202	no	no	no	no	no
flin	400	55	no	no	no	no	no
flin	17	17	no	no	no	no	no
gwent	127	23	no	no	no	no	no
gwent	1619	415	yes	fal and munt	no	no	no
gwynedd	6	1.5	yes	fall	no	no	no
monmouth	180	180	yes	fall	browsing	y aaprotect, fence tubes	500 dam, 500 mgt
monmouth	1500	300	yes	roe, fall	no	no	no
pembroke	34	24	yes	rshybrid	no	no	no
powys	20	20	no	no	no	no	no
powys	20	20	yes	red	browsing	y culling	300 dam
powys	140	140	no	no	no	no	no
powys	18	18	no	no	no	no	no
powys	44	1	yes	roe	no	no	no
powys	37	28	no	no	no	no	no
powys	16	16	no	no	no	no	no
powys	178	178	no	no	no	no	no
powys	200	15	yes	red	no	no	no
powys	3600	247	no	no	no	no	no
powys	6	6	no	no	no	no	no

County	Total area (ha)	Total woodland area (ha)	Deer observed	Species	Deer Damage Detail	Deer Management Detail	Estimated Economic Cost (£)
2005 (cont.)							
powys	600	600	yes	fall	browsing, fence dam	y electric fencing + cull	1000 dam, 2700 mgt
powys	300	50	no	no	no	no	no
powys	75	75	no	no	no	no	no
powys	160	80	no	no	no	no	no

County Key

52 Flintshire	56 Dyfed	59 Mid Glamorgan	62 Ceredigion
53 Powys	57 Clywd	60 West Glamorgan	63 Pembrokeshire
56 Gwynedd	58 South Glamorgan	61 Gwent	64 Camarthenshire

Farm Ref No.	County	Area (ha)	Woodland Area (ha)	Area Grass or Fodder Crop (ha)	Woodland Area (%)	Deer observed	Species	Deer Damage Details
2000								
11101	52	119.2	2.65	115.34	2.22	no	no	no
11147	56	778.41	1.01	735.37	0.13	no	no	no
11152	56	110.98	4.86	104.9	4.38	no	no	no
11181	55	124.4	1.5	121.4	1.21	no	no	no
11187	53	1014.32	0.41	1012.9	0.04	no	no	no
11190	53	683.84	0	681.81	0	no	no	no
11196	55	245.43	0	243.4	0	no	no	no
11209	52	176.92	5.67	169.63	3.2	no	no	no
11211	53	96.8	0	95.99	0	no	no	no
11218	56	924.39	49.8	872.6	5.39	no	no	no
11222	56	36.46	3.24	32.82	8.87	no	no	no
11236	55	149.36	5.68	130.38	3.8	no	no	no
11240	55	43.74	0	43.34	0	no	no	no
11245	53	32.4	0	31.4	0	no	no	no
11247	53	102.6	0	89.91	0	no	no	no
11248	53	77.56	0	76.34	0	no	no	no
11254	55	122.5	10.13	111.36	8.27	no	no	no
11261	52	310.18	37.97	267.69	12.24	no	no	no
11262	53	196.09	0	190.43	0	no	no	no
11264	53	280.53	0	279.53	0	no	no	no
11270	52	115.9	1.41	113.59	1.22	no	no	no
11271	60	174.3	1.9	82.76	1.09	no	no	no
11272	55	114.49	0	108.82	0	no	no	no
11276	55	128.79	0	107.33	0	no	no	no
11280	52	95.86	1.17	94.24	1.22	no	no	no
11282	53	22.49	0	22.29	0	no	no	no
11283	52	210.3	14.17	195.32	6.74	no	no	no
11287	52	403.31	34.79	367.52	8.63	no	no	no
11288	52	63.18	0.4	62.37	0.63	no	no	no
11289	52	349.6	23.04	326.16	6.59	no	no	no
11293	53	196.56	1.62	190.89	0.82	no	no	no
11295	53	122.35	0	121.54	0	no	no	no
11299	53	266.34	0	242.44	0	no	no	no

Farm Ref No.	County	Area (ha)	Woodland Area (ha)	Area Grass or Fodder Crop (ha)	Woodland Area (%)	Deer observed	Species	Deer Damage Details
2000								
11303	55	108.55	0	105.31	0	no	no	no
11305	53	138.92	1.21	136.49	0.87	no	no	no
11306	52	102.88	4.89	97.58	4.75	no	no	no
11308	55	63.18	0.2	62.57	0.32	no	no	no
11309	55	75.74	0	64.8	0	no	no	no
11317	55	65.05	0	68.65	0	no	no	no
11318	55	114.21	5.67	108.13	4.96	no	no	no
11322	53	766.26	3.24	759.98	0.43	no	no	no
11325	55	114.22	7	106.12	6.13	no	no	no
11330	56	134.74	1.06	132.57	0.79	no	no	no
11335	58	125.55	12.15	111.78	9.68	no	no	no
11338	55	162	10.13	150.66	6.25	no	no	no
11341	53	164.72	0	144.08	0	no	no	no
11342	52	385.16	1.43	382.73	0.37	no	no	no
11346	56	100	0	97.16	0	no	no	no
11347	56	104.46	0	99.2	0	no	no	no
11349	52	64.52	1	63.18	1.55	no	no	no
11352	55	74.12	0	71.69	0	no	no	no
11353	56	75.68	1.22	73.25	1.61	no	no	no
11358	55	79.38	2.03	76.54	2.56	no	no	no
11360	55	46.58	1.22	44.96	2.62	no	no	no
11378	53	289.49	0	260.36	0	no	no	no
11379	52	102.87	10.1	92.37	9.82	no	no	no
11381	52	97.2	0	96.39	0	no	no	no
11384	53	100.04	0	95.58	0	no	no	no
11388	57	107.73	4.05	83.43	3.76	no	no	no
11390	56	142.26	0	139.22	0	no	no	no
11393	52	202	4.82	162.84	2.39	no	no	no
11394	52	303.35	4.05	298.49	1.34	no	no	no
11396	52	125.75	0.4	124.96	0.32	no	no	no
11399	52	94.95	4.7	89.35	4.95	no	no	no
11400	56	67.64	0.81	66.02	1.2	no	no	no
11402	52	214.65	4.05	206.55	1.89	no	no	no
11413	55	36.68	0	36.45	0	no	no	no
11414	55	103.89	4.66	98.62	4.49	no	no	no
11416	62	108.96	19.03	89.93	17.47	no	no	no
11424	58	121.5	3.2	92.9	2.63	no	no	no
11426	55	101.25	0	89.51	0	no	no	no
11430	56	81.71	0.4	65.53	0.49	no	no	no

Farm Ref No.	County	Area (ha)	Woodland Area (ha)	Area Grass or Fodder Crop (ha)	Woodland Area (%)	Deer observed	Species	Deer Damage Details
2000								
11432	55	46.57	2.03	42.52	4.36	no	no	no
11434	53	63.59	0	18.23	0	no	no	no
11438	55	91.93	4.05	87.07	4.41	no	no	no
11439	56	277.02	37.26	171.97	13.45	no	no	no
11445	55	90.3	0.8	68.85	0.89	no	no	no
11446	60	147.42	0.81	128.39	0.55	no	no	no
11450	52	74.12	0.61	72.9	0.82	no	no	no
11452	52	205.34	47.79	156.74	23.27	no	no	no
11454	53	365.72	0.2	365.11	0.05	no	no	no
11455	53	143.78	0	143.37	0	no	no	no
11458	60	48.6	0	48.19	0	no	no	no
11461	52	199.05	12.15	186.49	6.1	no	no	no
11464	55	39.47	1.22	36.91	3.09	no	no	no
11469	53	244.22	0	243	0	no	no	no
11470	53	20.25	0	19.98	0	no	no	no
11472	52	108.99	4.05	77.82	3.72	no	no	no
11480	52	116	0	115	0	no	no	no
11485	52	76.95	4.05	72.5	5.26	no	no	no
11486	52	108	0.45	102.3	0.42	no	no	no
11487	52	264.06	0	263.25	0	no	no	no
11488	52	98.54	0	97.73	0	no	no	no
11496	52	84.01	4	79.01	4.76	no	no	no
11499	53	117.45	0	100.86	0	no	no	no
11504	56	30.170	0.000	29.970	0.000	no	no	no
11505	52	250.7	0	249.89	0	no	no	no
11510	56	40.49	40.49	0	0	no	no	no
11518	56	95.1	12.15	81.74	12.78	no	no	no
11521	52	58.32	0	57.92	0	no	no	no
11527	57	121.5	9.72	102.27	24.66	no	no	no
11531	52	336.15	2.02	332.1	0.6	no	no	no
11532	52	180.16	0	161.95	0	no	no	no
11540	61	149.15	0	148.64	0	no	no	no
11544	55	147	2	95.62	1.36	no	no	no
11546	55	48.6	6.08	42.12	12.51	no	no	no
11547	55	124.37	10.13	53.05	8.15	no	no	no
11549	55	52.65	0.81	51.03	1.54	no	no	no
11550	55	44.55	0.8	43.35	1.8	no	no	no
11551	52	85.45	6.48	78.16	7.58	no	no	no
11555	58	45.18	0	44.78	0	no	no	no

Farm Ref No.	County	Area (ha)	Woodland Area (ha)	Area Grass or Fodder Crop (ha)	Woodland Area (%)	Deer observed	Species	Deer Damage Details
2000								
11558	58	58.8	0	58.4	0	no	no	no
11560	53	72.98	1.21	71.16	1.66	no	no	no
11562	55	34.02	0.41	33.41	1.21	no	no	no
11572	53	68.04	0	50.47	0	no	no	no
11573	52	84.78	3.65	80.32	4.31	no	no	no
11574	52	64.4	0	62.78	0	no	no	no
11575	53	99.19	0.2	98.79	0.2	no	no	no
11576	56	91.93	4.45	34.56	4.84	no	no	no
11579	56	40.8	0	40.39	0	no	no	no
11582	55	150.02	0.42	148.79	0.28	no	no	no
11584	52	74.36	0.1	67.7	0.13	no	no	no
11588	55	122.68	0.3	121.38	0.24	no	no	no
11592	56	123.16	0.61	86.68	0.49	no	no	no
11593	53	152.25	1.62	150.02	1.06	no	no	no
11596	53	85.69	0.61	84.27	0.71	no	no	no
11598	52	46.6	0	44	0	no	no	no
11599	53	117.06	0.2	101.87	0.17	no	no	no
11600	63	64.83	0	64.83	0	no	no	no
11601	60	67	0	66	0	no	no	no
11602	52	41.33	0	41.33	0	yes	unkn	no
11603	55	121.41	1.57	118.84	1.29	no	no	no
11604	53	129.6	4.05	87.07	3.13	no	no	no
11610	60	86.68	0.81	85.06	0.93	no	no	no
11611	60	57.91	1.62	55.89	2.797	no	no	no
11614	55	120.9	0	104.57	0	no	no	no
11618	53	168.82	2.92	165.09	1.73	no	no	no
11625	55	121.4	0.81	118.56	0.67	no	no	no
11628	53	165.64	0	164.83	0	no	no	no
11630	52	129.6	0.6	126.98	3.06	no	no	no
11632	52	86.26	0	86.02	0	no	no	no
11633	52	46.4	1.6	44.39	3.49	no	no	no
11638	52	324.81	12.15	308.61	3.74	no	no	no
11644	58	68.04	5.27	62.37	0.08	yes	unk	no
11646	52	404.19	1.25	399.92	0.31	no	no	no
11657	53	578.85	8.1	569.94	1.39	no	no	no
11658	53	1073.44	23	1050.24	2.14	no	no	no
11661	55	145.8	0	144.99	0	no	no	no
11662	52	50.63	0	48.6	0	no	no	no
11664	52	121.5	0	119.88	0	no	no	no

Farm Ref No.	County	Area (ha)	Woodland Area (ha)	Area Grass or Fodder Crop (ha)	Woodland Area (%)	Deer observed	Species	Deer Damage Details
2000								
11665	52	68.8	1	67.3	1.45	no	no	no
11668	53	305.44	0	303.42	0	no	no	no
11670	52	92.34	1.22	89.09	1.32	no	no	no
11671	55	124.4	1.5	121.4	1.21	no	no	no
11672	55	155.6	0	151.6	0	no	no	no
11673	55	45.36	0	44.91	0	no	no	no
11676	52	81.77	0.52	80.6	0.64	no	no	no
11677	52	134.03	1.57	130.43	1.17	no	no	no
11678	55	151.87	0.2	150.76	0.13	no	no	no
11680	52	247.05	0.2	201.35	0.08	no	no	no
11681	52	106.14	21.97	83.97	20.70	no	no	no
11682	55	130.38	1.6	86.09	1.23	no	no	no
11683	56	42.52	0	42.12	0	no	no	no
11685	52	180.2	0	179.18	0	no	no	no
11687	52	159.18	15.8	142.17	9.92	no	no	no
11688	52	81	0	80	0	no	no	no
11690	52	30.78	0	30.37	0	no	no	no
11691	55	70.8	1.62	68.36	2.29	no	no	no
11695	52	79.38	0.81	78.57	1.02	no	no	no
11695	53	79.38	0.81	77.56	1.02	no	no	no
11697	52	72.9	0	72.7	0	no	no	no
11699	52	139.72	0	139.32	0	no	no	no
11701	52	134.44	6.34	127.6	4.72	no	no	no
11702	55	80.73	1.62	77.9	2.01	no	no	no
11703	53	431.65	0	430.84	0	no	no	no
11705	55	216.67	4.05	168.79	1.87	no	no	no
11706	52	250.2	0	249.79	0	no	no	no
11707	53	213.23	2.43	210.39	0.11	no	no	no
11708	53	253.11	2.83	241.18	1.12	no	no	no
11709	55	210.59	6.07	203.71	2.88	no	no	no
11710	55	137.7	12.96	123.52	9.41	no	no	no
11718	52	157.14	0	147.9	0	no	no	no
11721	52	280.9	0	279.9	0	no	no	no
11723	52	195.05	12.55	181.28	6.43	no	no	no
11725	52	74.32	3.5	69.74	4.71	no	no	no
11727	52	96	6	89.6	6.25	no	no	no
11737	53	358.43	0	357.21	0	no	no	no
11733	52	85.05	2.02	83.03	2.38	no	no	no
11738	53	247.05	0	246.64	0	no	no	no

Farm Ref No.	County	Area (ha)	Woodland Area (ha)	Area Grass or Fodder Crop (ha)	Woodland Area (%)	Deer observed	Species	Deer Damage Details
2000								
11741	55	105.17	0	104.36	0	no	no	no
11742	57	189.4	2.02	101.76	1.07	no	no	no
11743	55	106.09	6.07	76.76	5.72	no	no	no
11745	55	53.86	5.67	46.57	10.53	no	no	no
11746	55	89.91	0	73.08	0	no	no	no
11747	52	167.71	4	162.75	2.39	no	no	no
11748	52	33.01	0.81	31.59	2.45	no	no	no
11749	56	162	0	111.85	0	no	no	no
11751	52	69.34	16.2	52.73	23.36	no	no	no
11753	59	64.2	4.05	59.95	6.31	no	no	no
11759	52	112	0	111.39	0	no	no	no
11760	52	50.63	0.41	45.77	0.81	no	no	no
11762	55	69.65	0	68.84	0	no	no	no
11763	55	171.72	7.29	163.62	4.25	no	no	no
11764	53	49.41	0	49	0	no	no	no
11765	55	37.06	4.05	32.6	10.92	no	no	no
11767	52	151	9.5	141	6.29	no	no	no
11768	52	27.11	0	26.91	0	no	no	no
11769	56	218.25	2.43	213.38	1.11	no	no	no
11772	56	101.25	1.62	98.41	1.6	no	no	no
11774	53	45.43	1.62	43.4	3.57	no	no	no
11776	53	260.98	12.15	244.48	4.66	no	no	no
11777	53	168.8	25.98	126.82	15.39	no	no	no
11778	56	39.99	0	39.53	0	no	no	no
11780	60	90.73	0	90.12	0	no	no	no
11781	56	68.7	0.7	60	1.02	no	no	no
11785	52	173.34	0	167.84	0	no	no	no
11786	52	119.87	13.37	105.69	11.15	no	no	no
11787	52	37.26	0.41	36.44	1.1	no	no	no
11788	53	32	0	29.29	0	no	no	no
11789	53	98.82	0	98.41	0	no	no	no
11792	52	82	5.37	69.22	6.55	no	no	no
11794	55	121.5	0	107.32	0	no	no	no
11795	55	126.76	12	111.12	9.47	no	no	no
11799	56	93.56	0	92.75	0	no	no	no
11800	53	756.89	10.67	745.48	1.41	no	no	no
11803	56	502.75	4.06	497.47	0.81	no	no	no
11805	53	121.91	9.9	110.2	8.12	no	no	no
11806	53	129.6	0	127.98	0	no	no	no

Farm Ref No.	County	Area (ha)	Woodland Area (ha)	Area Grass or Fodder Crop (ha)	Woodland Area (%)	Deer observed	Species	Deer Damage Details
2000								
11808	52	46.58	0	46.17	0	no	no	no
11809	55	236.19	9.12	218.7	3.86	1	unk	no
11810	55	162	0	145.8	0	no	no	no
11812	55	594.72	0	593.22	0	no	no	no
11815	55	130.25	29.83	85.6	22.9	no	no	no
11819	52	221.91	0	135.13	0	no	no	no
11820	56	71.41	0.4	61.31	0.56	no	no	no
11823	60	28.35	4.45	14.58	15.7	no	no	no
11824	52	22.9	0	22.49	0	no	no	no
11826	55	53.46	1.62	51.44	3.03	no	no	no
11828	52	100.05	0	99.85	0	no	no	no
11829	52	41.34	0	40.93	0	no	no	no
11830	56	160.29	0	151.2	0	no	no	no
11831	53	53.86	0	53.46	0	no	no	no
11832	59	107.72	16.2	91.12	15.04	no	no	no
11833	53	254.9	0	232.23	0	no	no	no
11837	56	97.38	0.3	92.97	0.31	no	no	no
11841	55	85.44	11.33	73.71	13.26	no	no	no
11843	56	106.4	0	81.79	0	no	no	no
11844	53	114	1.22	111.56	1.07	no	no	no
11846	55	47.1	0	45.75	0	no	no	no
11848	56	211.2	1.6	208.9	0.76	no	no	no
11849	53	69.6	0	67.9	0	no	no	no
11851	52	70.87	0	70.46	0	no	no	no
11855	55	92.3	12.1	79.4	13.11	no	no	no
11856	56	134.26	1.62	78.42	1.2	no	no	no
11858	52	36.36	0	35.4	0	no	no	no
11861	55	68	0	55.44	0	no	no	no
11865	53	131.5	22.86	102.28	17.38	no	no	no
11866	52	368.55	19.44	305.4	5.27	no	no	no
11867	55	121.5	9.38	110.91	7.72	no	no	no
11868	52	75.74	4.86	70.38	6.42	no	no	no
11869	55	27.74	0	27.33	0	no	no	no
11871	55	82.74	6.48	75.45	7.83	no	no	no
11872	55	73.24	3	39.47	4.09	no	no	no
11874	55	145.79	6.08	138.9	4.17	no	no	no
11875	53	95.99	3.64	91.13	3.79	no	no	no

Farm Ref No.	County	Area (ha)	Woodland Area (ha)	Area Grass or Fodder Crop (ha)	Woodland Area (%)	Deer observed	Species	Deer Damage Details
2000								
11876	52	376.87	10.94	307.39	2.9	no	no	no
11877	53	25.59	0.2	25.19	0.78	no	no	no
11879	52	30.6	0	30.2	0	no	no	no
11881	55	182.25	7.29	174.15	4	no	no	no
11882	53	393.66	16.2	376.65	4.12	no	no	no
11886	55	88	3	84	3.41	no	no	no
11888	53	77.76	0	73.71	0	no	no	no
11889	53	176.07	0	175.26	0	no	no	no
11890	52	150.4	1	149.19	0.66	no	no	no
11891	52	45.73	0	44.11	0	no	no	no
11892	52	59.75	0	56.52	0	no	no	no
11893	55	85.39	0	84.39	0	no	no	no
11897	56	77.76	0	61.76	0	no	no	no
11899	55	136.48	0	111.37	0	no	no	no
11900	52	102.65	0	100.85	0	no	no	no
11901	55	124.34	18.23	84.27	14.66	no	no	no
11902	57	81	0	80.2	0	no	no	no
11904	52	75.5	3	72	3.97	no	no	no
11910	55	118.57	7.69	91.47	6.49	no	no	no
11916	56	60.15	0.61	57.11	1.01	no	no	no
11919	58	89.52	13.34	70.95	14.9	no	no	no
11921	56	89.5	0	89.09	0	no	no	no
11922	56	81.81	2.84	78.16	3.47	no	no	no
11923	56	71.71	0	71.3	0	no	no	no
11924	58	139.96	6.5	133.26	4.64	no	no	no
11926	52	200	0	195	0	no	no	no
11930	52	27.54	0	27.44	0	no	no	no
11932	56	187.92	6.89	179.81	3.67	no	no	no
11934	55	32.4	0	31.99	0	no	no	no
11936	55	24.3	0	23.9	0	no	no	no
11937	58	169.81	0	169.4	0	no	no	no
11938	52	48.58	1.62	46.56	3.33	no	no	no
11940	52	135.9	2.03	130.01	1.49	no	no	no
11941	52	257.18	4.05	252.32	1.57	no	no	no
11944	53	90.11	2.43	86.06	2.7	no	no	no
11945	56	48.6	4	44.3	8.23	no	no	no
11946	53	327.64	0	326.83	0	no	no	no
11948	52	59.95	3.64	55.3	6.07	no	no	no
11950	56	116.1	0	58.32	0	no	no	no

Farm Ref No.	County	Area (ha)	Woodland Area (ha)	Area Grass or Fodder Crop (ha)	Woodland Area (%)	Deer observed	Species	Deer Damage Details
2000								
11954	52	53.85	0	53.45	0	no	no	no
11955	60	98.51	3	95.11	3.04	no	no	no
11959	53	150.5	14.58	135.52	9.69	no	no	no
11960	53	100	15	81	15	no	no	no
11962	56	43.72	0	42.92	0	no	no	no
11963	52	74	5.7	67.5	7.7	no	no	no
11964	52	74.9	1.21	73.29	1.62	no	no	no
11966	60	160.73	6.07	153.85	3.77	no	no	no
11967	52	202.5	4	197.5	1.98	no	no	no
11969	52	22.68	0	22.27	0	no	no	no
11973	53	54.63	0	48.57	0	no	no	no
11974	53	102.94	0	95.46	0	no	no	no
11975	53	165.6	23	141.6	13.89	no	no	no
11976	53	113.22	0.4	112.72	0.35	no	no	no
11977	53	212.96	20.24	192.32	9.5	no	no	no
11979	55	36.22	0	36.02	0	no	no	no
11982	56	111.34	0	105.94	0	no	no	no
11983	56	329.01	1.81	213.32	0.55	no	no	no
11984	56	80	18.21	53.51	22.76	1	Muntjac	no
11985	60	43.32	0.2	40.49	0.46	no	no	no
11986	52	86.34	0	85.94	0	no	no	no
11987	60	100.43	1.62	98.4	1.61	1	unk	no
11990	55	69.67	4.46	65	6.37	no	no	no
11991	52	129.54	5	124.04	3.86	no	no	no
11993	52	164.23	0	163.73	0	no	no	no
11994	52	42	0.5	36.85	1.19	1	unk	no
11997	61	88.4	0.4	86.7	0.45	no	no	no
11998	63	52.59	0.5	52.09	0.95	no	no	no
11999	55	150.98	0.8	149.78	0.53	no	no	no
12001	52	22.68	0	22.48	0	no	no	no
12003	52	86.9	0	85.8	0	no	no	no
12005	52	172.15	0	160.62	0	no	no	no
12006	52	157	0	127.25	0	no	no	no
12008	55	142	1.5	140	1.06	no	no	no
12009	55	68.77	0.5	67.77	0.72	no	no	no
12011	58	31.3	3	28.09	9.58	no	no	no
12012	52	198.24	8.1	187.11	4.09	no	no	no
12012	52	198.24	8.1	187.11	4.09	no	no	no
12017	55	38.48	1.22	25.92	3.17	no	no	no

Farm Ref No.	County	Area (ha)	Woodland Area (ha)	Area Grass or Fodder Crop (ha)	Woodland Area (%)	Deer observed	Species	Deer Damage Details
2000								
12018	55	64.8	0	63.59	0	no	no	no
12018	55	64.8	0	63.59	0	no	no	no
12019	56	94.72	3	90.72	3.17	no	no	no
12020	56	114.96	0	114.55	0	no	no	no
12022	56	139.32	1.62	127.58	1.16	no	no	no
12023	63	87.3	3	83.3	3.44	no	no	no
12024	56	203.3	1.21	187.88	0.59	no	no	no
12025	56	101.03	0	100.03	0	no	no	no
12026	53	40.9	0	40	0	no	no	no
12027	53	23.89	0	23.08	0	no	no	no
12028	56	48.77	0	47.77	0	no	no	no
12029	56	107.39	0	103.82	0	no	no	no
12032	63	75.67	4.86	70.81	6.42	no	no	no
12033	53	75.46	0	74.86	0	no	no	no
12034	52	133.58	0	132.37	0	no	no	no
12035	53	69.56	12.87	55.89	18.5	no	no	no
12036	52	37.63	0	36.23	0	no	no	no
12037	52	433.68	12.07	420.5	2.78	yes	Fallow	800 fence dam
12038	53	70.27	0	70.27	0	no	no	no
12040	56	26.66	0	26.02	0	no	no	no
12041	56	12.14	0	11.74	0	no	no	no
12043	55	30.8	0	29.57	0	no	no	no
12046	55	112.19	0	109.76	0	no	no	no
12048	55	137	13	123.7	9.5	no	no	no
12051	60	119.62	0	68.01	0	no	no	no
12053	52	78.9	4.2	70.2	5.32	no	no	no
12055	52	107.33	5.26	101.27	4.9	no	no	no
12057	55	65.2	0	59.41	0	no	no	no
12058	56	117.45	2.43	114.21	2.07	no	no	no
12065	57	54.67	4.05	50.42	7.41	no	no	no
12066	56	70.42	0.3	69.71	0.43	no	no	no
12067	56	58.68	0	48.16	0	no	no	no
12069	56	334.96	0	333.77	0	no	no	no
12070	56	50.18	0	48.97	0	no	no	no
12071	56	99.55	0.2	98.74	0.2	no	no	no
12074	56	190.26	0	190.16	0	no	no	no
12075	56	174.15	3.24	150.27	1.86	no	no	no
12079	53	45.73	0	45.32	0	no	no	no

Farm Ref No.	County	Area (ha)	Woodland Area (ha)	Area Grass or Fodder Crop (ha)	Woodland Area (%)	Deer observed	Species	Deer Damage Details
2000								
12081	55	31.21	0	30.8	0	no	no	no
12082	53	98.01	0	97.4	0	no	no	no
12083	52	48.5	0	47.5	0	no	no	no
12085	55	68.44	10.12	56.7	14.79	no	no	no
12090	55	59.54	5.67	50.02	9.52	no	no	no
12091	55	130.08	0	130.08	0	no	no	no
12094	58	101.25	8.1	92.34	8	no	no	no
12095	55	79.58	0	74.31	0	no	no	no
12096	52	74.11	2.02	66.85	2.73	no	no	no
12097	60	64.38	0	63.88	0	no	no	no
12098	58	163	8	154	4.91	no	no	no
12102	60	202.5	0.81	199.67	0.4	no	no	no
12103	60	238.95	4.05	232.87	1.69	no	no	no
12104	53	133	0	132.59	0	no	no	no
12105	60	82.5	0	65.3	0	no	no	no
12106	56	22	0	21.59	0	no	no	no
12107	52	150	3	139.22	2	no	no	no
12109	52	101.25	0	100.44	0	no	no	no
12113	55	45.77	4.05	41.11	8.85	no	no	no
12115	55	77.56	0.4	68.85	0.52	no	no	no
12119	53	131.07	8	122.91	6.1	no	no	no
12120	52	142.04	0	141.04	0	no	no	no
12121	52	101.18	0.41	97.93	0.41	no	no	no
12122	52	138	5	131	3.62	no	no	no
12124	55	43.91	0	43.71	0	no	no	no
12125	53	240	4.05	235.14	1.69	no	no	no
12126	53	140.62	1.22	138.99	0.87	no	no	no
12127	56	68.42	12.15	67.22	17.76	no	no	no
12128	55	398.93	7.29	387.18	1.83	no	no	no
12129	52	68.4	0	67.84	0	no	no	no
12130	55	193.55	0	193.35	0	no	no	no
12131	53	123.12	0	121.9	0	no	no	no
12132	53	87.89	6.08	72.95	6.92	no	no	no
12133	53	53.42	0.4	52.58	0.75	no	no	no
12134	55	269.31	10.12	255.14	3.76	no	no	no
12139	53	25.9	0	23.1	0	no	no	no
12140	52	56.98	0	55.98	0	no	no	no
12142	56	74.4	0.81	65.69	1.09	no	no	no
12143	52	72.5	0	70	0	no	no	no

Farm Ref No.	County	Area (ha)	Woodland Area (ha)	Area Grass or Fodder Crop (ha)	Woodland Area (%)	Deer observed	Species	Deer Damage Details
2000								
12144	52	164	6.08	150.23	3.71	no	no	no
12145	60	71.66	1.47	68.69	2.05	no	no	no
12146	53	182.55	0	180.53	0	no	no	no
12148	55	888.98	4.86	878.26	0.55	no	no	no
12149	55	299.46	7.09	291.57	2.37	no	no	no
12150	53	20.88	0	20.61	0	no	no	no
12151	55	67.18	0.8	65.78	1.19	no	no	no
12152	53	93.15	3.24	89.5	3.48	no	no	no
12153	55	54.67	2	51.27	3.66	no	no	no
12154	52	62.37	0	61.96	0	no	no	no
12156	55	60.75	0	60.34	0	no	no	no
12157	52	46.83	0	46.33	0	no	no	no
12159	55	162	0	157.14	0	no	no	no
12160	55	265	0	258	0	no	no	no
12161	55	63	0	62.6	0	no	no	no
12162	55	203.31	0	168.1	0	no	no	no
12164	55	101.2	7.7	85.4	7.61	no	no	no
12165	63	30.24	1	29.03	3.31	no	no	no
12166	55	85.43	5.63	50.47	6.59	no	no	no
12168	55	98.82	1	83.84	1.01	no	no	no
12169	52	56	0	55	0	no	no	no
12170	52	37.46	0.2	36.65	0.54	no	no	no
12171	52	70.97	0	69.74	0	no	no	no
12172	55	32.8	0	32.6	0	no	no	no
12173	55	102.41	2.03	96.74	1.98	no	no	no
12174	56	110	0	108	0	no	no	no
12176	56	94.14	0	64.19	0	no	no	no
12177	55	85.31	4	80.11	4.69	no	no	no
12179	56	83.02	0	82.22	0	no	no	no
12180	55	69.16	0.41	68.65	0.59	no	no	no
12182	52	29.94	1.42	23.6	4.74	no	no	no
12185	55	68.22	4.65	59.27	6.82	no	no	no
12187	62	36.5	1.98	29.99	5.42	no	no	no
12188	55	127.05	3.24	123	2.55	no	no	no
12189	55	116.7	11.3	104.4	9.68	no	no	no
12190	55	48.6	0	48.19	0	no	no	no
12191	55	20.45	0	20.25	0	no	no	no
12192	55	44.53	1.01	42.91	2.27	no	no	no
12193	52	97.2	1.62	95.17	1.67	no	no	no

Farm Ref No.	County	Area (ha)	Woodland Area (ha)	Area Grass or Fodder Crop (ha)	Woodland Area (%)	Deer observed	Species	Deer Damage Details
2000								
12194	52	44.55	0	44.15	0	no	no	no
12195	53	35.61	0	32.78	0	no	no	no
12196	56	296	1	294	0.34	no	no	no
12197	53	108.14	0.41	94.38	0.38	no	no	no
12198	52	290.78	8.1	281.87	2.79	no	no	no
12199	55	77.36	1.22	74.54	1.58	no	no	no
12200	53	152.55	0	151.74	0	no	no	no
12202	53	84.01	0	83.01	0	no	no	no
12203	52	195.62	9.32	185.69	4.76	no	no	no
12204	52	123.99	2.43	121.15	1.96	no	no	no
12205	53	81.41	0.41	81	0.5	no	no	no
12207	53	61.42	0.41	50.23	0.67	no	no	no
12208	52	150.9	0.1	148.9	0.07	no	no	no
12209	52	214.63	1.62	212.6	0.75	no	no	no
12210	56	151.16	5.26	145.09	3.48	no	no	no
12211	55	36.2	0	35.9	0	no	no	no
12212	53	137.14	1.21	134.73	0.88	no	no	no
12213	58	66.66	2.43	61.63	3.65	no	no	no
12214	55	162	0	88.7	0	no	no	no
12215	55	165	0	145.21	0	no	no	no
12216	55	249.13	9.11	228.18	3.66	no	no	no
12218	55	107.33	10.13	93.19	9.44	no	no	no
12219	55	169.69	0	138	0	no	no	no
12221	55	50.4	0	41.7	0	no	no	no
12222	55	69.6	0	63.03	0	no	no	no
12223	55	43.74	3.24	39.69	7.41	no	no	no
12224	52	121.5	0	119.47	0	no	no	no
12225	52	34.43	0	32.4	0	no	no	no
12226	55	68.35	1.38	67.95	2.02	no	no	no
12227	55	71.08	18.23	43.75	25.65	no	no	no
12228	55	54.67	0	49.57	0	no	no	no
12229	55	98.83	7.45	90.65	7.54	no	no	no
12230	55	89.1	4.46	34.42	5.01	no	no	no
12232	55	77.76	2.43	47.32	3.13	no	no	no
12234	55	131.93	1.24	127.48	0.94	no	no	no
12235	56	232.87	4.05	185.47	1.74	no	no	no
12236	52	125.96	0	124.74	0	no	no	no
12237	60	176.05	1.21	171.03	0.69	no	no	no
12238	56	98.9	0.8	97.1	0.81	no	no	no

Farm Ref No.	County	Area (ha)	Woodland Area (ha)	Area Grass or Fodder Crop (ha)	Woodland Area (%)	Deer observed	Species	Deer Damage Details
2000								
12239	53	137.7	1.62	135.27	1.18	no	no	no
12240	52	483	0	480	0	no	no	no
12241	55	128.37	4.05	123.92	3.15	no	no	no
12242	52	81.63	0.28	80.85	0.34	no	no	no
12243	53	83.27	1.24	81.62	1.49	no	no	no
12244	56	145.68	0	130.29	0	no	no	no
12245	55	78.8	3.2	73.68	4.06	no	no	no
12246	56	198.05	1.22	159.12	0.62	no	no	no
12247	55	324.88	1.22	321.23	0.38	no	no	no
12248	53	141.43	1.43	139	1.01	no	no	no
12249	55	67.99	2.43	63.13	3.57	no	no	no
12250	56	62.73	0	62.57	0	no	no	no
12251	56	72.9	10.13	62.67	13.9	no	no	no
12252	55	206.55	0	203.92	0	no	no	no
12253	52	12.96	0	12.76	0	no	no	no
12254	57	119.08	0	104.92	0	no	no	no
12255	53	146.4	0	145.2	0	no	no	no
12256	53	73.65	1.21	67.58	1.64	no	no	no
12258	53	162	4.05	157.54	2.5	no	no	no
12260	59	786.47	10.13	775.53	1.29	no	no	no
12261	52	106.52	2.03	103.27	1.91	no	no	no
12262	55	52.65	0	52.25	2.59	no	no	no
12265	55	68.85	8.1	59	1.82	no	no	no
12266	55	163.06	4.22	138.75	1.93	no	no	no
12268	56	267.48	4.87	260.58	0	no	no	no
12269	56	73.63	1.42	69.23	4.17	no	no	no
12270	56	243	0	238.76	3.24	no	no	no
12271	52	339.59	14.17	324.81	0	no	no	no
12272	52	49.95	1.62	47.52	1.8	no	no	no
12273	52	125.55	0	124.74	0	no	no	no
12274	58	111	2	108	0	no	no	no
12275	52	18.63	0	18.23	0	no	no	no
12276	52	74.89	0	68.98	0	no	no	no
12277	53	25.1	0	25.1	0	no	no	no
12278	53	177.39	0	166.77	0	no	no	no
12279	55	125.55	0	111.78	0	no	no	no

Farm Ref No.	County	Area (ha)	Woodland Area (ha)	Area Grass or Fodder Crop (ha)	Woodland Area (%)	Deer observed	Species	Deer Damage Details
2000								
12280	55	198.45	0	182.87	0	no	no	no
12281	55	48.6	0	47.79	0	no	no	no
12282	55	84.65	0	84.65	0	no	no	no
12283	55	51.43	0	51.03	0	no	no	no
12284	55	76.95	0	76.54	0	no	no	no
12284	55	76.95	0	76.54	0	no	no	no
12285	55	69.9	0	65.85	0	no	no	no
12286	55	122.73	0	111.92	2.55	no	no	no
12287	52	115.93	0	81.57	1.68	no	no	no
12288	56	131.15	3.34	127	0.42	no	no	no
12289	56	72	1.21	70.38	0	no	no	no
12290	56	119.52	0.5	117.02	0	no	no	no
12291	56	126.39	0	124.89	3.78	no	no	no
12292	56	31.57	0	31.16	4.99	no	no	no
12294	56	105.9	4	96.9	26.56	no	no	no
12295	55	40.5	2.02	38.07	2.54	no	no	no
12296	52	281.88	74.88	205	4.27	no	no	no
12297	55	2151	54.6	2086.4	12.15	no	no	no
12298	52	237.32	10.13	226.58	0	no	no	no
12299	52	100.04	12.15	87.48	0	no	no	no
12300	52	425.25	0	424.85	14.5	no	no	no
12302	55	63	0	62	1.93	no	no	no
12303	58	83.2	12.07	55.15	0	no	no	no
12304	55	170.1	3.28	112.31	0	no	no	no
12305	55	128.38	0	95.56	0	no	no	no
12306	52	46.98	0	46.17	0	no	no	no
12307	55	113.4	0	112.44	1.21	no	no	no
12308	52	75.74	0	74.93	1.49	no	no	no
12309	56	133.65	1.62	121.5	5.52	no	no	no
12310	55	54.27	0.81	46.95	0	no	no	no
12311	55	58.72	3.24	52.04	0	no	no	no
12312	55	78.16	0	77.35	0	no	no	no
12314	60	65.56	0	64.75	0.3	no	no	no
12315	53	15.6	0	14.6	0.66	no	no	no
12316	55	267.12	0.8	266.32	0	no	no	no
12320	53	62.17	0.41	61.56	8.45	no	no	no
12321	59	32.28	0	32.18	0	no	no	no
12322	56	230.82	19.5	211.32	0	no	no	no
12323	52	57.51	0	57.51	0	no	no	no

Farm Ref No.	County	Area (ha)	Woodland Area (ha)	Area Grass or Fodder Crop (ha)	Woodland Area (%)	Deer observed	Species	Deer Damage Details
2000								
12324	60	136.08	0	62.98	7.26	no	no	no
12325	57	124.52	0	124.52	5.35	no	no	no
12327	59	1664.64	120.87	1433.99	0	no	no	no
12328	53	325.36	17.4	307.16	0	no	no	no
12329	53	116.64	0	115.83	4.95	no	no	no
12330	52	99.63	0	97.2	0.82	no	no	no
12331	53	101.01	5	95.01	6.35	no	no	no
12332	56	99.02	0.81	97.6	0	no	no	no
12335	55	63	4	58	1.74	no	no	no
12336	52	50.19	0	49.79	1.6	no	no	no
12337	55	93.12	1.62	91.3	1.65	no	no	no
12338	52	101.24	1.62	99.22	12.24	no	no	no
12339	52	98.01	1.62	96.39	0	no	no	no
12348	63	310.18	37.97	272.21	0.29	no	no	no
12352	52	224.41	0	224.41	5	no	no	no
12357	53	347.4	1	345.4	1.23	no	no	no
12359	55	162	8.1	153.4	1.79	no	no	no
12360	60	65.96	0.81	64.95	0.74	no	no	no
12362	55	334.32	6	328.32	1.5	no	no	no
12363	55	203.91	1.5	201.41	2.84	no	no	no
12364	55	46.58	0.7	45.32	3.17	no	no	no
12365	55	71.46	2.03	69.43	1.1	no	no	no
12366	63	38.48	1.22	37.26	1.16	no	no	no
12367	55	73.68	0.81	72.87	1.99	no	no	no
12368	55	870.8	10.1	856.7	0.59	no	no	no
12369	55	223.56	4.45	217.9	0.13	no	no	no
12371	52	67.23	0.4	66.42	0.6	no	no	no

County Key

52 Flintshire	58 South Glamorgan	63 Pembrokeshire	213 denbighshire
53 Powys	59 Mid Glamorgan	64 Camarthenshire	
56 Gwynedd	60 West Glamorgan	201 Monmouthshire	
56 Dyfed	61 Gwent	208 Conwy	
57 Clywd	62 Ceredigion	209 Bleanau Gwent	

Farm Ref No.	County	Area (ha)	Woodland Area (ha)	Area Grass or Fodder Crop (ha)	Woodland Area (%)	Deer observed	Species	Deer Damage Details
2005								
11309	55	75.74	0	64.8	0	no	no	no
11341	53	164.72	0	144.08	0	no	no	no
11342	52	385.16	1.43	382.73	0.37	no	no	no
11346	56	100	0	97.16	0	no	no	no
11347	56	104.46	0	99.2	0	no	no	no
11349	52	76.26	1	75	1.31	no	no	no
11352	55	74.12	0	71.69	0	no	no	no
11353	56	75.68	1.22	73.25	1.61	no	no	no
11358	55	110.56	2.03	76.54	2.56	no	no	no
11360	55	46.58	1.22	44.96	2.62	no	no	no
11378	53	289.49	0	260.36	0	no	no	no
11379	52	134.07	10.1	124.07	7.46	no	no	no
11381	52	97.2	0	96.39	0	no	no	no
11384	53	100.04	0	95.58	0	no	no	no
11390	56	145.29	0	142.25	0	no	no	no
11393	52	202	4.82	162.84	2.39	no	no	no
11394	52	303.35	4.05	298.49	1.34	no	no	no
11396	52	125.75	0.4	124.96	0.32	no	no	no
11399	52	94.95	4.7	89.35	4.95	no	no	no
11400	56	67.64	0.81	66.02	1.2	no	no	no
11402	52	214.65	4.05	206.55	1.89	no	no	no
11413	55	36.86	0	36.45	0	no	no	no
11414	55	103.89	4.66	98.62	4.49	no	no	no
11416	62	108.96	19.03	89.93	17.47	no	no	no
11424	58	121.5	3.2	92.9	2.63	no	no	no
11426	55	101.25	0	89.51	0	no	no	no
11430	56	81.71	0.4	65.53	0.49	no	no	no
11432	55	46.57	2.03	42.52	4.36	no	no	no
11434	53	63.59	0	18.23	0	no	no	no
11438	55	56.69	4.05	48.83	7.13	no	no	no
11439	56	277.02	37.26	171.97	13.45	no	no	no
11445	55	90.3	0.8	68.85	0.89	no	no	no

Farm Ref No.	County	Area (ha)	Woodland Area (ha)	Area Grass or Fodder Crop (ha)	Woodland Area (%)	Deer observed	Species	Deer Damage Details
2005								
11446	60	147.01	0.81	128.39	0.55	no	no	no
11450	52	74.12	0.61	72.9	0.82	no	no	no
11452	52	205.34	47.79	156.74	23.27	no	no	no
11454	53	365.72	0.2	365.11	0.05	no	no	no
11455	53	143.78	0	143.37	0	no	no	no
11469	53	244.22	0	243	0	no	no	no
11470	53	20.25	0	19.98	0	no	no	no
11472	52	108.99	4.05	77.82	3.72	no	no	no
11486	52	108	0.45	102.3	0.42	no	no	no
11487	52	264.06	0	263.25	0	no	no	no
11488	52	98.54	0	97.73	0	no	no	no
11496	52	84.01	4	79.01	4.76	no	no	no
11499	53	117.45	0	100.86	0	no	no	no
11504	56	30.170	0.000	29.970	0.000	no	no	no
11505	52	250.7	0	249.89	0	no	no	no
11510	56	40.49	40.49	0	0	no	no	no
11518	56	95.1	12.15	81.74	12.78	no	no	no
11521	52	58.32	0	57.92	0	no	no	no
11527	57	121.5	9.72	102.27	24.66	no	no	no
11531	52	411.08	2.02	407.03	0.49	no	no	no
11532	52	180.16	0	153.62	0	no	no	no
11535	52	148.19	2.03	145.06	1.37	no	no	no
11536	52	219.71	0	218.5	0	no	no	no
11540	61	149.15	0	148.64	0	no	no	no
11544	55	147	2	95.62	1.36	no	no	no
11546	55	48.6	6.08	42.12	12.51	no	no	no
11547	55	73.72	10.13	53.05	13.74	no	no	no
11549	55	52.65	0.81	51.03	1.54	no	no	no
11550	55	44.55	0.8	43.35	1.8	no	no	no
11551	52	85.45	6.48	78.16	7.58	no	no	no
11555	58	45.18	0	44.78	0	no	no	no
11558	58	58.8	0	58.4	0	no	no	no
11560	53	100.9	1.21	98.08	1.2	no	no	no
11562	55	34.02	0.41	33.41	1.21	no	no	no
11572	53	68.04	0	50.47	0	no	no	no
11573	52	84.78	3.65	80.32	4.31	no	no	no
11574	52	64.4	0	62.78	0	no	no	no
11575	53	126.71	0.2	126.57	0.16	no	no	no
11576	56	39.42	4.45	46.5	11.29	no	no	no

Farm Ref No.	County	Area (ha)	Woodland Area (ha)	Area Grass or Fodder Crop (ha)	Woodland Area (%)	Deer observed	Species	Deer Damage Details
2005								
11579	56	40.8	0	40.39	0	no	no	no
11582	55	150.02	0.42	148.79	0.28	no	no	no
11584	52	74.36	0.1	67.7	0.13	no	no	no
11588	55	133.68	0.3	121.38	0.24	no	no	no
11592	56	117.4	0.61	80	0.52	no	no	no
11593	53	152.25	1.62	150.02	1.06	no	no	no
11596	53	85.69	0.61	84.27	0.71	no	no	no
11598	52	46.6	4.5	39.5	9.66	1 fall	dam £800 fenc	no
11599	53	117.06	0.2	101.87	0.17	no	no	no
11600	63	64.83	0	64.83	0	no	no	no
11601	60	116.42	0	115.42	0	no	no	no
11602	52	41.33	0	41.33	0	yes	unkn	no
11603	55	121.41	1.57	118.84	1.29	no	no	no
11604	53	64.83	0	70	0	no	no	no
11610	60	86.68	0.81	85.06	0.93	no	no	no
11611	60	57.91	1.62	55.89	2.797	no	no	no
11614	55	120.29	0	104.57	0	no	no	no
11618	53	194.32	2.92	140.09	1.5	no	no	no
11625	55	121.4	0.81	118.56	0.67	no	no	no
11628	53	165.64	0	164.83	0	no	no	no
11630	52	129.6	0.6	126.98	3.06	no	no	no
11632	52	86.26	0	86.02	0	no	no	no
11633	52	46.4	1.6	44.39	3.49	no	no	no
11638	52	324.81	12.15	308.61	3.74	no	no	no
11644	58	68.04	5.27	62.37	0.08	yes	unk	no
11646	52	404.19	1.25	399.92	0.31	no	no	no
11657	53	578.85	8.1	569.94	1.39	no	no	no
11658	53	1073.44	23	1050.24	2.14	no	no	no
11661	55	145.8	0	144.99	0	no	no	no
11662	52	50.63	0	48.6	0	no	no	no
11664	52	121.5	0	119.88	0	no	no	no
11665	52	68.8	1	67.3	1.45	no	no	no
11668	53	305.44	0	303.42	0	no	no	no
11670	52	117.65	1.22	115.09	1.04	no	no	no
11671	55	96.08	0	94.58	0	no	no	no
11672	55	155.6	0	151.6	0	no	no	no
11673	55	45.36	0	44.91	0	no	no	no

Farm Ref No.	County	Area (ha)	Woodland Area (ha)	Area Grass or Fodder Crop (ha)	Woodland Area (%)	Deer observed	Species	Deer Damage Details
2005								
11676	52	81.77	0.52	80.6	0.64	no	no	no
11677	52	151.13	1.57	148	1.04	no	no	no
11678	55	151.87	0.2	150.76	0.13	no	no	no
11680	52	247.05	0.2	201.35	0.08	no	no	no
11681	52	106.14	21.97	83.97	20.70	no	no	no
11682	55	130.38	1.6	86.09	1.23	no	no	no
11683	56	42.52	0	42.12	0	no	no	no
11685	52	180.2	0	179.18	0	no	no	no
11687	52	159.18	15.8	142.17	9.92	no	no	no
11688	52	81	0	80	0	no	no	no
11690	52	87.44	0	87.13	0	no	no	no
11691	55	70.8	1.62	68.36	2.29	no	no	no
11701	52	134.44	6.34	127.6	4.72	no	no	no
11702	55	80.73	1.62	77.9	2.01	no	no	no
11703	53	441.36	0	420.84	0	no	no	no
11705	55	215.45	4.05	168.69	1.88	no	no	no
11706	52	250.2	0	249.79	0	no	no	no
11707	53	213.23	2.43	210.39	0.11	no	no	no
11708	53	253.11	2.83	241.18	1.12	no	no	no
11709	55	210.59	6.07	203.71	2.88	no	no	no
11710	55	137.7	12.96	123.52	9.41	no	no	no
11718	52	157.14	0	147.9	0	no	no	no
11721	52	280.9	0	279.9	0	no	no	no
11723	52	156.85	5.05	151.5	3.22	no	no	no
11725	52	74.32	3.5	69.74	4.71	no	no	no
11727	52	96	6	89.6	6.25	no	no	no
11737	53	358.43	0	357.21	0	no	no	no
11733	52	85.05	2.02	83.03	2.38	yes	unk	no
11738	53	247.05	0	246.64	0	no	no	no
11741	55	105.17	0	104.36	0	no	no	no
11742	57	189.4	2.02	101.76	1.07	no	no	no
11743	55	106.09	6.07	78.76	5.72	no	no	no
11745	55	53.86	5.67	46.57	10.53	no	no	no
11746	55	89.91	0	73.08	0	no	no	no
11747	52	173.01	4	167.31	5.48	no	no	no
11748	52	33.01	0.81	31.59	2.45	no	no	no
11749	56	162	0	111.85	0	no	no	no
11751	52	69.34	16.2	52.73	23.36	no	no	no
11753	59	64.2	4.05	59.95	6.31	no	no	no

Farm Ref No.	County	Area (ha)	Woodland Area (ha)	Area Grass or Fodder Crop (ha)	Woodland Area (%)	Deer observed	Species	Deer Damage Details
2005								
11759	52	112	0	111.39	0	no	no	no
11760	52	50.63	0.41	45.77	0.81	no	no	no
11762	55	60.37	0	59.56	0	no	no	no
11763	55	171.72	7.29	163.62	4.25	no	no	no
11764	53	49.41	0	49	0	no	no	no
11765	55	37.06	4.05	32.6	10.92	no	no	no
11767	52	151	9.5	141	6.29	no	no	no
11768	52	27.11	0	26.91	0	no	no	no
11769	56	289.47	2.43	284.2		no	no	no
11772	56	101.25	1.62	98.41	1.6	no	no	no
11774	53	45.43	1.62	43.4	3.57	no	no	no
11776	53	260.98	12.15	244.48	4.66	no	no	no
11777	53	172.51	25.98	130.53		no	no	no
11778	56	39.99	0	39.53	0	no	no	no
11780	60	75.34	0	71.5	0	no	no	no
11781	56	69.42	0.7	60	1.02	no	no	no
11785	52	177.72	0	176.22	0	no	no	no
11786	52	131.28	13.37	117.1	10.18	no	no	no
11787	52	37.26	0.41	36.44	1.1	no	no	no
11788	53	32	0	30.29	0	no	no	no
11789	53	98.72	0	93.31	0	no	no	no
11792	52	82.2	5.37	68.21	6.53	no	no	no
11794	55	162.32	0	121.02	0	no	no	no
11795	55	123.93	12	111.12	9.68	no	no	no
11799	56	93.56	0	92.75	0	no	no	no
11800	53	769.6	10.67	758.19	1.38	no	no	no
11810	55	162	0	145.8	0	no	no	no
11812	55	594.72	0	593.22	0	no	no	no
11815	55	130.25	29.83	85.6	22.9	no	no	no
11826	55	53.46	1.62	51.44	3.03	no	no	no
11828	52	100.05	0	99.85	0	no	no	no
11829	52	41.34	0	40.93	0	no	no	no
11830	56	160.29	0	157.7	0	no	no	no
11831	53	53.86	0	53.46	0	no	no	no
11832	59	107.72	16.2	91.12	15.04	yes	unk	no
11833	53	254.9	0	232.23	0	no	no	no
11837	56	97.38	0.3	92.97	0.31	no	no	no
11841	55	85.44	11.33	73.71	13.26	no	no	no
11843	56	123.59	1	101.14	0.81	no	no	no

Farm Ref No.	County	Area (ha)	Woodland Area (ha)	Area Grass or Fodder Crop (ha)	Woodland Area (%)	Deer observed	Species	Deer Damage Details
2005								
11844	53	114	1.22	111.56	1.07	no	no	no
11846	55	47.1	0	45.75	0	no	no	no
11848	56	211.2	1.6	208.9	0.76	no	no	no
11849	53	69.6	0	67.9	0	no	no	no
11851	52	70.87	0	70.46	0	no	no	no
11855	55	92.3	12.1	79.4	13.11	no	no	no
11856	56	134.26	1.62	78.42	1.2	no	no	no
11858	52	36.36	0	35.4	0	no	no	no
11859	52	345.18	0	332.02		no	no	no
11861	55	68	0	55.44	0	no	no	no
11865	53	131.5	19.43	110.65	14.78	no	no	no
11866	52	368.55	19.44	305.4	5.27	no	no	no
11867	55	121.5	9.38	110.91	7.72	no	no	no
11876	52	380.3	10.94	304.28	2.88	no	no	no
11877	53	25.59	0.2	25.19	0.78	no	no	no
11879	52	30.6	0	30.2	0	no	no	no
11881	55	182.25	7.29	174.15	4	no	no	no
11882	53	393.66	29.92	363.93	7.6	no	no	no
11886	55	94.47	3.41	90.06	3.61	no	no	no
11888	53	87.26	0	73.21	0	no	no	no
11889	53	176.07	0	175.26	0	no	no	no
11890	52	150.4	1	149.19	0.66	no	no	no
11891	52	45.73	0	44.11	0	no	no	no
11892	52	59.75	0	56.52	0	no	no	no
11893	55	85.39	0	84.39	0	no	no	no
11897	56	77.76	0	61.76	0	no	no	no
11898	56	30.29	0	26.25	0	no	no	no
11899	55	136.48	0	111.37	0	no	no	no
11900	52	102.65	0	100.85	0	no	no	no
11901	55	124.34	18.23	84.27	14.66	no	no	no
11902	57	81	0	80.2	0	no	no	no
11904	52	75.5	3	72	0	no	no	no
11910	55	118.57	7.69	91.47	6.49	no	no	no
11916	56	60.15	0.61	57.11	1.01	no	no	no
11919	58	129.57	5.97	121.23	4.61	no	no	no
11921	56	91.88	0	91.47	0	no	no	no
11922	56	81.81	2.84	78.16	3.47	no	no	no
11923	56	71.71	0	71.3	0	yes	unk	no
11924	58	139.96	6.5	133.26	4.64	no	no	no

Farm Ref No.	County	Area (ha)	Woodland Area (ha)	Area Grass or Fodder Crop (ha)	Woodland Area (%)	Deer observed	Species	Deer Damage Details
2005								
11926	52	223.48	0	218.48	0	no	no	no
11930	52	27.54	0	27.44	0	no	no	no
11932	56	187.92	6.89	179.81	3.67	no	no	no
11934	55	32.4	0	31.99	0	no	no	no
11936	55	24.3	0	23.9	0	no	no	no
11937	58	169.81	0	169.4	0	no	no	no
11938	52	48.58	1.62	46.56	3.33	no	no	no
11940	52	135.9	2.03	130.01	1.49	no	no	no
11941	52	257.18	4.05	252.32	1.57	no	no	no
11944	53	90.11	2.43	86.06	2.7	no	no	no
11945	56	48.6	4	44.3	8.23	no	no	no
11946	53	327.64	0	326.83	0	no	no	no
11948	52	59.95	3.64	55.3	6.07	no	no	no
11950	56	116.1	0	58.32	0	no	no	no
11954	52	53.85	0	53.45	0	no	no	no
11955	60	98.51	3	95.11	3.04	no	no	no
11959	53	150.5	14.58	135.52	9.69	no	no	no
11960	53	100	15	81	15	no	no	no
11962	56	43.72	0	42.92	0	no	no	no
11963	52	74	5.7	67.5	7.7	no	no	no
11964	52	74.9	1.21	73.29	1.62	no	no	no
11966	60	160.73	6.07	153.85	3.77	no	no	no
11967	52	202.5	4	197.5	1.98	no	no	no
11969	52	22.68	0	22.27	0	no	no	no
11973	53	54.63	0	48.57	0	no	no	no
11974	53	102.94	0	95.46	0	no	no	no
11975	53	165.6	23	141.6	13.89	no	no	no
11976	53	113.22	0.4	112.72	0.35	no	no	no
11977	53	212.96	20.24	192.32	9.5	no	no	no
11979	55	36.22	0	36.02	0	no	no	no
11982	56	111.34	0	105.94	0	no	no	no
11983	56	329.01	1.81	213.32	0.85	no	no	no
11984	56	80	18.21	53.51	22.76	yes	Muntjac	no
11985	60	43.32	0.2	40.49	0.46	no	no	no
11986	52	86.34	0	85.94	0	no	no	no
11987	60	100.43	1.62	98.4	1.61	yes	unk	no
11990	55	69.67	4.46	65	6.37	no	no	no
11991	52	129.54	5	124.04	3.86	no	no	no
11993	52	164.23	0	163.73	0	no	no	no

Farm Ref No.	County	Area (ha)	Woodland Area (ha)	Area Grass or Fodder Crop (ha)	Woodland Area (%)	Deer observed	Species	Deer Damage Details
2005								
11994	52	42	0.5	36.85	1.19	yes	unk	no
11997	61	88.4	0.4	86.7	0.45	no	no	no
11998	63	52.59	0.5	52.09	0.95	no	no	no
11999	55	150.98	0.8	149.78	0.53	no	no	no
12001	52	22.68	0	22.48	0	no	no	no
12003	52	86.9	4.5	85.8	0	no	no	no
12005	52	172.15	0	160.62	0	no	no	no
12006	52	157	0	127.25	0	no	no	no
12008	55	165	1.5	163	0.92	no	no	no
12009	55	68.77	0.5	67.77	0.72	no	no	no
12011	58	31.3	3	28.09	9.58	no	no	no
12012	52	198.24	8.1	187.11	4.09	no	no	no
12012	52	198.24	8.1	187.11	4.09	no	no	no
12017	55	38.48	1.22	25.92	3.17	no	no	no
12018	55	64.8	0	63.59	0	no	no	no
12018	55	64.8	0	63.59	0	no	no	no
12028	56	47.34	0	47.77	0	no	no	no
12029	56	107.39	0	103.82	0	no	no	no
12032	63	75.67	4.86	70.81	6.42	no	no	no
12033	53	75.46	0	74.86	0	no	no	no
12034	52	133.58	0	132.37	0	no	no	no
12035	53	69.56	12.87	55.89	18.5	no	no	no
12048	55	137	13	123.7	9.5	no	no	no
12051	60	119.62	0	68.01	0	no	no	no
12053	52	78.9	4.2	70.2	5.32	no	no	no
12055	52	109.96	5.26	98.44	4.9	no	no	no
12057	55	65.2	0	59.41	0	no	no	no
12058	56	117.45	2.43	114.21	2.07	no	no	no
12065	57	54.67	4.05	50.42	7.41	no	no	no
12066	56	95.82	3.54	91.87	3.69	no	no	no
12067	56	77.93	0	67.21	0	no	no	no
12069	56	299.27	0	298.08	0	no	no	no
12070	56	46.44	0	45.23	0	no	no	no
12071	56	99.55	0.2	98.74	0.2	no	no	no
12074	56	190.26	0	190.16	0	no	no	no
12075	56	174.15	3.24	150.27	1.86	no	no	no
12077	56	37.63	0	37.23	0	no	no	no
12079	53	45.73	0	45.32	0	no	no	no
12081	55	31.21	0	30.8	0	no	no	no

Farm Ref No.	County	Area (ha)	Woodland Area (ha)	Area Grass or Fodder Crop (ha)	Woodland Area (%)	Deer observed	Species	Deer Damage Details
2005								
12082	53	97.61	0	97.4	0	no	no	no
12083	52	48.5	0	47.5	0	no	no	no
12085	55	68.44	10.12	56.7	14.79	no	no	no
12090	55	59.54	5.67	50.42	9.52	no	no	no
12091	55	130.18	0	130.08	0	no	no	no
12094	58	101.25	8.1	92.34	8	no	no	no
12095	55	79.58	0	70.67	0	no	no	no
12096	52	74.11	2.02	66.85	2.73	no	no	no
12097	60	64.38	0	63.88	0	no	no	no
12098	58	163	8	154	4.91	no	no	no
12102	60	202.5	0.81	199.67	0.4	no	no	no
12103	60	238.95	4.05	204.52	1.69	no	no	no
12104	53	133	0	132.59	0	no	no	no
12105	60	82.5	0	65.3	0	no	no	no
12106	56	22	0	21.59	0	no	no	no
12107	52	150	3	139.22	2	no	no	no
12109	52	101.25	0	11.44	0	no	no	no
12113	55	45.77	4.05	41.11	8.85	no	no	no
12115	55	77.56	0.4	68.85	0.52	no	no	no
12118	53	486.07	8.1	467.97	1.67	no	no	no
12119	53	131.07	8	122.91	6.1	no	no	no
12120	52	142.04	0	141.04	0	no	no	no
12121	52	101.18	0.41	97.93	0.41	no	no	no
12122	52	138	5	131	3.62	no	no	no
12124	55	61.71	0	61.51	0	no	no	no
12125	53	240	4.05	235.14	1.69	no	no	no
12126	53	140.62	1.22	138.99	0.87	no	no	no
12127	56	68.42	0.4	67.22	0.02	no	no	no
12149	55	299.46	7.09	291.57	2.37	no	no	no
12150	53	20.93	0	20.71	0	no	no	no
12151	55	67.18	0.8	65.78	1.19	no	no	no
12152	53	93.15	3.24	89.5	3.48	no	no	no
12153	55	54.67	2	51.27	3.66	no	no	no
12154	52	62.37	0	61.96	0	no	no	no
12156	55	60.75	0	60.34	0	no	no	no
12161	55	63	0	62.6	0	no	no	no
12162	55	203.31	0	168.1	0	no	no	no
12164	55	105.85	7.7	79.94	7.27	no	no	no
12165	63	30.24	1	29.03	3.31	no	no	no

Farm Ref No.	County	Area (ha)	Woodland Area (ha)	Area Grass or Fodder Crop (ha)	Woodland Area (%)	Deer observed	Species	Deer Damage Details
2005								
12166	55	85.43	5.63	50.47	6.59	no	no	no
12168	55	98.82	1	83.84	1.01	no	no	no
12169	52	56	0	55	0	no	no	no
12170	52	37.46	0.2	36.65	0.54	no	no	no
12171	52	70.97	0	69.74	0	no	no	no
12172	55	32.8	0	32.6	0	no	no	no
12173	55	102.41	2.03	96.74	1.98	no	no	no
12174	56	110	0	108	0	no	no	no
12180	55	69.16	0.41	68.65	0.59	no	no	no
12182	52	29.94	1.42	23.87	4.74	no	no	no
12193	52	97.2	1.62	95.17	1.67	no	no	no
12195	52	35.61	0	35.21	0	no	no	no
12197	53	108.14	0.41	94.38	0.38	no	no	no
12201	53	426.5	2.4	423.7	0.56	no	no	no
12202	53	80.51	0	79.51	0	no	no	no
12203	52	245.39	9.32	235.46	3.8	no	no	no
12204	52	121.51	2.43	118.67	2	no	no	no
12205	53	81.41	0.41	81	0.5	no	no	no
12207	53	61.42	0.41	50.23	0.67	no	no	no
12208	52	150.9	0.1	148.9	0.07	no	no	no
12209	52	205.7	1.62	203.69	0.79	no	no	no
12210	56	151.16	5.26	145.09	3.48	no	no	no
12211	55	50.41	0.1	50.11	0.2	no	no	no
12212	53	137.14	1.21	134.73	0.88	no	no	no
12213	58	51.28	1.51	46.81	3.65	no	no	no
12214	55	162	0	88.7	0	no	no	no
12215	55	165	0	145.21	0	no	no	no
12216	55	249.13	9.11	228.18	3.66	no	no	no
12218	55	107.33	0	93.19	0	no	no	no
12219	55	169.69	0	138	0	no	no	no
12221	55	50.4	0	41.7	0	no	no	no
12222	55	69.6	0	62.7	0	no	no	no
12225	55	68.79	0	64.76	0	no	no	no
12229	55	98.83	7.45	90.65	7.54	no	no	no
12230	55	89.1	4.46	34.42	5.01	no	no	no
12232	55	77.76	2.03	51.86	2.61	no	no	no
12234	55	169.62	3.24	165.17	1.91	no	no	no
12235	56	232.87	4.05	185.47	1.74	no	no	no
12236	52	177.76	0	169.46	0	no	no	no

Farm Ref No.	County	Area (ha)	Woodland Area (ha)	Area Grass or Fodder Crop (ha)	Woodland Area (%)	Deer observed	Species	Deer Damage Details
2005								
12242	52	81.63	0.28	80.85	0.34	no	no	no
12243	53	83.27	1.24	0	0	no	no	no
12244	56	147.3	2.68	127.72	1.82	no	no	no
12245	55	78.8	3.2	73.68	4.06	yes	unk	no
12246	56	237.57	1.22	196.24	0.51	no	no	no
12247	55	324.88	1.22	321.23	0.38	no	no	no
12248	53	141.43	1.43	139	1.01	no	no	no
12249	55	67.99	2.43	63.13	3.57	no	no	no
12250	56	62.73	0	62.57	0	no	no	no
12251	56	72.9	10.13	62.67	13.9	no	no	no
12252	55	206.55	0	205.94	0	no	no	no
12253	57	12.96	0	12.76	0	no	no	no
12254	53	119.08	0	104.92	0	no	no	no
12255	53	146.4	0	145.2	0	no	no	no
12256	53	73.65	1.21	67.58	1.64	no	no	no
12258	59	162	4.05	157.54	2.5	no	no	no
12260	59	786.47	10.13	775.53	1.29	no	no	no
12261	52	106.52	2.03	103.27	1.91	no	no	no
12262	55	64.78	0	64.38	0	no	no	no
12263	55	30.3	0	29.8	0	no	no	no
12265	55	68.85	8.1	59	11.76	no	no	no
12266	55	191.28	4.22	185.24	2.21	no	no	no
12269	56	73.63	1.42	69.23	1.93	no	no	no
12271	52	339.59	14.17	324.81	4.17	no	no	no
12272	52	49.95	1.62	47.52	3.24	no	no	no
12273	52	125.55	0	124.74	0	no	no	no
12274	58	111	2	108	1.8	no	no	no
12275	52	18.63	0	18.23	0	no	no	no
12276	52	69.23	0	68.98	0	no	no	no
12277	53	28.73	0	27.53	0	no	no	no
12282	55	84.65	0	84.65	0	no	no	no
12283	55	51.43	0	51.03	0	no	no	no
12284	55	76.95	0	76.54	0	no	no	no
12285	55	69.9	0	69.5	0	no	no	no
12288	56	131.15	3.34	127	2.55	no	no	no
12289	56	72	1.21	70.38	1.68	no	no	no
12290	56	119.52	0.5	117.02	0.42	no	no	no
12291	56	126.39	0	124.89	0	no	no	no
12292	56	31.57	0	31.16	0	no	no	no

Farm Ref No.	County	Area (ha)	Woodland Area (ha)	Area Grass or Fodder Crop (ha)	Woodland Area (%)	Deer observed	Species	Deer Damage Details
2005								
12294	55	105.9	4	96.9	3.78	no	no	no
12295	55	40.5	2.02	38.07	4.99	no	no	no
12296	52	281.88	74.88	205	26.56	no	no	no
12297	52	2151	54.6	2086.4	2.54	no	no	no
12298	52	237.32	10.13	229.61	4.27	no	no	no
12299	52	100.04	12.15	87.48	12.15	no	no	no
12300	52	425.25	0	424.85	0	no	no	no
12302	58	63	0	62	0	no	no	no
12303	55	74.04	12.07	46.21	16.3	no	no	no
12304	55	173.75	3.28	113.69	1.93	no	no	no
12305	52	128.38	0	95.56	0	no	no	no
12306	55	46.98	0	46.17	0	no	no	no
12307	55	175.24	0	174.18	0	no	no	no
12308	52	84.64	0	83.83	0	no	no	no
12309	55	133.65	1.62	121.5	1.21	no	no	no
12310	55	38.68	0.81	24.46	1.49	no	no	no
12311	55	58.72	3.24	52.04	5.52	no	no	no
12312	55	78.16	0	77.35	0	no	no	no
12313	55	66.6	0	65.6	0	no	no	no
12319	55	15	0	42.17	0	no	no	no
12328	53	325.36	17.4	307.16	5.35	no	no	no
12329	53	116.64	0	115.83	0	no	no	no
12330	53	152.83	0	150.4	0	no	no	no
12331	53	101.01	5	96.55	4.95	no	no	no
12332	55	99.02	0.81	97.6	0.82	no	no	no
12333	56	38.48	0	36.74	0	no	no	no
12334	55	34.83	1.62	32.8	4.65	no	no	no
12335	52	63	4	58	6.35	no	no	no
12336	55	50.19	0	49.79	0	no	no	no
12340	52	38.9	2.8	23.49	7.2	no	no	no
12341	64	98.39	0.2	97.78	0.2	no	no	no
12343	210	96.8	0	95.99	0	no	no	no
12345	206	122.5	10.13	111.36	8.27	yes	unk	no
12346	52	310.18	37.97	272.21	12.24	no	no	no
12347	217	267.48	4.87	260.58	1.82	yes	unk	no
12348	62	69.42	0	69.02	0	no	no	no
12349	209	134.74	1.06	132.57	0.79	no	no	no
12356	208	75.68	1.22	73.25	1.61	no	no	no
12357	62	347.4	1	345.4	0.29	no	no	no

Farm Ref No.	County	Area (ha)	Woodland Area (ha)	Area Grass or Fodder Crop (ha)	Woodland Area (%)	Deer observed	Species	Deer Damage Details
2005								
12358	202	287.89	6.1	280.79	2.11	no	no	no
12359	201	162	17.9	143.6	11.05	no	no	no
12360	62	68.43	0.81	67.42	1.18	no	no	no
12361	214	260.99	26.02	223.45	9.97	no	no	no
12364	205	46.58	0.7	45.32	1.5	no	no	no
12365	63	71.46	2.03	69.43	2.84	no	no	no
12366	55	38.48	1.22	37.26	3.17	no	no	no
12367	205	73.68	0	72.87	0	no	no	no
12368	62	882.6	10.1	856.7	1.16	no	no	no
12375	208	789.34	1.01	757.57	0.13	no	no	no
12376	210	51.58	1	50.18	1.94	no	no	no
12377	205	118.35	12.95	105.4	10.94	no	no	no
12378	52	258.5	7.29	251.21	2.82	no	no	no
12381	207	112.43	6.07	104.97	5.4	no	no	no
12382	55	91.13	6.08	72.09	6.67	no	no	no
12383	62	245.43	0	243.4	0	no	no	no
12384	210	114.5	2	110.9	1.75	no	no	no
12386	55	124.75	0	123.07	0	no	no	no
12387	52	196.83	0	196.02	0	no	no	no
12388	55	266.34	0	248.82	0	no	no	no
12389	53	275.5	8.9	264.57	3.23	no	no	no
12390	59	163.49	20.7	140.37	12.66	no	no	no
12391	55	102.06	0	89.91	0	no	no	no
12393	208	1014.32	0.41	1012.9	0.04	no	no	no
12394	55	32.4	0	31.4	0	no	no	no
12395	208	1052.99	3.24	1048.94	0.31	no	no	no
12396	59	850.84	0	821.54	0	no	no	no
12402	208	186.56	1.01	146.06	0.54	1	fall	Dam - £200 elec fen, £100crop, £500grass 'poachers do DM'
12403	208	144.17	1.62	131.63	1.12	no	no	no
12404	52	199.9	6.7	191.4	3.35	no	no	no
12407	52	100.2	0	91.7	0	no	no	no
12408	52	197.08	4.05	170.47	2.06	no	no	no
12409	52	36.69	2.43	34.26	6.62	no	no	no

Farm Ref No.	County	Area (ha)	Woodland Area (ha)	Area Grass or Fodder Crop (ha)	Woodland Area (%)	Deer observed	Species	Deer Damage Details
2005								
12410	55	86.91	0.2	86.3	0.23	no	no	no
12411	55	206.93	4	202.3	1.93	no	no	no
12415	53	92.34	0	77.1	0	no	no	no
12423	52	122.35	0	121.54	0	no	no	no
12424	52	48.6	0	18.49	0	no	no	no
12425	52	768.26	3.24	759.98	0.42	no	no	no
12429	52	114.22	7	106.12	6.13	no	no	no
12430	52	63.4	0	63	0	no	no	no
12432	52	227.72	0	227.22	0	no	no	no
12433	52	77.65	0	72.4	0	no	no	no
12434	52	78.89	4	74.89	5.07	no	no	no
12435	52	24.2	0	24.2	0	no	no	no
12436	52	76.89	11.33	65.56	14.74	no	no	no
12437	53	63.94	0.81	62.73	1.27	no	no	no
12439	53	114.12	0.52	113.6	0.45	no	no	no
12440	53	46.57	0	45.02	0	no	no	no
12441	53	97	1	96	1.03	no	no	no
12442	61	25.9	0.2	25.7	0.77	no	no	no
12443	61	83.9	7.76	73.01	9.25	no	no	no
12445	62	143.77	0	127.17	0	no	no	no
12446	62	69.58	0	66.68	0	no	no	no
12447	62	149.36	5.68	125.08	3.8	no	no	no
12448	53	176.85	2.02	174.42	1.14	no	no	no
12455	64	41.67	0	39.26	0	no	no	no
12456	53	353.08	37.55	310	10.63	no	no	no
12457	61	82.8	0	79.29	0	no	no	no
12458	53	105.41	9.26	95.65	8.78	no	no	no
12459	53	63.18	0.4	62.37	0.63	no	no	no
12461	61	108.55	0	105.31	0	no	no	no
12462	63	138.92	1.21	136.49	0.87	no	no	no
12463	63	40.47	2	33.56	4.94	no	no	no
12464	63	924.39	49.8	874.59	5.39	1	unk	no
12466	61	57.5	0	36.76	0	1	unk	no
12467	64	36.21	1.21	34.8	3.34	1	fal	no
12468	52	147.2	9.5	137.7	6.45	no	no	no
12469	52	90.88	5.26	84	5.79	no	no	no
12470	52	80.17	2.03	73.53	2.53	no	no	no
12471	52	78.77	0.61	54.28	0.77	no	no	no
12474	52	32.62	0.4	31.97	1.23	no	no	no

Farm Ref No.	County	Area (ha)	Woodland Area (ha)	Area Grass or Fodder Crop (ha)	Woodland Area (%)	Deer observed	Species	Deer Damage Details
2005								
12475	59	114.21	5.67	108.13	4.96	no	no	no
12479	53	485.62	19.73	465.89	4.06	no	no	no
12480	58	134.76	2.02	132.74	1.5	no	no	no
12481	61	100.02	0.5	99.97	0.5	no	no	no
12484	61	52.14	4.67	46.47	8.96	no	no	no
12485	61	127.08	2.02	125.06	1.6	no	no	no
12489	53	50.45	0	50.45	0	no	no	no
12491	53	204.38	2.02	202.36	0.98	no	no	no
12492	63	259.36	10.12	248.99	3.9	no	no	no
12493	53	117.87	0	117.37	0	no	no	no
12494	60	286.68	16.2	270.48	5.65	no	no	no
12495	61	73.03	12.14	60.76	16.62	no	no	no
12496	61	12.64	0	12.14	0	no	no	no
12497	62	133.55	12.14	121.41	9.1	no	no	no
12498	61	53.41	0	53.41	0	no	no	no
12499	62	97.2	1.22	29.13	1.26	no	no	no
12500	59	70	0	69.5	0	no	no	no
12501	59	237.33	18.06	164.79	7.61	no	no	no
12502	213	106.58	3	90.44	2.81	no	no	no
12505	213	55.44	2.02	53.22	3.64	no	no	no
12506	60	69.6	0	55.04	0	no	no	no
12507	52	84.99	0	84.99	0	no	no	no
12510	63	25.49	0	25.49	0	no	no	no
12511	63	50	0.5	49.5	1	no	no	no
12512	63	50.18	9.31	40.87	18.55	no	no	no
12513	62	112	0	107.75	0	no	no	no
12514	60	56.49	0	56.49	0	no	no	no
12516	61	28.32	0.4	24.69	1.41	no	no	no
12517	64	74.92	0	74.52	0	no	no	no
12518	53	91.94	0	91.94	0	no	no	no
12519	64	172.51	4.1	4.1	2.38	no	no	no
12521	53	80.97	2.43	78.14	3	no	no	no
12522	64	87.4	0	87	0	no	no	no
12523	53	32.4	0.81	31.18	0.03	no	no	no
12524	52	110.44	0	105.18	0	no	no	no
12525	52	147.75	0	146.14	0	no	no	no
12526	63	83.7	2.43	81.27	2.9	no	no	no
12529	63	242.81	2.02	240.38	0.83	no	no	no

Farm Ref No.	County	Area (ha)	Woodland Area (ha)	Area Grass or Fodder Crop (ha)	Woodland Area (%)	Deer observed	Species	Deer Damage Details
2005								
12531	63	277.02	37.26	193.61	13.45	yes	fall	£1500 crop dam
12534	53	65.15	0	65.15	0	no	no	no
12535	53	107.29	0	105.22	0	no	no	no
12536	53	133.6	0.72	132.08	0.54	no	no	no
12537	53	152.1	1	151.1	0.66	no	no	no
12538	58	238.76	6.07	232.69	2.54	no	no	no
12539	53	75.98	0	74.98	0	no	no	no
12540	61	204.37	10.11	194.26	4.95	no	no	no
12541	53	97.53	0.2	97.13	0.21	no	no	no
12542	213	49.29	0	43.22	0	no	no	no
12543	53	40.47	0	40.07	0	no	no	no
12544	213	78.9	10.12	67.98	12.83	no	no	no
12545	213	94.68	1.21	35.2	1.28	no	no	no
12546	213	71.9	0	47.52	0	no	no	no
12547	213	180.09	0	175	0	no	no	no
12548	213	93.08	4.76	80.69	5.11	no	no	no
12550	213	46.97	0.4	46.17	0.85	no	no	no
12551	213	182.9	6.07	34.39	3.32	no	no	no
12552	213	187.4	12.5	59.5	6.67	no	no	no
12553	213	340.93	3.08	4.73	0.9	no	no	no
12554	53	108.55	0.5	102.45	0.46	no	no	no
12556	56	40.47	0	40.06	0	no	no	no
12558	62	100	10	90	10	no	no	no
12559	62	81	3.24	43.43	4	no	no	no
12570	59	107.73	4.05	83.03	3.76	no	no	no
12571	59	141	0	42.07	0	no	no	no
12572	53	27.54	0	27.44	0	no	no	no
12573	52	162	0	126.4	0	no	no	no
12574	208	103.19	0	102.99	0	no	no	no
12575	63	132.33	2.02	130.31	1.53	no	no	no
12576	213	42.52	0	41.12	0	no	no	no

DATE	9,10/07/02				WOODLAND				Bailey Einon		
BEARING	304 (280-330)				TRANSECT SEP.				40		
TRANSECT (m)	10	20	30	40	50	60	70	80	90	100	TOTAL
0-100	0	0	0	0	0	0	0	0	0	0	0
100-200	0	0	0	0	0	0	0	0	0	0	0
200-300	0	0	0	0	0	0	0	0	0	0	0
300-400	0	0	0	0	0	0	0	0	0	0	0
400-500	0	0	0	0	0	0	0	0	0	0	0
500-600	0	0	0	0	0	0	0	0	0	0	0
600-700	0	0	0	0	0	0	0	0	0	0	0
700-800	0	0	0	0	0	0	0	0	0	0	0
800-900	0	0	0	0	0	0	0	0	0	0	0
900-1000	0	0	0	0	0	0	0	0	0	0	0
1000-1100	0	0	0	0	0	0	0	0	0	0	0
1100-1200	0	0	0	0	0	0	0	0	0	0	0
1200-1300	0	0	0	0	0	0	0	0	0		0
1300-1400											0
1400-1500											0
1500-1600											0
1600-1700											0
1700-1800											0
1800-1900											0
1900-2000											0
TOTAL											0

DATE	21,22/06/02				WOODLAND				Big Pool		
BEARING	46 (0-90)				TRANSECT SEP.				30		
TRANSECT (m)	10	20	30	40	50	60	70	80	90	100	TOTAL
0-100	0	0	0	0	0	0	0	0	0	0	0
100-200	0	0	0	0	0	0	0	0	0	0	0
200-300	0	0	0	0	0	0	0	0	0	0	0
300-400	0	0	0	0	0	0	0	0	0	0	0
400-500	0	0	0	0	0	0	0	0	0	0	0
500-600	0	0	0	0	0	0	0	0	0	0	0
600-700	0	0	0	0	0	0	0	0	0	0	0
700-800	0	0	0	0	0	0	0	0	0	0	0
800-900	0	0	0	0	0	0	0	0	0	0	0
900-1000	0	0	0	0	0	0	0	0	0	0	0
1000-1100	0	0	0	0	0	0	0	0	0	0	0
1100-1200	0	0	0	0	0	0	0	0	0	0	0
1200-1300	0	0	0	0	0	0	0	0	0	0	0
1300-1400											0
1400-1500											0
1500-1600											0
1600-1700											0
1700-1800											0
1800-1900											0
1900-2000											0
TOTAL											0

DATE	15,16/07/02				WOODLAND				Cilycroeslwyd		
BEARING	290 (270-355)				TRANSECT SEP.				40		
TRANSECT (m)	10	20	30	40	50	60	70	80	90	100	TOTAL
0-100	0	0	0	0	0	0	0	0	0	0	0
100-200	0	0	0	0	0	0	0	0	0	0	0
200-300	0	0	0	0	0	0	0	0	0	0	0
300-400	0	0	0	0	0	0	0	0	0	0	0
400-500	0	0	0	0	0	0	0	0	0	0	0
500-600	0	0	0	0	0	0	0	0	0	0	0
600-700	0	0	0	0	0	0	0	0	0	0	0
700-800	0	0	0	0	0	0	0	0	0	0	0
800-900	0	0	0	0	0	0	0	0	0	0	0
900-1000	0	0	0	0	0	0	0	0	0	0	0
1000-1100	0	0	0	0	0	0	0	0	0	0	0
1100-1200	0	0	0	0	0	0	0	0	0	0	0
1200-1300	0	0	0	0	0	0	0	0	0	0	0
1300-1400	0	0	0	0	0	0					0
1400-1500											0
1500-1600											0
1600-1700											0
1700-1800											0
1800-1900											0
1900-2000											0
TOTAL											0

DATE	1,2/07/02				WOODLAND				Coed Drysiog		
BEARING	97 (50-110)				TRANSECT SEP.				80		
TRANSECT (m)	10	20	30	40	50	60	70	80	90	100	TOTAL
0-100	0	0	0	0	0	0	0	0	0	0	0
100-200	0	0	0	0	0	0	0	0	0	0	0
200-300	0	0	0	0	0	0	0	0	0	0	0
300-400	0	0	0	0	0	0	0	0	0	0	0
400-500	0	0	0	0	0	0	0	0	0	0	0
500-600	0	0	0	0	0	0	0	0	0	0	0
600-700	0	0	0	0	0	0	0	0	0	0	0
700-800	0	0	0	0	0	0	0	0	0	0	0
800-900	0	0	0	0	0	0	0	0	0	0	0
900-1000	0	0	0	0	0	0	0	0	0	0	0
1000-1100	0	0	0	0	0	0	0	0	0	0	0
1100-1200	0	0	0	0	0	0	0	0	0	0	0
1200-1300	0	0	0	0	0	0	0	0	0	0	0
1300-1400											0
1400-1500											0
1500-1600											0
1600-1700											0
1700-1800											0
1800-1900											0
1900-2000											0
TOTAL											0

DATE	1,2/08/02				WOODLAND				Coed-y-Brenin		
BEARING	19 (315-45)				TRANSECT SEP.				20		
TRANSECT (m)	10	20	30	40	50	60	70	80	90	100	TOTAL
0-100	0	1	1	2	0	0	1	0	0	0	5
100-200	0	0	2	1	0	0	0	0	1	0	4
200-300	0	0	0	0	0	0	0	0	1	1	2
300-400	2	1	0	2	0	1	1	0	0	1	8
400-500	0	0	0	0	1	0	3	0	0	0	4
500-600	0	1	0	0	0	0	0	0	0	1	2
600-700	0	0	1	0	0	0	0	1	2	0	4
700-800	0	0	0	0	0	0	0	1	1	0	2
800-900	0	0	0	0	0	0	0	0	1	1	2
900-1000	1	0	0	0	1	0	0	0	0	0	2
1000-1100	1	0	1	0	0	0	0	0	0	0	2
1100-1200	0	0	2	0	0	0	0	0	0	1	3
1200-1300	0	0	0	0	0	0	0	0	0	1	1
1300-1400											0
1400-1500											0
1500-1600											0
1600-1700											0
1700-1800											0
1800-1900											0
1900-2000											0
TOTAL											41

DATE	27,28/06/02				WOODLAND				Croes Robert		
BEARING	175 (155-225)				TRANSECT SEP.				150		
TRANSECT (m)	10	20	30	40	50	60	70	80	90	100	TOTAL
0-100	0	0	0	0	0	0	1	0	0	0	1
100-200	0	0	0	1	0	0	0	0	0	0	1
200-300	0	0	0	1	0	1	0	0	0	0	2
300-400	0	0	2	0	0	0	0	0	0	0	2
400-500	0	0	0	0	0	0	0	0	0	0	0
500-600	0	1	0	0	0	0	0	0	0	0	1
600-700	0	0	0	0	0	0	1	0	0	0	1
700-800	0	0	1	0	0	0	0	0	0	0	1
800-900	0	0	0	0	0	0	0	0	0	0	0
900-1000	0	0	0	0	0	0	0	0	0	0	0
1000-1100	0	0	0	0	0	0	0	0	0	0	0
1100-1200	0	0	0	0	0	0	0	0	0	0	0
1200-1300	0	0	0	0	0	1	1	1	0	0	3
1300-1400	0	0	0	0	0	0	0	0	0	0	0
1400-1500	0	0	0	0	0	0	0	0	0	0	0
1500-1600	0	0	0	0	0	0	0	0	0	0	0
1600-1700	0	0	0	0	1	0	0	0	0	0	1
1700-1800											0
1800-1900											0
1900-2000											0
TOTAL											13

DATE	5,6/07/02				WOODLAND				Cwm Byddog		
BEARING	218 (180-300)				TRANSECT SEP.				25		
TRANSECT (m)	10	20	30	40	50	60	70	80	90	100	TOTAL
0-100	0	0	0	0	0	0	0	0	0	0	0
100-200	0	0	0	0	0	0	0	0	0	0	0
200-300	0	0	0	0	0	0	0	0	0	0	0
300-400	0	0	0	0	0	0	0	0	0	0	0
400-500	0	0	0	0	0	0	0	0	0	0	0
500-600	0	0	0	0	0	0	0	0	0	0	0
600-700	0	0	0	0	0	0	0	0	0	0	0
700-800	0	0	0	0	0	0	0	0	0	0	0
800-900	0	0	0	0	0	0	0	0	0	0	0
900-1000	0	0	0	0	0	0	0	0	0	0	0
1000-1100	0	0	0	0	0	0	0	0	0	0	0
1100-1200	0	0	0	0	0	0	0	0	0	0	0
1200-1300	0	0	0	0	0	0	0	0	0		0
1300-1400											0
1400-1500											0
1500-1600											0
1600-1700											0
1700-1800											0
1800-1900											0
1900-2000											0
TOTAL											0

DATE	29,30/06/02				WOODLAND				Cwm Oergwm		
BEARING	283 (250-300)				TRANSECT SEP.				100		
TRANSECT (m)	10	20	30	40	50	60	70	80	90	100	TOTAL
0-100	0	0	0	0	0	0	0	0	0	0	0
100-200	0	0	0	0	0	0	0	0	0	0	0
200-300	0	0	0	0	0	0	0	0	0	0	0
300-400	0	0	0	0	0	0	0	0	0	0	0
400-500	0	0	0	0	0	0	0	0	0	0	0
500-600	0	0	0	0	0	0	0	0	0	0	0
600-700	0	0	0	0	0	0	0	0	0	0	0
700-800	0	0	0	0	0	0	0	0	0	0	0
800-900	0	0	0	0	0	0	0	0	0	0	0
900-1000	0	0	0	0	0	0	0	0	0	0	0
1000-1100	0	0	0	0	0	0	0	0	0	0	0
1100-1200	0	0	0	0	0	0	0	0	0	0	0
1200-1300	0	0	0	0	0	0	0				0
1300-1400											0
1400-1500											0
1500-1600											0
1600-1700											0
1700-1800											0
1800-1900											0
1900-2000											0
TOTAL											0

DATE	13,14/07/02				WOODLAND				Dyfnant		
BEARING	167 (130-170)				TRANSECT SEP.				20		
TRANSECT (m)	10	20	30	40	50	60	70	80	90	100	TOTAL
0-100	0	0	0	0	0	0	0	0	0	0	0
100-200	0	0	0	0	0	0	0	0	0	0	0
200-300	0	0	0	0	0	0	0	0	0	0	0
300-400	0	0	0	0	0	0	0	0	0	0	0
400-500	0	0	0	0	0	0	0	0	0	0	0
500-600	0	0	0	0	0	0	0	0	0	0	0
600-700	0	0	0	0	0	0	0	0	0	0	0
700-800	0	0	0	0	0	0	0	0	0	0	0
800-900	0	0	0	0	0	0	0	0	0	0	0
900-1000	0	0	0	0	0	0	0	0	0	0	0
1000-1100	0	0	0	0	0	0	0	0	0	0	0
1100-1200	0	0	0	0	0	0	0	0	0	0	0
1200-1300	0	0	0	0	0	0	0	0	0	0	0
1300-1400											0
1400-1500											0
1500-1600											0
1600-1700											0
1700-1800											0
1800-1900											0
1900-2000											0
TOTAL											0

DATE	15,16/06/02				WOODLAND				Nantporth		
BEARING	122 (90-130)				TRANSECT SEP.				10		
TRANSECT (m)	10	20	30	40	50	60	70	80	90	100	TOTAL
0-100	0	0	0	0	0	0	0	0	0	0	0
100-200	0	0	0	0	0	0	0	0	0	0	0
200-300	0	0	0	0	0	0	0	0	0	0	0
300-400	0	0	0	0	0	0	0	0	0	0	0
400-500	0	0	0	0	0	0	0	0	0	0	0
500-600	0	0	0	0	0	0	0	0	0	0	0
600-700	0	0	0	0	0	0	0	0	0	0	0
700-800	0	0	0	0	0	0	0	0	0	0	0
800-900	0	0	0	0	0	0	0	0	0	0	0
900-1000	0	0	0	0	0	0	0	0	0	0	0
1000-1100	0	0	0	0	0	0	0	0	0		0
1100-1200											0
1200-1300											0
1300-1400											0
1400-1500											0
1500-1600											0
1600-1700											0
1700-1800											0
1800-1900											0
1900-2000											0
TOTAL											0

DATE	11,12/07/02				WOODLAND				Pendugwm		
BEARING	270 (180-270)				TRANSECT SEP.				30		
TRANSECT (m)	10	20	30	40	50	60	70	80	90	100	TOTAL
0-100	0	0	0	0	0	0	0	0	0	0	0
100-200	0	0	0	0	0	0	0	0	0	0	0
200-300	0	0	0	0	0	0	0	0	0	0	0
300-400	0	0	0	0	0	0	0	0	0	0	0
400-500	0	0	0	0	0	0	0	0	0	0	0
500-600	0	0	0	0	0	0	0	0	0	0	0
600-700	0	0	0	0	0	0	0	0	0	0	0
700-800	0	0	0	0	0	0	0	0	0	0	0
800-900	0	0	0	0	0	0	0	0	0	0	0
900-1000	0	0	0	0	0	0	0	0	0	0	0
1000-1100	0	0	0	0	0	0	0	0	0	0	0
1100-1200	0	0	0	0	0	0	0	0	0	0	0
1200-1300	0	0	0	0	0	0	0	0	0	0	0
1300-1400	0	0	0	0	0	0	0	0	0	0	0
1400-1500	0	0	0	0	0	0	0	0	0	0	0
1500-1600	0	0	0	0	0						0
1600-1700											0
1700-1800											0
1800-1900											0
1900-2000											0
TOTAL											0

DATE	25,26/06/02				WOODLAND				Prisk Wood		
BEARING	102 (80-120)				TRANSECT SEP.				60		
TRANSECT (m)	10	20	30	40	50	60	70	80	90	100	TOTAL
0-100	0	2	0	0	1	2	0	2	1	2	10
100-200	1	1	1	2	2	0	0	0	0	2	9
200-300	1	0	1	0	0	1	0	0	0	0	3
300-400	0	1	1	2	3	3	3	5	0	0	18
400-500	0	0	0	1	0	2	0	0	1	0	4
500-600	0	0	0	0	0	2	1	0	1	0	4
600-700	0	0	0	0	1	1	0	0	0	0	2
700-800	0	0	1	1	0	0	0	1	2	0	5
800-900	0	1	0	0	1	0	2	0	0	0	4
900-1000	0	0	0	0	0	0	0	0	0	0	0
1000-1100	0	0	0	0	1	1	0	0	1	0	3
1100-1200	0	0	0	0	0	0	1	0	1	0	2
1200-1300	3	1	0	0	0	0	0	0	1	0	5
1300-1400	0	0	0	0	0						0
1400-1500											0
1500-1600											0
1600-1700											0
1700-1800											0
1800-1900											0
1900-2000											0
TOTAL											69

DATE	3,4/07/02				WOODLAND				Pwll-y-wrach		
BEARING	321 (310-345)				TRANSECT SEP.				70		
TRANSECT (m)	10	20	30	40	50	60	70	80	90	100	TOTAL
0-100	0	0	0	0	0	0	0	0	0	0	0
100-200	0	0	0	0	0	0	0	0	0	0	0
200-300	0	0	0	0	0	0	0	0	0	0	0
300-400	0	0	0	0	0	0	0	0	0	0	0
400-500	0	0	0	0	0	0	0	0	0	0	0
500-600	0	0	0	0	0	0	0	0	0	0	0
600-700	0	0	0	0	0	0	0	0	0	0	0
700-800	0	0	0	0	0	0	0	0	0	0	0
800-900	0	0	0	0	0	0	0	0	0	0	0
900-1000	0	0	0	0	0	0	0	0	0	0	0
1000-1100	0	0	0	0	0	0	0	0	0	0	0
1100-1200	0	0	0	0	0	0	0	0	0	0	0
1200-1300	0	0	0	0	0	0	0	0	0	0	0
1300-1400	0	0	0	0	0	0					0
1400-1500											0
1500-1600											0
1600-1700											0
1700-1800											0
1800-1900											0
1900-2000											0
TOTAL											0

Reference No.	Site	date	treatment	Exclosure	Ash - Fraxinus Excelsior	Autumn hawkbit - Leontodon autumnalis	Barren strawberry - Potentilla sterilis	Beech- Fagus sylvatica	Birds Foot Trefoil - Lotus corniculatus	Black Bryony - Tamus communis	Bluebell - Hyacinthoides non-scripta	Bracken - Pteridium aquilinum
1111	1	1	1	1	0	0	0	0	0	0	0	0
1112	1	1	1	2	1	0	0	0	0	0	0	0
1113	1	1	1	3	0	0	0	0	0	0	0	0
1121	1	1	2	1	0	0	0	0	0	0	0	0
1122	1	1	2	2	1	0	0	0	0	0	1	0
1123	1	1	2	3	0	0	0	0	0	0	0	0
1211	1	2	1	1	1	0	0	0	0	0	23	0
1212	1	2	1	2	0	0	0	0	0	0	0	0
1213	1	2	1	3	1	0	0	0	0	0	21	0
1221	1	2	2	1	0	0	0	0	0	0	5	0
1222	1	2	2	2	0	0	0	0	0	0	0	0
1223	1	2	2	3	1	0	0	0	0	0	1	0
1311	1	3	1	1	1	0	0	0	0	0	23	0
1312	1	3	1	2	1	0	0	0	0	0	23	0
1313	1	3	1	3	0	0	0	0	0	0	0	0
1321	1	3	2	1	0	0	0	0	0	0	13	0
1322	1	3	2	2	0	0	0	0	0	0	0	0
1323	1	3	2	3	0	0	0	0	0	0	0	0
2111	2	1	1	1	0	0	0	0	0	0	1	0
2112	2	1	1	2	0	0	0	0	0	0	0	0
2113	2	1	1	3	0	0	0	0	0	0	0	0
2121	2	1	2	1	3	0	0	0	0	0	0	0
2122	2	1	2	2	0	0	0	0	0	0	0	0
2123	2	1	2	3	3	0	0	0	0	0	1	0
2211	2	2	1	1	0	0	0	0	0	0	22	0
2212	2	2	1	2	0	0	0	0	0	0	0	0
2213	2	2	1	3	0	0	0	0	0	0	0	0
2221	2	2	2	1	3	0	0	0	0	0	0	0
2222	2	2	2	2	0	0	0	0	0	0	0	0
2223	2	2	2	3	3	0	0	0	0	0	0	0
2311	2	3	1	1	0	0	0	0	0	0	22	0
1312	2	3	1	2	0	0	0	0	0	0	0	0
2313	2	3	1	3	0	0	0	0	0	0	0	0
2321	2	3	2	1	0	0	0	0	0	0	0	0
2322	2	3	2	2	3	0	0	0	0	0	0	0
2323	2	3	2	3	0	0	0	0	0	0	0	0
3111	3	1	1	1	0	0	0	0	0	0	0	0
3112	3	1	1	2	0	0	0	0	0	0	0	0
3113	3	1	1	3	0	0	0	0	0	0	0	0

Reference No.	Site	date	treatment	Exclosure	Ash - Fraxinus Excelsior	Autumn hawkbit - Leontodon autumnalis	Barren strawberry - Potentilla sterilis	Beech- Fagus sylvatica	Birds Foot Trefoil - Lotus corniculatus	Black Bryony - Tamus communis	Bluebell - Hyacinthoides non-scripta	Bracken - Pteridium aquilinum
3121	3	1	2	1	0	0	0	0	0	0	0	0
3122	3	1	2	2	0	0	0	0	0	0	0	0
3123	3	1	2	3	0	0	0	0	0	0	0	0
3211	3	2	1	1	0	0	0	0	0	0	0	0
3212	3	2	1	2	0	0	0	0	0	0	0	0
3213	3	2	1	3	0	0	0	0	0	0	0	0
3221	3	2	2	1	0	0	0	0	0	0	0	0
3222	3	2	2	2	0	0	0	0	0	0	0	0
3223	3	2	2	3	0	0	0	0	0	0	0	0
3311	3	3	1	1	0	0	0	0	0	0	0	0
3312	3	3	1	2	0	0	0	0	0	0	0	0
3313	3	3	1	3	0	0	0	0	0	0	0	0
3321	3	3	2	1	0	0	0	0	0	0	0	0
3322	3	3	2	2	0	0	0	0	0	0	0	0
3323	3	3	2	3	0	0	0	0	0	0	0	0
4111	4	1	1	1	1	0	0	0	0	0	0	0
4112	4	1	1	2	0	0	0	0	0	0	0	0
4113	4	1	1	3	0	0	0	0	0	0	0	0
4121	4	1	2	1	0	0	0	0	0	0	0	0
4122	4	1	2	2	2	0	0	0	0	0	0	0
4123	4	1	2	3	0	0	0	0	0	0	0	0
4211	4	2	1	1	1	0	0	0	0	0	0	0
4212	4	2	1	2	1	0	0	0	0	0	0	0
4213	4	2	1	3	0	0	0	0	0	0	0	0
4221	4	2	2	1	0	0	0	0	0	0	0	0
4222	4	2	2	2	3	0	0	0	0	0	0	0
4223	4	2	2	3	0	0	0	0	0	0	0	0
4311	4	3	1	1	1	0	0	0	0	0	0	0
4312	4	3	1	2	1	0	0	0	0	0	0	0
4313	4	3	1	3	0	0	0	0	0	0	0	0
4321	4	3	2	1	0	0	0	0	0	0	0	0
4323	4	3	2	2	3	0	0	0	0	0	0	0
4323	4	3	2	3	0	0	0	0	0	0	0	0
5111	5	1	1	1	0	0	0	0	0	0	0	0
5112	5	1	1	2	0	0	0	0	0	0	0	0
5113	5	1	1	3	0	0	0	0	0	0	0	0
5121	5	1	2	1	0	0	0	0	0	0	0	0
5122	5	1	2	2	0	0	0	0	0	0	0	0
5123	5	1	2	3	0	0	0	0	0	0	0	0

Reference No.	Site	date	treatment	Exclosure	Ash - Fraxinus Excelsior	Autumn hawkbit - Leontodon autumnalis	Barren strawberry - Potentilla sterilis	Beech- Fagus sylvatica	Birds Foot Trefoil - Lotus corniculatus	Black Bryony - Tamus communis	Bluebell - Hyacinthoides non-scripta	Bracken - Pteridium aquilinum
5211	5	2	1	1	0	0	0	0	0	0	0	0
5212	5	2	1	2	0	0	0	0	0	0	0	1
5213	5	2	1	3	0	0	0	0	0	0	0	0
5221	5	2	2	1	0	0	0	0	0	0	0	0
5222	5	2	2	2	0	0	0	0	0	0	0	0
5223	5	2	2	3	0	0	0	0	0	0	0	0
5311	5	3	1	1	0	0	0	0	0	0	0	0
5312	5	3	1	2	0	0	0	0	0	0	0	1
5313	5	3	1	3	0	0	0	0	0	0	0	0
5321	5	3	2	1	0	0	0	0	0	0	0	0
5322	5	3	2	2	0	0	0	0	0	0	0	0
5323	5	3	2	3	0	0	0	0	0	0	0	0
6111	6	1	1	1	3	0	0	0	0	0	0	0
6112	6	1	1	2	0	0	0	0	0	0	0	0
6113	6	1	1	3	0	0	0	0	0	0	0	0
6121	6	1	2	1	0	0	0	0	0	0	0	0
6122	6	1	2	2	1	0	0	0	0	0	0	0
6123	6	1	2	3	0	0	0	0	0	0	0	0
6211	6	2	1	1	0	0	0	0	0	0	0	0
6212	6	2	1	2	0	0	0	0	0	0	0	0
6213	6	2	1	3	0	0	0	0	0	0	0	0
6221	6	2	2	1	0	0	0	0	0	0	0	0
6222	6	2	2	2	0	0	0	0	0	0	0	0
6223	6	2	2	3	0	0	0	0	0	0	0	0
6311	6	3	1	1	3	0	0	0	0	0	0	0
6312	6	3	1	2	8	0	0	0	0	0	0	0
6313	6	3	1	3	0	0	0	0	0	0	0	0
6321	6	3	2	1	0	0	0	0	0	0	0	0
6322	6	3	2	2	0	0	0	0	0	0	0	0
6323	6	3	2	3	0	0	0	0	0	0	0	0
7111	7	1	1	1	0	0	0	0	4	0	0	0
7112	7	1	1	2	0	0	0	0	0	0	0	0
7113	7	1	1	3	0	12	0	0	0	0	0	0
7121	7	1	2	1	0	10	0	0	0	0	0	0
7122	7	1	2	2	0	0	0	0	0	0	0	0
7123	7	1	2	3	0	20	0	0	0	0	0	0
7211	7	2	1	1	0	0	0	0	0	0	0	0
7212	7	2	1	2	0	0	0	0	0	0	0	0
7213	7	2	1	3	0	0	0	0	0	0	0	0

Reference No.	Site	date	treatment	Exclosure	Ash - Fraxinus Excelsior	Autumn hawkbit - Leontodon autumnalis	Barren strawberry - Potentilla sterilis	Beech- Fagus sylvatica	Birds Foot Trefoil - Lotus corniculatus	Black Bryony - Tamus communis	Bluebell - Hyacinthoides non-scripta	Bracken - Pteridium aquilinum
7222	7	2	2	1	0	0	0	0	0	0	0	0
7222	7	2	2	2	0	0	0	0	0	0	0	0
7223	7	2	2	3	0	0	0	0	0	0	0	0
7311	7	3	1	1	0	0	0	0	0	0	0	0
7312	7	3	1	2	0	0	0	0	0	0	0	0
7313	7	3	1	3	0	0	0	0	0	0	0	0
7321	7	3	2	1	0	0	0	0	0	0	0	0
7322	7	3	2	2	0	0	0	0	0	0	0	0
7323	7	3	2	3	0	0	0	0	0	0	0	0
8111	8	1	1	1	0	0	0	0	0	0	0	1
8112	8	1	1	2	0	0	0	0	0	0	0	0
8113	8	1	1	3	0	0	0	0	0	0	0	0
8121	8	1	2	1	0	0	0	0	0	0	0	0
8122	8	1	2	2	0	0	0	0	0	0	0	0
8123	8	1	2	3	0	0	0	0	0	0	0	0
8211	8	2	1	1	1	0	0	0	0	0	0	1
8212	8	2	1	2	0	0	0	0	0	0	0	10
8213	8	2	1	3	0	0	0	0	0	0	0	0
8222	8	2	2	1	3	0	0	0	0	0	0	9
8222	8	2	2	2	0	0	0	0	0	0	0	3
8223	8	2	2	3	0	0	0	0	0	0	0	0
8311	8	3	1	1	1	0	0	0	0	0	0	1
8312	8	3	1	2	0	0	0	0	0	0	0	10
8313	8	3	1	3	0	0	0	0	0	0	0	15
8321	8	3	2	1	3	0	0	0	0	0	0	9
8322	8	3	2	2	0	0	0	0	0	0	0	3
8323	8	3	2	3	0	0	0	0	0	0	0	10
9111	9	1	1	1	2	0	0	0	0	0	2	0
9112	9	1	1	2	3	0	0	0	0	0	0	0
9113	9	1	1	3	0	0	0	0	0	0	0	0
9121	9	1	2	1	3	0	0	0	0	0	1	0
9122	9	1	2	2	0	0	0	0	0	0	0	0
9123	9	1	2	3	0	0	0	0	0	0	0	0
9211	9	2	1	1	2	0	0	0	0	0	2	0
9212	9	2	1	2	0	0	0	0	0	0	22	0
9213	9	2	1	3	0	0	0	0	0	0	0	0
9221	9	2	2	1	3	0	0	0	0	0	1	0
9222	9	2	2	2	0	0	0	0	0	0	30	0
9223	9	2	2	3	0	0	0	0	0	0	0	0

Reference No.	Site	date	treatment	Exclosure	Ash - Fraxinus Excelsior	Autumn hawkbit - Leontodon autumnalis	Barren strawberry - Potentilla sterilis	Beech- Fagus sylvatica	Birds Foot Trefoil - Lotus corniculatus	Black Bryony - Tamus communis	Bluebell - Hyacinthoides non-scripta	Bracken - Pteridium aquilinum
9311	9	3	1	1	2	0	0	0	0	0	2	0
9312	9	3	1	2	0	0	0	0	0	0	22	0
9313	9	3	1	3	0	0	0	0	0	0	0	0
9321	9	3	2	1	3	0	0	0	0	0	1	0
9322	9	3	2	2	0	0	0	0	0	0	30	0
9323	9	3	2	3	0	0	0	0	0	0	0	0
10111	10	1	1	1	6	0	0	0	0	0	0	0
10112	10	1	1	2	0	0	0	0	0	0	0	0
10113	10	1	1	3	0	0	0	0	0	0	0	0
10121	10	1	2	1	4	0	0	0	0	0	0	0
10122	10	1	2	2	1	0	0	0	0	0	0	0
10123	10	1	2	3	1	0	0	0	0	0	0	0
10211	10	2	1	1	0	0	0	0	0	0	0	0
10212	10	2	1	2	6	0	0	0	0	0	0	0
10213	10	2	1	3	6	0	0	0	0	0	0	0
10221	10	2	2	1	0	0	0	0	0	0	0	0
10222	10	2	2	2	1	0	0	0	0	0	0	0
10223	10	2	2	3	1	0	0	0	0	0	0	0
10311	10	3	1	1	0	0	0	0	0	0	0	0
10312	10	3	1	2	0	0	0	0	0	0	0	0
10313	10	3	1	3	6	0	0	0	0	0	1	0
10321	10	3	2	1	0	0	0	0	0	0	0	0
10322	10	3	2	2	1	0	0	0	0	0	0	0
10323	10	3	2	3	1	0	0	0	0	0	1	0
11111	11	1	1	1	0	0	0	0	0	0	0	0
11112	11	1	1	2	0	0	0	0	0	0	0	0
11113	11	1	1	3	0	0	0	0	0	0	0	0
11121	11	1	2	1	0	0	0	0	0	0	0	0
11122	11	1	2	2	0	0	0	0	0	0	0	0
11123	11	1	2	3	0	0	0	0	0	0	0	0
11211	11	2	1	1	0	0	0	0	0	0	0	0
11212	11	2	1	2	0	0	0	0	0	0	0	0
11213	11	2	1	3	0	0	0	0	0	0	43	0
11221	11	2	2	1	0	0	0	0	0	0	0	0
11222	11	2	2	2	0	0	0	0	0	0	0	0
11223	11	2	2	3	0	0	0	0	0	0	30	0
11311	11	3	1	1	0	0	0	0	0	0	0	0
11312	11	3	1	2	0	0	0	0	0	0	0	0
11313	11	3	1	3	0	0	0	0	0	0	43	0

Reference No.	Site	date	treatment	Exclosure	Ash - Fraxinus Excelsior	Autumn hawkbit - Leontodon autumnalis	Barren strawberry - Potentilla sterilis	Beech- Fagus sylvatica	Birds Foot Trefoil - Lotus corniculatus	Black Bryony - Tamus communis	Bluebell - Hyacinthoides non-scripta	Bracken - Pteridium aquilinum
11321	11	3	2	1	0	0	0	0	0	0	0	0
11322	11	3	2	2	0	0	0	0	0	0	0	0
11323	11	3	2	3	0	0	0	0	0	0	30	0
12111	12	1	1	1	0	0	0	0	0	0	0	1
12112	12	1	1	2	3	0	0	0	0	0	0	0
12113	12	1	1	3	1	0	0	1	0	0	0	3
12121	12	1	2	1	0	0	0	0	0	0	0	0
12122	12	1	2	2	1	0	0	0	0	0	0	0
12123	12	1	2	3	0	0	0	0	0	0	0	1
12211	12	2	1	1	0	0	0	0	0	0	0	1
12212	12	2	1	2	3	0	0	0	0	0	0	0
12213	12	2	1	3	1	0	0	1	0	0	0	3
12221	12	2	2	1	0	0	0	0	0	0	0	0
12222	12	2	2	2	1	0	0	0	0	0	0	0
12223	12	2	2	3	0	0	0	0	0	0	0	2
12311	12	3	1	1	0	0	0	0	0	0	0	1
12312	12	3	1	2	3	0	0	0	0	0	0	0
12313	12	3	1	3	1	0	0	1	0	0	0	3
12321	12	3	2	1	0	0	0	0	0	0	0	0
12322	12	3	2	2	1	0	0	0	0	0	0	0
12323	12	3	2	3	0	0	0	0	0	0	0	1

Reference No.	Bramble - Rubus fruiticosus	Broad Buckler Fern - Dryopteris austriaca	Bugle - Ajuga reptans	Cleavers – Galium aparine	Clustered dock – Rumex conglomeratus	Common bent – Agrostis capillaris	Common couch - Elystrigia repens	Compact rush- Juncus conglomeratus	Common spotted orchid- Dactylorhiza fuschii	Cow Parsley - Anthriscus slyvestris	Cranesbill - Geranium spp.	Creeping Bent - Agrostis stolonifera
1111	0	0	0	0	0	5	0	0	0	0	0	0
1112	3	0	0	0	0	0	0	0	0	0	0	0
1113	4	0	0	0	0	0	0	0	0	0	0	0
1121	0	0	0	1	4	4	0	0	0	0	0	0
1122	4	0	0	0	0	0	0	0	0	0	0	0
1123	2	0	0	0	0	0	0	0	0	0	0	0
1211	7	0	0	0	0	0	0	0	0	0	0	0
1212	0	0	0	34	0	0	0	0	0	0	0	0
1213	6	0	0	0	0	0	0	0	0	0	0	0
1221	6	0	0	9	0	0	0	0	0	0	0	0
1222	0	0	0	17	0	0	0	0	0	0	0	0
1223	4	0	0	0	0	0	0	0	0	0	0	0
1311	7	0	0	0	0	0	0	0	0	0	0	0
1312	6	0	0	0	0	0	0	0	0	0	0	0
1313	0	0	0	0	0	0	0	0	0	0	0	0
1321	6	0	0	12	0	0	0	0	0	0	0	0
1322	0	0	0	0	0	0	0	0	0	0	0	0
1323	0	0	0	0	0	0	0	0	0	0	0	0
2111	0	0	0	1	0	0	0	0	0	0	0	0
2112	0	0	0	8	0	0	0	0	0	0	0	0
2113	2	0	0	5	0	0	0	0	0	0	0	0
2121	1	0	0	1	0	0	0	0	0	0	0	0
2122	0	0	0	4	0	0	0	0	0	0	0	0
2123	2	0	0	8	0	0	0	0	0	0	0	0
2211	2	0	0	30	0	0	0	0	0	0	0	0
2212	1	0	0	35	0	0	0	0	0	0	0	0
2213	2	0	0	36	0	0	0	0	0	0	0	0
2221	1	0	0	1	0	0	0	0	0	0	0	0
2222	1	0	0	4	0	0	0	0	0	0	0	0
2223	2	0	0	8	0	0	0	0	0	0	0	0
2311	2	0	0	30	0	0	0	0	0	0	0	0
1312	1	0	0	35	0	0	0	0	0	0	0	0
2313	2	0	0	40	0	0	0	0	0	0	0	0
2321	1	0	0	1	0	0	0	0	0	0	0	0
2322	1	0	0	4	0	0	0	0	0	0	0	0
2323	2	0	0	20	0	0	0	0	0	0	0	0
3111	13	0	0	0	0	0	0	0	0	0	0	0
3112	5	0	0	0	0	0	0	0	0	0	0	0
3113	3	0	0	2	0	0	0	0	0	1	0	0

Reference No.	Bramble - Rubus fruiticosus	Broad Buckler Fern - Dryopteris austriaca	Bugle - Ajuga reptans	Cleavers -- Galium aparine	Clustered dock -- Rumex conglomeratus	Common bent -- Agrostis capillaris	Common couch - Elystrigia repens	Compact rush- Juncus conglomeratus	Common spotted orchid- Dactylorhiza fuschii	Cow Parsley - Anthriscus slyvestris	Cranesbill - Geranium spp.	Creeping Bent - Agrostis stolonifera
3121	0	0	0	0	0	0	0	0	0	0	0	0
3122	7	0	0	0	0	0	0	0	0	0	0	0
3123	0	0	0	0	0	0	0	0	0	2	0	0
3211	0	0	0	0	0	0	0	0	0	0	0	0
3212	4	0	0	0	0	0	0	0	0	0	0	0
3213	4	0	0	0	0	0	0	0	0	7	0	0
3221	0	0	0	0	0	0	0	0	0	0	0	0
3222	7	0	0	0	0	0	0	0	0	0	0	0
3223	0	0	0	0	0	0	0	0	0	2	0	0
3311	0	0	0	0	0	0	0	0	0	0	0	0
3312	4	0	0	0	0	0	0	0	0	0	0	0
3313	4	0	0	2	0	0	0	0	0	7	0	0
3321	13	0	0	0	0	0	0	0	0	0	0	0
3322	7	0	0	0	0	0	0	0	0	0	0	0
3323	0	0	0	0	0	0	0	0	0	2	0	0
4111	0	5	0	0	0	0	0	0	0	0	0	0
4112	3	0	0	0	0	0	0	0	0	0	0	0
4113	0	0	0	0	0	0	0	0	0	0	0	0
4121	1	4	0	0	0	0	0	0	0	0	0	0
4122	6	0	0	0	0	0	0	0	0	0	0	0
4123	0	0	0	0	0	0	0	0	0	0	0	0
4211	0	8	0	0	0	0	0	0	0	0	0	0
4212	8	0	0	0	0	0	0	0	0	0	0	0
4213	0	0	0	0	0	0	0	0	0	0	0	0
4221	1	7	0	0	0	0	0	0	0	0	0	0
4222	7	0	0	0	0	0	0	0	0	0	0	0
4223	0	0	0	0	0	0	0	0	0	0	0	0
4311	0	8	0	0	0	0	0	0	0	0	0	0
4312	8	0	0	0	0	0	0	0	0	0	0	0
4313	2	0	0	0	0	0	0	0	0	0	0	0
4321	1	7	0	0	0	0	0	0	0	0	0	0
4323	7	0	0	0	0	0	0	0	0	0	0	0
4323	1	0	0	0	0	0	0	0	0	0	0	0
5111	0	0	0	0	0	0	0	0	0	0	0	0
5112	4	0	0	0	0	0	0	0	0	0	0	0
5113	0	0	0	0	0	0	0	0	0	0	0	0
5121	0	0	0	0	0	0	0	0	0	0	0	0
5122	7	0	0	0	0	0	0	0	0	0	0	0
5123	0	0	0	0	0	0	0	0	0	0	0	0

Reference No.	Bramble - Rubus fruiticosus	Broad Buckler Fern - Dryopteris austriaca	Bugle - Ajuga reptans	Cleavers – Galium aparine	Clustered dock – Rumex conglomeratus	Common bent – Agrostis capillaris	Common couch - Elystrigia repens	Compact rush- Juncus conglomeratus	Common spotted orchid- Dactylorhiza fuschii	Cow Parsley - Anthriscus slyvestris	Cranesbill - Geranium spp.	Creeping Bent - Agrostis stolonifera
5211	0	0	0	6	0	0	0	0	0	2	0	0
5212	2	0	0	0	0	0	0	0	0	0	0	0
5213	0	0	0	2	0	0	0	0	0	0	0	0
5221	0	0	0	11	0	0	0	0	0	0	0	0
5222	7	0	0	0	0	0	0	0	0	0	0	0
5223	0	0	0	3	0	0	0	0	0	0	0	0
5311	0	0	0	20	0	0	0	0	0	2	0	0
5312	2	0	0	0	0	0	0	0	0	0	0	0
5313	0	0	0	2	0	0	0	0	0	0	0	0
5321	0	0	0	11	0	0	0	0	0	0	0	0
5322	7	0	0	0	0	0	0	0	0	0	0	0
5323	0	0	0	3	0	0	0	0	0	0	0	0
6111	0	2	0	0	0	0	0	0	0	0	0	0
6112	0	0	0	0	0	0	0	0	0	0	0	0
6113	8	0	0	1	0	0	0	0	0	0	0	0
6121	2	1	0	0	0	0	0	0	0	0	0	0
6122	0	0	0	0	0	0	0	0	0	0	0	0
6123	8	0	0	0	0	0	0	0	0	0	0	0
6211	0	0	0	0	0	0	0	0	0	0	0	0
6212	0	0	0	0	0	0	0	0	0	0	0	0
6213	0	0	0	0	0	0	0	0	0	0	0	0
6221	0	0	0	0	0	0	0	0	0	0	0	0
6222	0	0	0	0	0	0	0	0	0	0	0	0
6223	0	0	0	0	0	0	0	0	0	0	0	0
6311	0	2	0	0	0	0	0	0	0	0	0	0
6312	1	4	0	0	0	0	0	0	0	0	0	0
6313	8	0	0	1	0	0	0	0	0	0	0	0
6321	2	1	0	0	0	0	0	0	0	0	0	1
6322	3	1	0	0	0	0	0	0	0	0	0	0
6323	8	0	0	0	0	0	0	0	0	0	0	0
7111	0	0	0	0	0	5	0	0	0	0	0	0
7112	0	0	0	0	0	0	0	0	0	0	0	0
7113	0	0	0	0	0	5	0	0	0	0	0	0
7121	0	0	0	0	0	15	0	0	0	0	0	0
7122	0	0	0	0	0	0	0	0	0	0	0	0
7123	0	0	0	0	0	5	0	0	0	0	0	0
7211	0	0	0	0	0	10	5	0	0	0	0	0
7212	0	0	0	0	0	0	0	0	8	0	0	30
7213	0	0	0	0	0	5	0	0	0	0	0	0

Reference No.	Bramble - Rubus fruiticosus	Broad Buckler Fern - Dryopteris austriaca	Bugle - Ajuga reptans	Cleavers – Galium aparine	Clustered dock – Rumex conglomeratus	Common bent – Agrostis capillaris	Common couch - Elystrigia repens	Compact rush- Juncus conglomeratus	Common spotted orchid- Dactylorhiza fuschii	Cow Parsley - Anthriscus slyvestris	Cranesbill - Geranium spp.	Creeping Bent - Agrostis stolonifera
7222	0	0	0	0	0	15	0	0	0	0	0	0
7222	0	0	0	0	0	0	0	0	0	0	0	0
7223	0	0	0	0	0	5	0	0	0	0	0	0
7311	0	0	0	0	0	10	2	0	0	0	0	0
7312	0	0	0	0	0	0	0	0	3	0	0	30
7313	0	0	0	0	0	5	0	0	0	0	0	0
7321	0	0	0	0	0	15	0	0	0	0	0	0
7322	0	0	0	0	0	0	0	1	0	0	0	0
7323	0	0	0	0	0	5	0	0	0	0	0	0
8111	0	0	0	0	0	0	0	0	0	0	0	0
8112	0	0	0	0	0	0	0	0	0	0	0	0
8113	0	0	0	0	0	0	0	0	0	0	0	0
8121	0	0	0	0	0	0	0	0	0	0	0	0
8122	0	0	0	0	0	0	0	0	0	0	0	0
8123	0	0	0	0	0	0	0	0	0	0	0	0
8211	0	0	0	0	0	0	0	0	0	0	0	0
8212	0	0	0	0	0	0	0	0	0	0	0	0
8213	0	0	0	0	0	0	0	0	0	0	0	0
8222	0	0	0	0	0	0	0	0	0	0	0	0
8222	0	0	0	0	0	0	0	0	0	0	0	0
8223	0	0	0	0	0	0	0	0	0	0	0	0
8311	0	0	0	0	0	0	0	0	0	0	0	0
8312	0	0	0	0	0	0	0	0	0	0	0	0
8313	0	0	0	0	0	0	0	0	0	0	0	0
8321	0	0	0	0	0	0	0	0	0	0	0	0
8322	0	0	0	0	0	0	0	0	0	0	0	0
8323	0	0	0	0	0	0	0	0	0	0	0	0
9111	1	0	0	0	0	0	0	0	0	0	0	0
9112	1	1	0	0	0	0	0	0	0	0	0	0
9113	0	0	0	0	0	0	0	0	0	0	0	0
9121	0	0	0	0	0	0	0	0	0	0	0	0
9122	2	0	0	0	0	0	0	0	0	0	0	0
9123	0	0	0	0	0	0	0	0	0	0	0	0
9211	11	0	0	2	0	0	0	0	0	0	0	0
9212	0	0	0	0	0	0	0	0	0	0	0	0
9213	0	0	0	0	0	0	0	0	0	0	0	0
9221	0	0	0	1	0	0	0	0	0	0	0	0
9222	0	0	0	0	0	0	0	0	0	0	0	0
9223	0	0	0	0	0	0	0	0	0	0	0	0

Reference No.	Bramble - Rubus fruiticosus	Broad Buckler Fern - Dryopteris austriaca	Bugle - Ajuga reptans	Cleavers – Galium aparine	Clustered dock – Rumex conglomeratus	Common bent – Agrostis capillaris	Common couch - Elystrigia repens	Compact rush- Juncus conglomeratus	Common spotted orchid- Dactylorhiza fuschii	Cow Parsley - Anthriscus slyvestris	Cranesbill - Geranium spp.	Creeping Bent - Agrostis stolonifera
9311	11	0	0	2	0	0	0	0	0	0	0	0
9312	0	0	0	0	0	0	0	0	0	0	0	0
9313	0	0	0	0	0	0	0	0	0	0	0	0
9321	2	0	0	0	0	0	0	0	0	0	0	0
9322	0	0	0	0	0	0	0	0	0	0	0	0
9323	0	0	0	0	0	0	0	0	0	0	0	0
10111	4	0	0	0	0	0	0	0	0	0	0	0
10112	5	0	0	0	0	0	0	0	0	0	0	0
10113	5	0	0	0	0	0	0	0	0	0	0	0
10121	4	0	0	0	0	0	0	0	0	0	0	0
10122	4	0	0	0	0	0	0	0	0	0	0	0
10123	4	0	0	0	0	0	0	0	0	0	0	0
10211	0	0	0	0	0	0	0	0	0	0	0	0
10212	3	0	0	0	0	0	0	0	0	0	0	0
10213	3	0	0	0	0	0	0	0	0	0	0	0
10221	0	0	0	0	0	0	0	0	0	0	0	0
10222	4	0	0	0	0	0	0	0	0	0	0	0
10223	4	0	0	0	0	0	0	0	0	0	0	0
10311	0	0	0	0	0	0	0	0	0	0	0	0
10312	5	0	0	0	0	0	0	0	0	0	0	0
10313	1	0	0	0	0	0	0	0	0	0	0	0
10321	0	0	0	0	0	0	0	0	0	0	0	0
10322	4	0	0	0	0	0	0	0	0	0	0	0
10323	4	0	0	0	0	0	0	0	0	0	0	0
11111	0	0	0	0	0	0	0	0	0	0	0	0
11112	0	0	0	0	0	0	0	0	0	0	0	0
11113	0	0	0	0	0	0	0	0	0	0	0	0
11121	0	0	0	0	0	0	0	0	0	0	0	0
11122	0	0	0	0	0	0	0	0	0	0	0	0
11123	0	0	0	0	0	0	0	0	0	0	0	0
11211	0	0	0	0	0	0	0	0	0	0	0	0
11212	0	0	0	7	0	0	0	0	0	0	4	12
11213	4	0	0	4	0	0	0	0	0	0	0	0
11221	0	0	0	0	0	0	0	0	0	0	0	0
11222	0	0	0	0	0	0	0	0	0	0	0	19
11223	0	0	0	3	0	0	0	0	0	0	0	0
11311	0	0	0	0	0	0	0	0	0	0	0	0
11312	0	0	0	7	0	0	0	0	0	0	4	0
11313	4	0	0	0	0	0	0	0	0	0	0	0

Reference No.	Bramble - Rubus fruiticosus	Broad Buckler Fern - Dryopteris austriaca	Bugle - Ajuga reptans	Cleavers - Galium aparine	Clustered dock - Rumex conglomeratus	Common bent - Agrostis capillaris	Common couch - Elystrigia repens	Compact rush- Juncus conglomeratus	Common spotted orchid- Dactylorhiza fuschii	Cow Parsley - Anthriscus slyvestris	Cranesbill - Geranium spp.	Creeping Bent - Agrostis stolonifera
11321	0	0	0	0	0	0	0	0	0	0	0	0
11322	0	0	0	0	0	0	0	0	0	0	0	0
11323	0	0	0	0	0	0	0	0	0	0	0	0
12111	0	0	0	0	0	0	0	0	0	0	0	0
12112	0	0	0	0	0	0	0	0	0	0	0	0
12113	2	0	0	0	0	0	0	0	0	0	0	0
12121	2	0	0	0	0	0	0	0	0	0	0	0
12122	0	0	0	0	0	0	0	0	0	0	0	0
12123	2	0	0	0	0	0	0	0	0	0	0	0
12211	0	0	0	0	0	0	0	0	0	0	0	0
12212	0	0	0	0	0	0	0	0	0	0	0	0
12213	2	0	0	0	0	0	0	0	0	0	0	0
12221	0	0	0	0	0	0	0	0	0	0	0	0
12222	0	0	0	0	0	0	0	0	0	0	0	0
12223	2	0	0	0	0	0	0	0	0	0	0	0
12311	0	0	0	0	0	0	0	0	0	0	0	0
12312	0	0	0	0	0	0	0	0	0	0	0	0
12313	4	0	0	0	0	0	0	0	0	0	0	0
12321	0	0	0	0	0	0	0	0	0	0	0	0
12322	0	0	0	0	0	0	0	0	0	0	0	0
12323	2	0	0	0	0	0	0	0	0	0	0	0

Reference No.	Creeping Buttercup - Ranunculus repens	Creeping jenny – Lysimachia nummularia	Creeping Soft grass - Holcus mollis	Creeping Thistle - Cirsium arvense	Crested Dogs Tail - Cynosurus cristatus	Cuckoo flower - Cardamine pratensis	Daisy- Bellis perenis	Dandelion - Taraxacum agg.	Deschampsia caespitosa var parviflora	Dock spp- Rumex spp	Dog Rose - Rosa canina	Dogs mercury – Mercurialis perennis
1111	0	12	0	0	0	0	0	0	0	0	0	2
1112	0	0	0	0	0	0	0	0	0	0	0	0
1113	0	1	0	0	0	0	0	0	0	0	1	0
1121	0	0	0	0	0	0	0	0	0	0	0	0
1122	0	0	0	0	0	0	0	0	0	0	0	0
1123	0	0	0	0	0	0	0	0	0	0	0	0
1211	0	0	0	0	0	0	0	0	0	0	0	0
1212	0	0	0	0	0	0	0	0	0	0	0	0
1213	0	0	0	0	0	0	0	0	0	0	0	0
1221	0	0	0	0	0	0	0	0	0	0	0	0
1222	0	0	0	0	0	0	0	0	0	3	0	0
1223	0	0	0	0	0	0	0	0	0	0	0	0
1311	0	0	0	0	0	0	0	0	0	0	0	0
1312	0	0	0	0	0	0	0	0	0	0	0	0
1313	0	0	0	0	0	0	0	0	0	0	0	0
1321	0	0	0	0	0	0	0	0	0	0	0	0
1322	0	0	0	0	0	0	0	0	0	0	0	0
1323	0	0	0	0	0	0	0	0	0	0	0	0
2111	0	0	0	0	0	0	0	0	0	0	0	60
2112	0	0	0	0	0	0	0	0	0	0	0	45
2113	0	0	0	0	0	0	0	0	0	0	0	10
2121	0	0	0	0	0	0	0	0	0	0	0	20
2122	0	0	0	0	0	0	0	0	0	0	0	0
2123	0	0	0	0	0	0	0	0	0	0	0	20
2211	0	0	0	0	0	0	0	0	0	0	0	70
2212	0	0	0	0	0	0	0	0	0	0	0	99
2213	0	0	0	0	0	0	0	0	0	0	0	20
2221	0	0	0	0	0	0	0	0	0	0	0	20
2222	0	0	0	0	0	0	0	0	0	0	0	0
2223	0	0	0	0	0	0	0	0	0	0	0	23
2311	0	0	0	0	0	0	0	0	0	0	0	72
1312	0	0	0	0	0	0	0	0	0	0	0	99
2313	0	0	0	0	0	0	0	0	0	0	0	20
2321	0	0	0	0	0	0	0	0	0	0	0	21
2322	0	0	0	0	0	0	0	0	0	0	0	0
2323	0	0	0	0	0	0	0	0	0	0	0	23
3111	0	0	0	0	0	0	0	0	0	0	0	20
3112	0	0	0	0	0	0	0	0	0	0	0	0
3113	0	0	0	0	0	0	0	0	0	0	0	15

Reference No.	Creeping Buttercup - Ranunculus repens	Creeping jenny – Lysimachia nummularia	Creeping Soft grass - Holcus mollis	Creeping Thistle - Cirsium arvense	Crested Dogs Tail - Cynosurus cristatus	Cuckoo flower - Cardamine pratensis	Daisy- Bellis perenis	Dandelion - Taraxacum agg.	Deschampsia caespitosa var parviflora	Dock spp- Rumex spp	Dog Rose - Rosa canina	Dogs mercury – Mercurialis perennis
3121	0	0	0	0	0	0	0	0	0	0	0	0
3122	0	0	0	0	0	0	0	0	0	0	0	0
3123	0	0	0	0	0	0	0	0	0	0	0	5
3211	0	0	0	0	0	0	0	0	0	0	0	0
3212	0	0	0	0	0	0	0	0	0	0	0	0
3213	0	0	0	0	0	0	0	0	0	0	0	21
3221	0	0	0	0	0	0	0	0	0	0	0	0
3222	0	0	0	0	0	0	0	0	0	0	0	0
3223	0	0	0	0	0	0	0	0	0	0	0	5
3311	0	0	0	0	0	0	0	0	0	0	0	0
3312	0	0	0	0	0	0	0	0	0	0	0	0
3313	0	0	0	0	0	0	0	0	0	0	0	21
3321	0	0	0	0	0	0	0	0	0	0	0	20
3322	0	0	0	0	0	0	0	0	0	0	0	0
3323	0	0	0	0	0	0	0	0	0	0	0	5
4111	0	0	0	0	0	0	0	0	0	0	0	0
4112	0	0	0	0	0	0	0	0	3	0	0	0
4113	0	0	0	0	0	0	0	0	0	0	0	0
4121	0	0	0	0	0	0	0	0	0	0	0	0
4122	0	0	0	0	0	0	0	0	3	0	0	0
4123	0	0	0	0	0	0	0	0	0	0	0	0
4211	0	0	10	0	0	0	0	0	0	0	0	0
4212	0	0	0	0	0	0	0	0	0	0	0	0
4213	0	0	0	0	0	0	0	0	0	0	0	0
4221	0	0	25	0	0	0	0	0	0	0	0	0
4222	0	0	0	0	0	0	0	0	0	0	0	0
4223	0	0	0	0	0	0	0	0	0	0	0	0
4311	0	0	10	0	0	0	0	0	0	0	0	0
4312	0	0	0	0	0	0	0	0	0	0	0	0
4313	0	0	0	0	0	0	0	0	0	0	0	0
4321	0	0	25	0	0	0	0	0	0	0	0	0
4323	0	0	0	0	0	0	0	0	0	0	0	0
4323	0	0	0	0	0	0	0	0	0	0	0	0
5111	0	0	0	0	0	0	0	0	0	0	0	0
5112	0	0	0	0	0	0	0	0	0	0	0	0
5113	0	0	0	0	0	0	0	0	0	0	0	0
5121	0	0	0	0	0	0	0	0	0	0	0	0
5122	0	0	0	0	0	0	0	0	0	0	0	0
5123	0	0	0	0	0	0	0	0	0	0	0	0

Reference No.	Creeping Buttercup - Ranunculus repens	Creeping jenny – Lysimachia nummularia	Creeping Soft grass - Holcus mollis	Creeping Thistle - Cirsium arvense	Crested Dogs Tail - Cynosurus cristatus	Cuckoo flower - Cardamine pratensis	Daisy- Bellis perenis	Dandelion - Taraxacum agg.	Deschampsia caespitosa var parviflora	Dock spp- Rumex spp	Dog Rose - Rosa canina	Dogs mercury – Mercurialis perennis
5211	0	0	0	0	0	0	0	0	0	0	0	0
5212	0	0	0	0	0	0	0	0	0	0	0	0
5213	0	0	0	0	0	0	0	0	0	0	0	0
5221	0	0	0	0	0	0	0	0	0	0	0	0
5222	0	0	0	0	0	0	0	0	0	0	0	0
5223	0	0	0	0	0	0	0	0	0	0	0	0
5311	0	0	0	0	0	0	0	0	0	0	0	0
5312	0	0	0	0	0	0	0	0	0	0	0	0
5313	0	0	0	0	0	0	0	0	0	0	0	0
5321	0	0	0	0	0	0	0	0	0	0	0	0
5322	0	0	0	0	0	0	0	0	0	0	0	0
5323	0	0	0	0	0	0	0	0	0	0	0	0
6111	0	0	0	0	0	0	0	0	0	0	0	0
6112	0	0	0	0	0	0	0	0	0	0	0	20
6113	0	0	0	0	0	0	0	0	0	0	0	6
6121	0	0	0	0	0	0	0	0	0	0	0	0
6122	0	0	0	0	0	0	0	0	0	0	0	14
6123	0	0	0	0	0	0	0	0	0	0	0	0
6211	0	0	0	0	0	0	0	0	0	0	0	0
6212	0	0	0	0	0	0	0	0	0	0	0	0
6213	0	0	0	0	0	0	0	0	0	0	0	0
6221	0	0	0	0	0	0	0	0	0	0	0	0
6222	0	0	0	0	0	0	0	0	0	0	0	0
6223	0	0	0	0	0	0	0	0	0	0	0	0
6311	0	0	0	0	0	0	0	0	0	0	0	0
6312	0	0	0	0	0	0	0	0	0	0	0	0
6313	0	0	0	0	0	0	0	0	0	0	0	6
6321	0	0	0	0	0	0	0	0	0	0	0	0
6322	0	0	0	0	0	0	0	0	0	0	0	0
6323	0	0	0	0	0	0	0	0	0	0	0	0
7111	2	0	0	2	25	0	0	0	0	0	0	0
7112	0	0	0	0	0	0	0	0	0	0	0	0
7113	0	0	0	0	30	0	0	0	0	0	0	0
7121	1	0	0	0	15	0	0	0	0	0	0	0
7122	0	0	0	0	0	0	0	0	0	0	0	0
7123	0	0	0	3	10	0	0	1	0	0	0	0
7211	2	0	0	2	25	2	0	2	0	0	0	0
7212	0	0	0	0	0	0	0	0	0	0	0	0
7213	5	0	0	0	5	1	6	5%	0	0	0	0

Reference No.	Creeping Buttercup - Ranunculus repens	Creeping jenny – Lysimachia nummularia	Creeping Soft grass - Holcus mollis	Creeping Thistle - Cirsium arvense	Crested Dogs Tail - Cynosurus cristatus	Cuckoo flower - Cardamine pratensis	Daisy- Bellis perenis	Dandelion - Taraxacum agg.	Deschampsia caespitosa var parviflora	Dock spp- Rumex spp	Dog Rose - Rosa canina	Dogs mercury – Mercurialis perennis
7222	1	0	0	0	15	0	0	0	0	0	0	0
7222	0	0	0	0	0	0	0	0	0	0	0	0
7223	0	0	0	0	10	3	9	1	0	0	0	0
7311	2	0	0	2	25	2	0	2	0	0	0	0
7312	0	0	0	0	0	0	0	0	0	0	0	0
7313	5	0	0	0	5	1	6	5%	0	0	0	0
7321	1	0	0	0	15	3	0	0	0	0	0	0
7322	0	0	0	0	0	0	0	0	0	0	0	0
7323	0	0	0	0	10	0	9	1	0	0	0	0
8111	0	0	0	0	0	0	0	0	0	0	0	0
8112	0	0	0	0	0	0	0	0	0	0	0	0
8113	0	0	0	0	0	0	0	0	0	0	0	0
8121	0	0	0	0	0	0	0	0	0	0	0	0
8122	0	0	0	0	0	0	0	0	0	0	0	0
8123	0	0	0	0	0	0	0	0	0	0	0	0
8211	0	0	0	0	0	0	0	0	0	0	0	0
8212	0	0	0	0	0	0	0	0	0	0	0	0
8213	0	0	0	0	0	0	0	0	0	0	0	0
8222	0	0	0	0	0	0	0	0	0	0	0	2
8222	0	0	0	0	0	0	0	0	0	0	0	0
8223	0	0	0	0	0	0	0	0	0	0	0	0
8311	0	0	0	0	0	0	0	0	0	0	0	0
8312	0	0	0	0	0	0	0	0	0	0	0	0
8313	0	0	0	0	0	0	0	0	0	0	0	0
8321	0	0	0	0	0	0	0	0	0	0	0	2
8322	0	0	0	0	0	0	0	0	0	0	0	0
8323	0	0	0	0	0	0	0	0	0	0	0	0
9111	0	0	0	0	0	0	0	0	0	0	0	0
9112	0	0	0	0	0	0	0	0	0	0	0	4
9113	0	0	0	0	0	0	0	0	0	0	0	0
9121	0	0	0	0	0	0	0	0	0	0	0	0
9122	0	0	0	0	0	0	0	0	0	0	0	30
9123	0	0	0	0	0	0	0	0	0	0	0	0
9211	0	0	0	0	0	0	0	0	0	0	0	6
9212	0	0	0	0	0	0	0	0	0	0	0	0
9213	0	0	0	0	0	0	0	0	0	0	0	0
9221	0	0	0	0	0	0	0	0	0	0	0	0
9222	0	0	0	0	0	0	0	0	0	0	0	0
9223	0	0	0	0	0	0	0	0	0	0	0	0

Reference No.	Creeping Buttercup - Ranunculus repens	Creeping jenny – Lysimachia nummularia	Creeping Soft grass - Holcus mollis	Creeping Thistle - Cirsium arvense	Crested Dogs Tail - Cynosurus cristatus	Cuckoo flower - Cardamine pratensis	Daisy- Bellis perenis	Dandelion - Taraxacum agg.	Deschampsia caespitosa var parviflora	Dock spp- Rumex spp	Dog Rose - Rosa canina	Dogs mercury – Mercurialis perennis
9311	0	0	0	0	0	0	0	0	0	0	0	6
9312	0	0	0	0	0	0	0	0	0	0	0	0
9313	0	0	0	0	0	0	0	0	0	0	0	0
9321	0	0	0	0	0	0	0	0	0	0	0	0
9322	0	0	0	0	0	0	0	0	0	0	0	0
9323	0	0	0	0	0	0	0	0	0	0	0	0
10111	0	0	0	0	0	0	0	0	0	0	0	0
10112	0	0	0	0	0	0	0	0	0	0	0	0
10113	0	0	0	0	0	0	0	0	0	0	0	0
10121	2	0	0	0	0	0	0	0	0	0	0	0
10122	0	0	0	0	0	0	0	0	0	0	0	0
10123	0	0	0	0	0	0	0	0	0	0	0	0
10211	0	0	0	0	0	0	0	0	0	0	0	0
10212	0	0	0	0	0	0	0	0	0	0	2	0
10213	0	0	0	0	0	0	0	0	0	0	2	0
10221	0	0	0	0	0	0	0	0	0	0	0	0
10222	0	0	0	0	0	0	0	0	0	0	0	0
10223	0	0	0	0	0	0	0	0	0	0	0	0
10311	0	0	0	0	0	0	0	0	0	0	0	0
10312	0	0	0	0	0	0	0	0	0	0	0	0
10313	0	0	0	0	0	0	0	0	0	0	0	3
10321	0	0	0	0	0	0	0	0	0	0	0	0
10322	0	0	0	0	0	0	0	0	0	0	0	0
10323	0	0	0	0	0	0	0	0	0	0	0	3
11111	0	0	0	0	0	0	0	0	0	0	0	0
11112	0	0	0	0	0	0	0	0	0	0	0	0
11113	0	0	0	0	0	0	0	0	0	0	0	0
11121	0	0	0	0	0	0	0	0	0	0	0	0
11122	0	0	0	0	0	0	0	0	0	0	0	0
11123	0	0	0	0	0	0	0	0	0	0	0	0
11211	0	0	0	0	0	0	0	0	0	0	0	0
11212	0	0	0	0	0	0	0	0	0	0	0	8
11213	0	0	0	0	0	0	0	0	0	0	0	0
11221	0	0	0	0	0	0	0	0	0	0	0	0
11222	0	0	0	0	0	0	0	0	0	0	0	8
11223	0	0	0	0	0	0	0	0	0	0	0	0
11311	0	0	0	0	0	0	0	0	0	0	0	0
11312	0	0	12	0	0	0	0	0	0	0	0	8
11313	0	0	0	0	0	0	0	0	0	0	0	0

Reference No.	Creeping Buttercup - Ranunculus repens	Creeping jenny – Lysimachia nummularia	Creeping Soft grass - Holcus mollis	Creeping Thistle - Cirsium arvense	Crested Dogs Tail - Cynosurus cristatus	Cuckoo flower - Cardamine pratensis	Daisy- Bellis perenis	Dandelion - Taraxacum agg.	Deschampsia caespitosa var parviflora	Dock spp- Rumex spp	Dog Rose - Rosa canina	Dogs mercury – Mercurialis perennis
11321	0	0	0	0	0	0	0	0	0	0	0	0
11322	0	0	19	0	0	0	0	0	0	0	0	8
11323	0	0	0	0	0	0	0	0	0	0	0	0
12111	0	0	0	0	0	0	0	0	0	0	0	0
12112	0	0	0	0	0	0	0	0	0	0	0	0
12113	0	0	0	0	0	0	0	0	0	0	0	0
12121	0	0	0	0	0	0	0	0	0	0	0	0
12122	0	0	0	0	0	0	0	0	0	0	0	0
12123	0	0	0	0	0	0	0	0	0	0	2	0
12211	0	0	0	0	0	0	0	0	0	0	0	0
12212	0	0	0	0	0	0	0	0	0	0	0	0
12213	0	0	0	0	0	0	0	0	0	0	0	0
12221	0	0	0	0	0	0	0	0	0	0	0	0
12222	0	0	0	0	0	0	0	0	0	0	0	0
12223	0	0	0	0	0	0	0	0	0	0	2	0
12311	0	0	0	0	0	0	0	0	0	0	0	0
12312	0	0	0	0	0	0	0	0	0	0	0	0
12313	0	0	0	0	0	0	0	0	0	0	0	0
12321	0	0	0	0	0	0	0	0	0	0	0	0
12322	0	0	0	0	0	0	0	0	0	0	0	0
12323	0	0	0	0	0	0	0	0	0	0	2	0

Reference No.	Dog violet - Viola riviniana	Dog Wood - Cornus sanguinea	Elder- Sambucus nigra	Enchanters nightshade -- Circaea lutetiana	False oat-grass - Ahrenathrum elatius	Field maple- Acer campestre	Foxglove- Digitalis purpurea	Garlic mustard- Alliaria petiolata	Giant fescue -- Festuca gigantea	Great Westm Scaly Male Fern- Dryopteris affinis	Ground ivy- Glechoma hederacea	Goldilocks - xxxx
1111	0	0	0	2	0	0	0	0	6	0	0	6
1112	0	0	0	10	0	0	0	0	0	0	0	0
1113	0	0	0	0	0	0	0	0	0	0	0	0
1121	0	0	0	0	0	0	0	0	2	0	0	2
1122	0	0	0	0	0	0	0	0	0	0	0	0
1123	0	0	0	0	0	0	0	0	0	0	0	0
1211	0	0	0	0	0	0	0	0	0	0	0	0
1212	0	0	0	0	20	0	0	0	22	0	2	0
1213	0	0	0	10	0	0	0	0	0	0	0	0
1221	0	0	0	0	0	0	0	0	0	0	0	0
1222	0	0	0	0	5	0	0	0	0	0	3	0
1223	0	0	0	0	0	0	0	0	0	0	0	0
1311	0	0	0	0	0	0	0	0	0	0	0	0
1312	0	0	0	10	0	0	0	0	0	0	0	0
1313	0	0	0	0	0	0	0	0	0	0	0	0
1321	0	0	0	0	0	0	0	0	0	0	0	0
1322	0	0	0	0	0	0	0	0	0	0	0	0
1323	0	0	0	0	0	0	0	0	0	0	0	0
2111	0	0	0	0	0	0	0	0	0	0	0	0
2112	0	0	0	0	0	0	0	0	0	0	0	0
2113	0	0	0	0	0	0	0	0	0	0	0	0
2121	0	0	0	0	0	0	0	0	0	0	0	0
2122	0	0	0	0	0	0	0	0	0	0	0	0
2123	0	0	0	0	0	0	0	0	0	0	0	0
2211	0	0	0	0	0	0	0	0	0	0	0	0
2212	0	0	0	0	0	0	0	0	0	0	0	0
2213	0	0	0	0	0	0	0	0	0	0	0	0
2221	0	0	0	0	0	0	0	0	0	0	0	0
2222	0	0	0	0	0	0	0	0	0	0	0	0
2223	0	0	0	0	0	0	0	0	0	0	0	0
2311	0	0	0	0	0	0	0	0	0	0	0	0
1312	0	0	0	0	0	0	0	0	0	0	0	0
2313	0	0	0	0	0	0	0	0	0	0	0	0
2321	0	0	0	0	0	0	0	0	0	0	0	0
2322	0	0	0	0	0	0	0	0	0	0	0	0
2323	0	0	0	0	0	0	0	0	0	0	0	0
3111	0	0	0	0	0	0	0	0	0	0	0	0
3112	0	0	0	0	0	1	0	0	0	0	0	0
3113	0	0	0	0	0	0	0	0	0	0	0	0

Reference No.	Dog violet - Viola riviniana	Dog Wood - Cornus sanguinea	Elder- Sambucus nigra	Enchanters nightshade – Circaea lutetiana	False oat-grass - Ahrenathrum elatius	Field maple- Acer campestre	Foxglove- Digitalis purpurea	Garlic mustard- Alliaria petiolata	Giant fescue – Festuca gigantea	Great Westm Scaly Male Fern- Dryopteris affinis	Ground ivy- Glechoma hederacea	Goldilocks - xxxx
3121	0	0	0	0	0	0	0	0	0	0	0	0
3122	0	0	0	0	0	0	0	0	0	0	0	0
3123	0	0	0	0	0	0	0	0	0	0	0	0
3211	0	0	0	0	0	0	0	0	0	0	0	0
3212	0	0	0	0	0	1	0	0	0	0	0	0
3213	0	0	0	0	0	0	0	2	0	0	0	0
3221	0	0	0	0	0	0	0	0	0	0	0	0
3222	0	0	0	0	0	0	0	0	0	0	0	0
3223	0	0	0	0	0	0	0	0	0	0	0	0
3311	0	0	0	0	0	0	0	0	0	0	0	0
3312	0	0	0	0	0	1	0	0	0	0	0	0
3313	0	0	0	0	0	0	0	2	0	0	0	0
3321	0	0	0	0	0	0	0	0	0	0	0	0
3322	0	0	0	0	0	0	0	0	0	0	0	0
3323	0	0	0	0	0	0	0	0	0	0	0	0
4111	0	0	0	0	0	0	0	0	0	0	0	0
4112	0	0	0	0	0	0	0	0	0	0	0	0
4113	0	0	0	0	0	0	0	0	0	0	0	0
4121	0	0	0	0	0	0	0	0	0	0	0	0
4122	0	0	0	1	0	0	0	0	0	0	0	0
4123	0	0	0	0	0	0	0	0	0	0	0	0
4211	0	0	0	0	0	0	0	0	0	0	0	0
4212	0	0	0	0	0	0	0	0	0	0	0	0
4213	0	0	0	0	0	0	0	0	0	0	0	0
4221	0	0	0	0	0	0	0	0	0	0	0	0
4222	0	0	0	0	0	0	0	0	0	0	0	0
4223	0	0	0	0	0	0	0	0	0	0	0	0
4311	0	0	0	0	0	0	0	0	0	0	0	0
4312	0	0	0	0	0	0	0	0	0	0	0	0
4313	0	0	0	0	0	0	0	0	0	0	0	0
4321	0	0	0	0	0	0	0	0	0	0	0	0
4323	0	0	0	0	0	0	0	0	0	0	0	0
4323	0	0	0	0	0	0	0	0	0	0	0	0
5111	0	0	0	0	0	0	0	0	0	0	0	0
5112	0	0	0	0	0	0	0	0	0	0	0	0
5113	0	0	3	0	0	0	0	0	0	0	0	0
5121	0	0	0	0	0	0	0	0	0	0	0	1
5122	0	0	0	0	0	0	0	0	0	0	0	0
5123	0	0	5	0	0	0	0	0	0	0	0	0

Reference No.	Dog violet - Viola riviniana	Dog Wood - Cornus sanguinea	Elder- Sambucus nigra	Enchanters nightshade – Circaea lutetiana	False oat-grass - Ahrenathrum elatius	Field maple- Acer campestre	Foxglove- Digitalis purpurea	Garlic mustard- Alliaria petiolata	Giant fescue – Festuca gigantea	Great Westm Scaly Male Fern- Dryopteris affinis	Ground ivy- Glechoma hederacea	Goldilocks - xxxx
5211	0	0	0	0	0	0	0	0	0	0	0	0
5212	0	0	0	0	0	0	0	0	0	0	0	0
5213	0	0	1	0	0	0	0	0	0	0	5	0
5221	0	0	0	0	0	0	0	0	0	0	0	0
5222	0	0	0	0	0	0	0	0	0	0	0	0
5223	0	0	0	0	0	0	0	0	0	0	1	0
5311	0	0	0	0	0	0	0	0	0	0	0	0
5312	0	0	0	0	0	0	0	0	0	0	0	0
5313	0	0	1	0	0	0	0	0	0	0	5	0
5321	0	0	0	0	0	0	0	0	0	0	0	0
5322	0	0	0	0	0	0	0	0	0	0	0	0
5323	0	0	0	0	0	0	0	0	0	0	1	0
6111	0	0	0	0	0	0	0	0	0	0	0	0
6112	0	0	0	0	0	0	0	0	0	0	0	0
6113	0	0	0	0	0	0	0	0	0	0	0	0
6121	0	0	0	0	0	0	0	0	0	0	0	0
6122	0	0	0	0	0	0	0	0	0	0	0	0
6123	0	0	0	0	0	0	0	0	0	0	0	0
6211	0	0	0	0	0	0	0	0	0	0	0	0
6212	0	0	0	0	0	0	0	0	0	0	0	0
6213	0	0	0	0	0	0	0	0	0	0	0	0
6221	0	0	0	0	0	0	0	0	0	0	0	0
6222	0	0	0	0	0	0	0	0	0	0	0	0
6223	0	0	0	0	0	0	0	0	0	0	0	0
6311	0	0	0	0	0	0	0	0	0	0	0	0
6312	0	0	0	0	0	0	0	0	0	0	0	0
6313	0	0	0	0	0	0	0	0	0	0	0	0
6321	0	0	0	0	0	0	0	0	0	0	0	0
6322	0	0	0	0	0	0	0	0	0	0	0	0
6323	0	0	0	0	0	0	0	0	0	0	0	0
7111	0	0	0	0	0	0	0	0	0	0	0	0
7112	0	0	0	0	0	0	0	0	0	0	0	0
7113	0	0	0	0	0	0	0	0	0	0	0	0
7121	0	0	0	0	0	0	0	0	0	0	0	0
7122	0	0	0	0	0	0	0	0	0	0	0	0
7123	0	0	0	0	0	0	0	0	0	0	0	0
7211	0	0	0	0	0	0	0	0	0	0	0	0
7212	0	0	0	0	0	0	0	0	0	0	0	0
7213	0	0	0	0	0	0	0	0	0	0	0	0

Reference No.	Dog violet - Viola riviniana	Dog Wood - Cornus sanguinea	Elder- Sambucus nigra	Enchanters nightshade - Circaea lutetiana	False oat-grass - Ahrenathrum elatius	Field maple- Acer campestre	Foxglove- Digitalis purpurea	Garlic mustard- Alliaria petiolata	Giant fescue -- Festuca gigantea	Great Westrn Scaly Male Fern- Dryopteris affinis	Ground ivy- Glechoma hederacea	Goldilocks - xxxx
7222	0	0	0	0	0	0	0	0	0	0	0	0
7222	0	0	0	0	0	0	0	0	0	0	0	0
7223	0	0	0	0	0	0	0	0	0	0	0	0
7311	0	0	0	0	0	0	0	0	0	0	0	0
7312	0	0	0	0	0	0	0	0	0	0	0	0
7313	0	0	0	0	0	0	0	0	0	0	0	0
7321	0	0	0	0	0	0	0	0	0	0	0	0
7322	0	0	0	0	0	0	0	0	0	0	0	0
7323	0	0	0	0	0	0	0	0	0	0	0	0
8111	0	0	0	0	0	0	0	0	0	0	0	0
8112	0	0	0	0	0	0	0	0	0	0	0	0
8113	0	0	0	0	0	0	0	0	0	0	0	0
8121	0	0	0	0	0	0	0	0	0	0	0	0
8122	0	0	0	0	0	0	0	0	0	0	0	0
8123	0	0	0	0	0	0	0	0	0	0	0	0
8211	0	0	0	0	0	0	0	0	0	0	0	0
8212	0	0	0	0	0	0	0	1	0	0	0	0
8213	0	0	0	0	0	0	0	0	0	0	0	0
8222	0	0	0	0	0	0	0	0	0	0	0	0
8222	0	0	0	0	0	0	0	0	0	0	0	0
8223	0	0	0	0	0	0	0	0	0	0	0	0
8311	0	0	0	0	0	0	0	0	0	0	0	0
8312	0	0	0	0	0	0	0	1	0	0	0	0
8313	0	3	0	0	2	0	0	0	0	0	0	0
8321	0	0	0	0	0	0	0	0	0	0	0	0
8322	0	0	0	0	0	0	0	0	0	0	0	0
8323	0	11	0	0	0	0	0	0	0	0	0	0
9111	0	0	0	3	0	0	0	0	0	0	0	0
9112	3	0	0	1	0	0	0	0	0	0	0	0
9113	0	0	0	0	0	0	0	0	0	0	0	0
9121	0	0	0	2	0	0	0	0	0	0	0	0
9122	10	0	0	1	0	0	0	0	0	0	0	0
9123	0	0	0	0	0	0	0	0	0	0	0	0
9211	0	0	0	3	0	0	0	0	0	0	0	0
9212	0	0	0	1	0	0	0	0	0	0	0	0
9213	0	0	0	0	0	0	0	0	0	0	0	0
9221	0	0	0	2	0	0	0	0	0	0	0	0
9222	0	0	0	4	0	0	0	0	0	0	0	0
9223	0	0	0	0	0	0	0	0	0	0	0	0

Reference No.	Dog violet - Viola riviniana	Dog Wood - Comus sanguinea	Elder- Sambucus nigra	Enchanters nightshade – Circaea lutetiana	False oat-grass - Ahrenathrum elatius	Field maple- Acer campestre	Foxglove- Digitalis purpurea	Garlic mustard- Alliaria petiolata	Giant fescue – Festuca gigantea	Great Westm Scaly Male Fem- Dryopteris affinis	Ground ivy- Glechoma hederacea	Goldilocks - xxxx
9311	0	0	0	3	0	0	0	0	0	0	0	0
9312	0	0	0	5	0	0	0	0	0	0	0	0
9313	0	0	0	0	0	0	0	0	0	0	0	0
9321	0	0	0	2	0	0	0	0	0	0	0	0
9322	0	0	0	4	0	0	0	0	0	0	0	0
9323	0	0	0	0	0	0	0	0	0	0	0	0
10111	0	0	0	0	0	0	0	0	0	0	0	0
10112	0	0	0	0	0	0	0	0	0	0	0	0
10113	0	0	0	50	0	0	0	0	0	0	0	0
10121	0	0	0	0	0	0	0	0	0	0	0	0
10122	0	0	0	0	0	0	0	0	0	0	0	0
10123	0	5	0	70	0	0	0	0	0	0	2	0
10211	0	0	0	0	0	0	0	0	0	0	0	0
10212	0	0	0	0	0	0	0	0	0	0	0	0
10213	0	0	0	0	0	0	0	0	0	0	0	0
10221	0	0	0	0	0	0	0	0	0	0	0	0
10222	0	5	0	0	0	0	0	0	0	0	2	0
10223	0	0	0	0	0	0	0	0	0	0	0	0
10311	0	0	0	0	0	0	0	0	0	0	0	0
10312	0	0	0	0	0	0	0	0	0	0	0	0
10313	0	0	0	40	0	0	0	0	0	0	0	0
10321	0	0	0	0	0	0	0	0	0	0	0	0
10322	0	5	0	0	0	0	0	0	0	0	2	0
10323	0	0	0	30	0	0	0	0	0	0	0	0
11111	0	0	0	0	0	0	0	0	0	0	0	0
11112	0	0	0	0	0	0	0	0	0	0	0	0
11113	0	0	0	0	0	0	0	0	0	0	0	0
11121	0	0	0	0	0	0	0	0	0	0	0	0
11122	0	0	0	0	0	0	0	0	0	0	0	0
11123	0	0	0	0	0	0	0	0	0	0	0	0
11211	0	0	0	0	0	0	0	0	0	0	0	0
11212	0	0	0	0	0	0	0	0	0	0	0	0
11213	0	0	0	0	15	0	0	0	0	0	0	0
11221	0	0	0	0	0	0	0	0	0	0	0	0
11222	0	0	0	0	0	0	0	0	0	0	0	0
11223	0	0	0	0	10	0	0	0	0	0	0	0
11311	0	0	0	0	0	0	0	0	0	0	0	0
11312	0	0	0	0	0	0	0	0	0	0	0	0
11313	0	0	0	0	15	0	0	0	0	0	0	0

Reference No.	Dog violet - Viola riviniana	Dog Wood - Comus sanguinea	Elder- Sambucus nigra	Enchanters nightshade – Circaea lutetiana	False oat-grass - Ahrenathrum elatius	Field maple- Acer campestre	Foxglove- Digitalis purpurea	Garlic mustard- Alliaria petiolata	Giant fescue – Festuca gigantea	Great Westm Scaly Male Fern- Dryopteris affinis	Ground Ivy- Glechoma hederacea	Goldilocks - xxxx
11321	0	0	0	0	0	0	0	0	0	0	0	0
11322	0	0	0	0	0	0	0	0	0	0	0	0
11323	0	0	0	0	10	0	0	0	0	0	0	0
12111	0	0	0	0	0	0	0	0	0	0	0	0
12112	0	0	0	0	0	0	0	0	0	0	0	0
12113	0	0	0	0	0	0	0	0	0	0	0	0
12121	0	0	0	0	0	0	0	0	0	0	0	0
12122	0	6	0	6	0	0	0	0	0	0	0	0
12123	0	0	0	0	0	0	0	0	0	0	0	0
12211	0	0	0	0	0	0	0	0	0	0	0	0
12212	0	0	0	0	0	0	0	0	0	0	0	0
12213	0	0	0	0	0	0	0	0	0	0	0	0
12221	0	0	0	0	0	0	0	0	0	0	0	0
12222	0	3	0	0	0	0	0	0	0	0	0	0
12223	0	0	0	0	0	0	0	0	0	0	0	0
12311	0	0	0	0	0	0	0	0	0	0	0	0
12312	0	0	0	0	0	0	0	0	0	0	0	0
12313	0	0	0	0	0	0	0	0	0	0	0	0
12321	0	0	0	0	0	0	0	0	0	0	0	0
12322	0	3	0	0	0	0	0	0	0	0	0	0
12323	0	0	0	0	0	0	0	0	0	0	0	0

Reference No.	Hariy brome - Bromus ramosus	Hartstongue Fern - Phyllitis scolopendrium	Hawthorn - Crataegus monogyna	Hazel – Corylus avellana	Herb Bennet - Geum urbanum	Herb Robert - Geranium robertium	Hogweed-Heracleum sphondylium	Holly - Ilex aquifolium	Honeysuckle - Lonicarea periclymenum	Ivy - Hedera Helix	Jointed rush - Juncus articulatus	Lady Fern - Anthyrium filix femina
1111	0	0	0	0	0	12	0	0	0	0	0	0
1112	0	0	0	0	0	1	0	0	0	0	0	0
1113	0	0	2	0	0	0	0	0	0	4	0	0
1121	0	0	0	1	0	4	0	0	0	0	0	0
1122	0	0	1	0	0	0	0	0	0	0	0	0
1123	0	0	1	0	0	0	0	0	0	4	0	0
1211	0	0	0	1	0	0	0	0	0	0	0	0
1212	0	0	0	0	0	2	0	0	0	0	0	0
1213	0	0	0	0	0	1	0	0	0	0	0	0
1221	0	0	0	0	0	0	0	0	0	0	0	0
1222	0	0	0	1	0	2	0	0	0	0	0	0
1223	0	0	1	0	0	0	0	0	0	0	0	0
1311	0	0	0	1	0	0	0	0	0	0	0	0
1312	0	0	0	0	0	7	0	0	0	0	0	0
1313	0	0	0	0	0	0	0	0	0	0	0	0
1321	0	0	0	0	0	0	0	0	0	0	0	0
1322	0	0	0	0	0	0	0	0	0	0	0	0
1323	0	0	0	0	0	0	0	0	0	0	0	0
2111	0	0	0	0	0	0	0	0	0	2	0	0
2112	0	0	0	0	0	0	0	0	0	1	0	0
2113	0	0	0	0	0	0	0	0	0	2	0	0
2121	0	0	6	0	0	0	0	0	0	3	0	0
2122	0	0	0	0	0	0	0	0	0	0	0	0
2123	0	0	0	0	0	0	0	0	0	0	0	0
2211	0	0	0	0	0	0	0	0	0	7	0	0
2212	0	0	0	0	0	0	0	0	0	1	0	0
2213	0	0	0	0	0	0	0	0	0	1	0	0
2221	0	0	0	0	0	0	0	0	0	3	0	0
2222	0	0	0	0	0	0	0	0	0	0	0	0
2223	0	0	0	0	0	0	3	0	0	0	0	0
2311	0	0	0	0	0	0	0	0	0	7	0	0
1312	0	0	0	0	0	0	0	0	0	1	0	0
2313	0	0	0	0	0	0	0	0	0	1	0	0
2321	0	0	0	0	0	0	0	0	0	3	0	0
2322	0	0	0	0	0	0	0	0	0	0	0	0
2323	0	0	0	0	0	0	3	0	0	0	0	0
3111	0	0	0	0	0	0	0	0	0	0	0	0
3112	0	0	0	0	0	0	0	0	0	0	0	0
3113	0	2	0	0	4	0	0	0	0	1	0	0

Reference No.	Harty brome - Bromus ramosus	Hartstongue Fern - Phyllitis scolopendrium	Hawthorn - Crataegus monogyna	Hazel – Corylus avellana	Herb Bennet - Geum urbanum	Herb Robert - Geranium robertium	Hogweed-Heracleum sphondylium	Holly - Ilex aquifolium	Honeysuckle - Lonicarea periclymenum	Ivy - Hedera Helix	Jointed rush - Juncus articulatus	Lady Fern - Anthyrium filix femina
3121	0	0	0	0	0	0	0	0	0	0	0	0
3122	0	0	0	0	0	0	0	0	0	0	0	0
3123	0	0	0	0	7	0	0	0	0	3	0	0
3211	0	0	0	0	0	0	0	0	0	0	0	0
3212	0	0	0	0	0	0	0	0	4	0	0	0
3213	0	2	0	0	0	0	0	0	0	1	0	0
3221	0	0	0	0	0	0	0	0	0	0	0	0
3222	0	0	0	0	0	0	0	0	0	0	0	0
3223	0	0	0	0	0	0	0	0	0	3	0	0
3311	0	0	0	0	0	0	0	0	0	0	0	0
3312	0	0	0	0	0	0	0	0	4	0	0	0
3313	0	2	0	0	0	0	0	0	3	1	0	0
3321	0	0	0	0	0	0	0	0	0	0	0	0
3322	0	0	0	0	0	0	0	0	0	0	0	0
3323	0	0	0	0	0	0	0	0	0	3	0	0
4111	0	0	0	1	0	0	0	0	0	0	0	0
4112	0	0	0	0	0	0	0	0	0	0	0	0
4113	0	0	0	0	0	0	0	0	0	0	0	0
4121	0	0	0	1	0	0	0	2	0	0	0	0
4122	0	0	0	0	0	0	0	0	0	0	0	0
4123	0	0	0	0	0	0	0	0	0	0	0	0
4211	0	0	0	1	0	0	0	0	0	0	0	0
4212	0	0	0	0	0	0	0	0	0	0	0	0
4213	0	0	0	0	0	0	0	0	0	0	0	0
4221	0	0	0	1	0	0	0	1	0	0	0	0
4222	0	0	0	0	0	0	0	2	0	0	0	0
4223	0	0	0	0	0	0	0	0	0	0	0	0
4311	0	0	0	1	0	0	0	0	0	0	0	0
4312	0	0	0	0	0	0	0	0	0	0	0	0
4313	0	0	0	0	0	0	0	0	0	0	0	0
4321	0	0	0	1	0	0	0	1	0	0	0	0
4323	0	0	0	0	0	0	0	2	0	0	0	0
4323	0	0	0	0	0	0	0	0	0	0	0	0
5111	0	0	0	0	5	4	1	0	0	0	0	0
5112	0	0	0	0	0	0	0	0	0	0	0	0
5113	0	0	0	0	0	0	0	0	0	0	0	0
5121	0	0	0	0	0	0	0	0	0	0	0	0
5122	0	0	0	0	0	0	0	0	0	0	0	0
5123	0	0	0	0	0	0	0	0	0	0	0	0

Reference No.	Hariy brome - Bromus ramosus	Hartstongue Fern - Phyllitis scolopendrium	Hawthorn - Crataegus monogyna	Hazel – Corylus avellana	Herb Bennet - Geum urbanum	Herb Robert - Geranium robertium	Hogweed-Heracleum sphondylium	Holly - Ilex aquifolium	Honeysuckle - Lonicarea periclymenum	Ivy - Hedera Helix	Jointed rush - Juncus articulatus	Lady Fern - Anthyrium filix femina
5211	0	0	0	0	0	2	0	0	0	0	0	0
5212	0	0	0	0	0	0	0	0	0	0	0	0
5213	0	0	0	0	0	1	0	0	0	0	0	0
5221	0	0	0	0	0	6	0	0	0	0	0	0
5222	0	0	0	0	0	0	0	0	0	0	0	0
5223	0	0	0	0	0	1	0	0	0	0	0	0
5311	0	0	0	0	0	2	0	0	0	0	0	0
5312	0	0	0	0	0	0	0	0	0	0	0	0
5313	0	0	0	0	0	1	0	0	0	0	0	0
5321	0	0	0	0	0	6	0	0	0	0	0	0
5322	0	0	0	0	0	0	0	0	0	0	0	0
5323	0	0	0	0	0	1	0	0	0	0	0	0
6111	0	0	0	1	0	0	0	0	6	0	0	0
6112	0	0	0	0	0	0	1	0	0	6	0	0
6113	0	0	0	0	0	0	0	0	0	0	0	0
6121	0	0	0	0	0	0	0	0	1	0	0	0
6122	0	0	1	0	0	0	0	0	0	8	0	0
6123	0	0	0	1	0	0	0	0	0	0	0	0
6211	0	0	0	0	0	0	0	0	0	0	0	0
6212	0	0	0	0	0	0	0	0	0	0	0	0
6213	0	0	0	0	0	0	0	0	0	0	0	0
6221	0	0	0	0	0	0	0	0	0	0	0	0
6222	0	0	0	0	0	0	0	0	0	0	0	0
6223	0	0	0	0	0	0	0	0	0	0	0	0
6311	0	0	0	1	0	0	0	0	6	0	0	0
6312	0	0	0	1	0	0	0	0	16	0	0	0
6313	0	0	0	0	0	0	0	0	0	0	0	0
6321	0	0	0	0	0	0	0	0	1	0	0	0
6322	0	0	0	0	0	0	0	0	3	0	0	0
6323	0	0	0	1	0	0	0	0	0	0	0	0
7111	0	0	0	0	0	0	0	0	0	0	0	0
7112	0	0	0	0	0	0	0	0	0	0	0	0
7113	0	0	0	0	0	0	0	0	0	0	0	0
7121	0	0	0	0	0	0	0	0	0	0	0	0
7122	0	0	0	0	0	0	0	0	0	0	0	0
7123	0	0	0	0	0	0	0	0	0	0	0	0
7211	0	0	0	0	0	0	0	0	0	0	0	0
7212	0	0	0	0	0	0	0	0	0	0	1	0
7213	0	0	0	0	0	0	0	0	0	0	0	0

Reference No.	Hairy brome - Bromus ramosus	Hartstongue Fern - Phyllitis scolopendrium	Hawthorn - Crataegus monogyna	Hazel – Corylus avellana	Herb Bennet - Geum urbanum	Herb Robert - Geranium robertium	Hogweed-Heracleum sphondylium	Holly - Ilex aquifolium	Honeysuckle - Lonicarea periclymenum	Ivy - Hedera Helix	Jointed rush - Juncus articulatus	Lady Fern - Anthyrium filix femina
7222	0	0	0	0	0	0	0	0	0	0	0	0
7222	0	0	0	0	0	0	0	0	0	0	0	0
7223	0	0	0	0	0	0	0	0	0	0	0	0
7311	0	0	0	0	0	0	0	0	0	0	0	0
7312	0	0	0	0	0	0	0	0	0	0	1	0
7313	0	0	0	0	0	0	0	0	0	0	0	0
7321	0	0	0	0	0	0	0	0	0	0	0	0
7322	0	0	0	0	0	0	0	0	0	0	0	0
7323	0	0	0	0	0	0	0	0	0	0	0	0
8111	0	0	0	0	0	0	0	0	0	0	0	0
8112	0	0	0	0	0	0	0	0	0	0	0	0
8113	0	0	0	0	0	0	0	0	0	0	0	0
8121	0	0	0	0	0	0	0	0	0	0	0	0
8122	0	0	0	0	0	0	0	0	0	0	0	0
8123	0	0	0	0	0	0	0	0	0	0	0	0
8211	0	7	0	0	0	0	0	0	0	5	0	0
8212	2	1	0	0	0	0	0	0	0	3	0	0
8213	0	0	0	0	0	0	0	0	0	0	0	0
8222	0	30	0	0	0	0	0	0	0	0	0	0
8222	4	0	0	0	0	0	0	0	0	4	0	0
8223	0	0	0	0	0	0	0	0	0	0	0	0
8311	0	7	0	0	0	0	0	0	0	5	0	0
8312	2	1	0	0	0	0	0	0	0	3	0	0
8313	2	1	0	0	0	0	0	0	0	1	0	0
8321	0	30	0	0	0	0	0	0	0	0	0	0
8322	4	0	0	0	0	0	0	0	0	4	0	0
8323	4	5	0	0	0	0	0	0	0	3	0	0
9111	0	0	0	0	0	0	0	0	0	2	0	0
9112	0	0	0	0	0	0	0	0	0	5	0	0
9113	0	0	0	0	0	0	0	0	0	0	0	0
9121	0	0	0	0	0	0	0	0	0	1	0	2
9122	0	0	0	0	0	0	0	0	0	0	0	0
9123	0	0	0	0	0	0	0	0	0	0	0	0
9211	0	0	0	0	0	0	0	0	0	2	0	1
9212	0	0	0	0	0	0	0	0	0	1	0	0
9213	0	0	0	0	0	0	0	0	0	0	0	0
9221	0	0	0	0	0	0	0	0	0	1	0	2
9222	0	0	0	0	0	0	0	0	0	1	0	0
9223	0	0	0	0	0	0	0	0	0	0	0	0

Reference No.	Hariy brome - Bromus ramosus	Hartstongue Fern - Phyllitis scolopendrium	Hawthorn - Crataegus monogyna	Hazel – Corylus avellana	Herb Bennet - Geum urbanum	Herb Robert - Geranium robertium	Hogweed-Heracleum sphondylium	Holly - Ilex aquifolium	Honeysuckle - Lonicarea periclymenum	Ivy - Hedera Helix	Jointed rush - Juncus articulatus	Lady Fern - Anthyrium filix femina
9311	0	0	0	0	0	0	0	0	0	2	0	1
9312	0	0	0	0	0	0	0	0	0	3	0	0
9313	0	0	0	0	0	0	0	0	0	0	0	0
9321	0	0	0	0	0	0	0	0	0	1	0	2
9322	0	0	0	0	0	0	0	0	0	9	0	0
9323	0	0	0	0	0	0	0	0	0	0	0	0
10111	0	0	0	0	0	0	0	0	0	0	0	0
10112	0	0	0	0	4	4	0	0	0	0	0	0
10113	0	0	0	0	0	0	0	0	0	0	0	0
10121	0	0	0	1	1	2	0	0	0	0	0	0
10122	0	0	0	0	0	0	0	0	0	0	0	0
10123	0	0	0	0	0	0	0	0	0	0	0	0
10211	0	0	0	0	0	0	0	0	0	0	0	0
10212	0	0	1	0	0	1	0	0	0	0	0	0
10213	0	0	1	0	0	1	0	0	0	0	0	0
10221	0	0	0	0	0	0	0	0	0	0	0	0
10222	0	0	0	1	0	2	0	0	0	2%	0	0
10223	0	0	0	1	0	2	0	0	0	2%	0	0
10311	0	0	0	0	0	0	0	0	0	0	0	0
10312	0	0	0	0	0	0	0	0	0	0	0	0
10313	0	0	0	0	0	1	0	0	0	0	0	0
10321	0	0	0	0	0	0	0	0	0	0	0	0
10322	0	0	0	0	0	0	0	0	0	0	0	0
10323	0	0	0	0	0	2	0	0	0	2%	0	0
11111	0	0	0	0	0	0	0	0	0	0	0	0
11112	0	0	0	0	0	0	0	0	0	0	0	0
11113	0	0	0	0	0	0	0	0	0	0	0	0
11121	0	0	0	0	0	0	0	0	0	0	0	0
11122	0	0	0	0	0	0	0	0	0	0	0	0
11123	0	0	0	0	0	0	0	0	0	0	0	0
11211	0	0	0	0	0	0	0	0	0	0	0	0
11212	0	0	0	0	0	5	0	0	0	0	0	0
11213	50	0	0	0	0	0	0	0	0	0	0	0
11221	0	0	0	0	0	0	0	0	0	0	0	0
11222	0	0	0	0	0	2	0	0	0	0	0	0
11223	10	0	0	0	0	0	0	0	0	0	0	0
11311	0	0	0	0	0	0	0	0	0	0	0	0
11312	0	0	0	0	0	5	0	0	0	0	0	0
11313	50	0	0	0	0	0	0	0	0	0	0	0

Reference No.	Hairy brome - Bromus ramosus	Hartstongue Fern - Phyllitis scolopendrium	Hawthorn - Crataegus monogyna	Hazel - Corylus avellana	Herb Bennet - Geum urbanum	Herb Robert - Geranium robertium	Hogweed-Heracleum sphondylium	Holly - Ilex aquifolium	Honeysuckle - Lonicarea periclymenum	Ivy - Hedera Helix	Jointed rush - Juncus articulatus	Lady Fern - Anthyrium filix femina
11321	0	0	0	0	0	0	0	0	0	0	0	0
11322	0	0	0	0	0	2	0	0	0	0	0	0
11323	10	0	0	0	0	0	0	0	0	0	0	0
12111	0	0	0	0	0	0	0	0	0	0	0	0
12112	0	0	0	0	0	0	0	0	0	0	0	0
12113	0	0	0	2	0	0	0	0	3	0	0	0
12121	0	0	0	0	0	0	0	1	3	0	0	0
12122	0	0	0	0	0	0	0	0	0	0	0	0
12123	0	0	2	2	0	0	0	0	2	1	0	0
12211	0	0	0	0	0	0	0	0	3	0	0	0
12212	0	0	0	0	0	0	0	0	0	0	0	0
12213	0	0	0	2	0	0	0	0	3	0	0	0
12221	0	0	0	0	0	0	0	1	3	0	0	0
12222	0	0	0	0	0	0	0	3	0	0	0	0
12223	0	0	2	2	0	0	0	0	2	1	0	0
12311	0	0	0	0	0	0	0	0	3	0	0	0
12312	0	0	0	0	0	0	0	0	0	0	0	0
12313	0	0	0	2	0	0	0	0	3	0	0	0
12321	0	0	0	0	0	0	0	1	3	0	0	0
12322	0	0	0	0	0	0	0	3	0	0	0	0
12323	0	0	2	2	0	0	0	0	2	1	0	0

Reference No.	Lesser Celadine - Ranunculus ficaria	Male fern - Dryopteris filix -mas	Marsh lousewort- Pedicularis palustris	Marsh Marigold - Caltha palustris	Meadow buttercup - Ranunculus acris	Meadowsweet – Filipendula ulmaria	Moschatel - Adoxa moscatellina	Moss- Eurynchium praelongum	Moss- Mnium hornum	Moss - Polytrichum commune
1111	0	0	0	0	0	0	0	0	0	0
1112	0	0	0	0	0	0	0	0	0	0
1113	0	2	0	0	0	0	0	0	0	0
1121	0	0	0	0	0	8	0	0	0	0
1122	0	0	0	0	0	0	0	0	0	0
1123	0	0	0	0	0	0	0	0	0	0
1211	0	0	0	0	0	0	0	0	0	0
1212	0	0	0	0	0	0	0	0	0	0
1213	0	0	0	0	0	0	0	0	0	0
1221	0	0	0	0	0	0	0	0	0	0
1222	0	0	0	0	0	40	0	0	0	0
1223	0	0	0	0	0	0	0	0	0	0
1311	0	0	0	0	0	0	0	0	0	0
1312	0	0	0	0	0	0	0	0	0	0
1313	0	0	0	0	0	0	0	0	0	0
1321	0	0	0	0	0	0	0	0	0	0
1322	0	0	0	0	0	0	0	0	0	0
1323	0	0	0	0	0	0	0	0	0	0
2111	0	0	0	0	0	0	0	0	0	0
2112	0	0	0	0	0	0	0	0	0	0
2113	0	0	0	0	0	0	0	0	0	0
2121	0	0	0	0	0	0	0	0	0	0
2122	0	1	0	0	0	0	0	0	0	0
2123	0	0	0	0	0	0	0	0	0	0
2211	0	0	0	0	0	0	0	0	0	0
2212	0	0	0	0	0	0	0	0	0	0
2213	0	0	0	0	0	0	0	0	0	0
2221	0	0	0	0	0	0	0	0	0	0
2222	0	0	0	0	0	0	0	0	0	0
2223	0	0	0	0	0	0	0	0	0	0
2311	0	0	0	0	0	0	0	0	0	0
1312	0	0	0	0	0	0	0	0	0	0
2313	0	0	0	0	0	0	0	0	0	0
2321	0	0	0	0	0	0	0	0	0	0
2322	0	0	0	0	0	0	0	0	0	0
2323	0	0	0	0	0	0	0	0	0	0
3111	0	0	0	0	0	0	0	0	0	0
3112	0	0	0	0	0	0	0	0	0	0
3113	0	1	0	0	0	0	6	0	0	0

Reference No.	Lesser Celadine - Ranunculus ficaria	Male fern - Dryopteris filix -mas	Marsh lousewort- Pedicularis palustris	Marsh Marigold - Caltha palustris	Meadow buttercup - Ranunculus acris	Meadowsweet - Filipendula ulmaria	Moschatel - Adoxa moscatellina	Moss- Eurynchium praelongum	Moss- Mnium hornum	Moss - Polytrichum commune
3121	0	0	0	0	0	0	0	0	0	0
3122	0	0	0	0	0	0	0	0	0	0
3123	0	0	0	0	0	0	10	0	0	0
3211	0	0	0	0	0	0	0	0	0	0
3212	0	0	0	0	0	0	0	0	0	0
3213	0	1	0	0	0	0	0	0	0	0
3221	0	0	0	0	0	0	0	0	0	0
3222	0	0	0	0	0	0	0	0	0	0
3223	0	0	0	0	0	0	0	0	0	0
3311	0	0	0	0	0	0	0	0	0	0
3312	0	0	0	0	0	0	0	0	0	0
3313	0	1	0	0	0	0	0	0	0	0
3321	0	0	0	0	0	0	0	0	0	0
3322	0	0	0	0	0	0	0	0	0	0
3323	0	0	0	0	0	0	0	0	0	0
4111	0	0	0	0	0	0	0	0	0	0
4112	0	0	0	0	0	0	0	0	0	0
4113	0	0	0	2	0	60	0	0	0	0
4121	0	0	0	0	0	0	0	0	0	10
4122	0	0	0	0	0	0	0	0	0	0
4123	0	0	0	0	0	50	0	0	0	0
4211	0	0	0	0	0	0	0	0	0	0
4212	0	0	0	0	0	0	0	0	0	0
4213	0	0	0	0	0	99	0	0	0	0
4221	0	0	0	0	0	0	0	0	0	0
4222	0	0	0	0	0	0	0	0	0	0
4223	0	0	0	0	0	90	0	0	0	0
4311	0	0	0	0	0	0	0	0	0	0
4312	0	0	0	0	0	0	0	0	0	0
4313	0	0	0	0	0	99	0	0	0	0
4321	0	0	0	0	0	0	0	0	0	0
4323	0	0	0	0	0	0	0	0	0	0
4323	0	0	0	0	0	90	0	0	0	0
5111	0	0	0	0	0	0	0	0	0	0
5112	0	0	0	0	0	0	0	2	0	0
5113	0	0	0	0	0	0	0	0	0	0
5121	0	0	0	0	0	0	0	0	0	0
5122	0	0	0	0	0	0	0	1	0	0
5123	0	0	0	0	0	0	0	0	0	0

Reference No.	Lesser Celadine - Ranunculus ficaria	Male fern - Dryopteris filix -mas	Marsh lousewort- Pedicularis palustris	Marsh Marigold - Caltha palustris	Meadow buttercup - Ranunculus acris	Meadowsweet – Filipendula ulmaria	Moschatel - Adoxa moscatellina	Moss- Eurynchium praelongum	Moss- Mnium hornum	Moss - Polytrichum commune
5211	0	0	0	0	0	0	0	0	0	0
5212	0	0	0	0	0	0	0	1	0	0
5213	0	0	0	0	0	0	0	0	0	0
5221	0	0	0	0	0	0	0	0	0	0
5222	0	0	0	0	0	0	0	1	0	0
5223	0	0	0	0	0	0	0	0	0	0
5311	0	0	0	0	0	0	0	0	0	0
5312	0	0	0	0	0	0	0	1	0	0
5313	0	0	0	0	0	0	0	0	0	0
5321	0	0	0	0	0	0	0	0	0	0
5322	0	0	0	0	0	0	0	1	0	0
5323	0	0	0	0	0	0	0	0	0	0
6111	0	0	0	0	0	0	0	0	0	0
6112	0	0	0	0	0	0	0	0	0	0
6113	0	0	0	0	0	0	0	0	0	0
6121	0	0	0	0	0	0	0	0	0	0
6122	0	0	0	0	0	0	0	0	0	0
6123	0	0	0	0	0	0	0	0	0	0
6211	0	0	0	0	0	0	0	0	0	0
6212	0	0	0	0	0	0	0	0	0	0
6213	0	0	0	0	0	0	0	0	0	0
6221	0	0	0	0	0	0	0	0	0	0
6222	0	0	0	0	0	0	0	0	0	0
6223	0	0	0	0	0	0	0	0	0	0
6311	0	0	0	0	0	0	0	0	0	0
6312	0	0	0	0	0	0	0	0	0	0
6313	0	0	0	0	0	0	0	0	0	0
6321	10	0	0	0	0	0	0	0	0	0
6322	0	0	0	0	0	0	0	0	0	0
6323	0	0	0	0	0	0	0	0	0	0
7111	0	0	0	0	5	0	0	0	0	0
7112	0	0	0	0	0	0	0	0	0	0
7113	0	0	0	0	6	0	0	0	0	0
7121	0	0	0	0	5	0	0	0	0	0
7122	0	0	0	0	0	0	0	0	0	0
7123	0	0	0	0	40	0	0	0	0	0
7211	0	0	0	0	16	0	0	0	0	0
7212	0	0	2	0	0	0	0	0	0	0
7213	0	0	0	0	0	0	0	0	0	0

Reference No.	Lesser Celadine - Ranunculus ficaria	Male fern - Dryopteris filix -mas	Marsh lousewort- Pedicularis palustris	Marsh Marigold - Caltha palustris	Meadow buttercup - Ranunculus acris	Meadowsweet - Filipendula ulmaria	Moschatel - Adoxa moscatellina	Moss- Eurynchium praelongum	Moss- Mnium hornum	Moss - Polytrichum commune
7222	0	0	0	0	5	0	0	0	0	0
7222	0	0	0	0	0	0	0	0	0	0
7223	0	0	0	0	11	0	0	0	0	0
7311	0	0	0	0	16	0	0	0	0	0
7312	0	0	0	0	0	0	0	0	0	0
7313	0	0	0	0	0	0	0	0	0	0
7321	0	0	0	0	5	0	0	0	0	0
7322	0	0	0	0	0	0	0	0	0	0
7323	0	0	0	0	11	0	0	0	0	0
8111	0	0	0	0	0	0	0	0	0	0
8112	0	0	0	0	0	0	0	0	0	0
8113	0	0	0	0	0	0	0	0	0	0
8121	0	0	0	0	0	0	0	0	0	0
8122	0	0	0	0	0	0	0	0	0	0
8123	0	0	0	0	0	0	0	0	0	0
8211	0	0	0	0	0	0	0	0	0	0
8212	0	0	0	0	0	0	0	0	0	0
8213	0	0	0	0	0	0	0	0	0	0
8222	0	0	0	0	0	0	0	0	0	0
8222	0	0	0	0	0	0	0	0	0	0
8223	0	0	0	0	0	0	0	0	0	0
8311	0	0	0	0	0	0	0	0	0	0
8312	0	0	0	0	0	0	0	0	0	0
8313	0	0	0	0	0	0	0		0	0
8321	0	0	0	0	0	0	0	0	0	0
8322	0	0	0	0	0	0	0	0	0	0
8323	0	0	0	0	0	0	0	0	0	0
9111	0	1	0	0	0	0	0	0	0	0
9112	0	0	0	0	0	0	0	0	0	0
9113	0	0	0	0	0	0	0	0	0	0
9121	0	0	0	0	0	0	0	0	0	0
9122	0	0	0	0	0	0	0	0	0	0
9123	0	0	0	0	0	0	0	0	0	0
9211	3	0	0	0	0	0	0	0	0	0
9212	0	0	0	0	0	0	0	0	0	0
9213	0	0	0	0	0	0	0	0	0	0
9221	0	0	0	0	0	0	0	0	0	0
9222	0	0	0	0	0	0	0	0	0	0
9223	0	0	0	0	0	0	0	0	0	0

Reference No.	Lesser Celadine - Ranunculus ficaria	Male fern - Dryopteris filix -mas	Marsh lousewort- Pedicularis palustris	Marsh Marigold - Caltha palustris	Meadow buttercup - Ranunculus acris	Meadowsweet – Filipendula ulmaria	Moschatel - Adoxa moscatellina	Moss- Eurynchium praelongum	Moss- Mnium hornum	Moss - Polytrichum commune
9311	3	0	0	0	0	0	0	0	0	0
9312	0	0	0	0	0	0	0	0	0	0
9313	0	0	0	0	0	0	0	0	0	0
9321	0	0	0	0	0	0	0	0	0	0
9322	0	0	0	0	0	0	0	0	0	0
9323	0	0	0	0	0	0	0	0	0	0
10111	0	0	0	0	0	0	0	0	0	0
10112	0	0	0	0	0	0	0	0	0	0
10113	0	0	0	0	0	0	0	0	0	0
10121	0	0	0	0	0	0	0	0	0	0
10122	0	0	0	0	0	0	0	0	0	0
10123	0	0	0	0	0	0	0	0	0	0
10211	0	0	0	0	0	0	0	0	0	0
10212	0	0	0	0	0	0	0	0	0	0
10213	0	0	0	0	0	0	0	0	0	0
10221	0	0	0	0	0	0	0	0	0	0
10222	0	0	0	0	0	0	0	0	0	0
10223	0	0	0	0	0	0	0	0	0	0
10311	0	0	0	0	0	0	0	0	0	0
10312	0	0	0	0	0	0	0	0	0	0
10313	0	0	0	0	0	0	0	0	0	0
10321	0	0	0	0	0	0	0	0	0	0
10322	0	0	0	0	0	0	0	0	0	0
10323	0	0	0	0	0	0	0	0	0	0
11111	0	0	0	0	0	0	0	0	0	0
11112	0	0	0	0	0	0	0	0	0	0
11113	0	0	0	0	0	0	0	0	0	0
11121	0	0	0	0	0	0	0	0	0	0
11122	0	0	0	0	0	0	0	0	0	0
11123	0	0	0	0	0	0	0	0	0	0
11211	0	0	0	0	0	0	0	0	0	0
11212	0	0	0	0	0	2	0	0	0	0
11213	0	0	0	0	0	0	0	0	0	0
11221	0	0	0	0	0	0	0	0	0	0
11222	0	0	0	0	0	7	0	0	0	0
11223	0	0	0	0	0	0	0	0	0	0
11311	0	0	0	0	0	0	0	0	0	0
11312	0	0	0	0	0	2	0	0	0	0
11313	0	0	0	0	0	0	0	0	0	0

Reference No.	Lesser Celadine - Ranunculus ficaria	Male fern - Dryopteris filix -mas	Marsh lousewort- Pedicularis palustris	Marsh Marigold - Caltha palustris	Meadow buttercup - Ranunculus acris	Meadowsweet – Filipendula ulmaria	Moschatel - Adoxa moscatellina	Moss- Eurynchium praelongum	Moss- Mnium hornum	Moss - Polytrichum commune
11321	0	0	0	0	0	0	0	0	0	0
11322	0	0	0	0	0	7	0	0	0	0
11323	0	0	0	0	0	0	0	0	0	0
12111	0	0	0	0	0	0	0	0	0	0
12112	0	0	0	0	0	0	0	0	1	0
12113	0	0	0	0	0	0	0	0	0	0
12121	0	0	0	0	0	0	0	0	0	0
12122	0	0	0	0	0	0	0	0	0	0
12123	0	0	0	0	0	0	0	0	0	0
12211	0	0	0	0	0	0	0	0	0	0
12212	0	0	0	0	0	0	0	0	0	0
12213	0	0	0	0	0	0	0	0	0	0
12221	0	0	0	0	0	0	0	0	0	0
12222	0	0	0	0	0	0	0	0	0	0
12223	0	0	0	0	0	0	0	0	0	0
12311	0	0	0	0	0	0	0	0	0	0
12312	0	0	0	0	0	0	0	0	0	0
12313	0	0	0	0	0	0	0	0	0	0
12321	0	0	0	0	0	0	0	0	0	0
12322	0	0	0	0	0	0	0	0	0	0
12323	0	0	0	0	0	0	0	0	0	0

Reference No.	Moss - Rhytidiadelphus triqetrus	Moss- Rhynchostegium confertum	Moss spp.	Mountain Ash - Sorbus Aucuparia	Narrow buckler fern – Dryopteris carthusiana	Nettle - Urtica diocia	Oak- Quercus robur	Opposite leaved saxifrage - Chrysosplenium	Pedunculate oak- Quercus robur	Perrenial Rye Grass - Lolium perenne	Pignut - Conopodium majus
1111	0	0	0	0	0	0	0	0	0	0	0
1112	0	0	0	0	2	0	0	0	0	0	0
1113	0	0	0	0	0	0	0	0	0	0	0
1121	0	0	0	0	2	0	1	0	0	0	0
1122	0	0	0	0	0	0	0	0	0	0	0
1123	0	0	0	0	2	0	0	0	0	0	0
1211	0	0	0	0	0	0	0	0	0	0	0
1212	0	0	0	0	0	0	0	0	0	0	0
1213	0	0	0	0	0	0	0	0	0	0	0
1221	0	0	0	0	0	0	0	0	0	0	0
1222	0	0	0	0	0	0	0	0	1	0	0
1223	0	0	0	0	1	0	0	0	0	0	0
1311	0	0	0	0	0	0	0	0	0	0	0
1312	0	0	0	0	0	0	0	0	0	0	0
1313	0	0	0	0	0	0	0	0	0	0	0
1321	0	0	0	0	0	0	0	0	0	0	0
1322	0	0	0	0	0	0	0	0	0	0	0
1323	0	0	0	0	0	0	0	0	0	0	0
2111	0	0	0	0	0	0	0	0	0	0	0
2112	0	0	0	0	0	8	0	0	0	0	0
2113	0	0	0	0	0	0	0	0	0	0	0
2121	0	0	0	0	0	0	1	0	0	0	0
2122	0	0	0	0	0	6	0	0	0	0	0
2123	0	0	0	0	0	0	1	0	0	0	0
2211	0	0	0	0	0	0	0	0	0	0	0
2212	0	0	0	0	0	15	0	0	0	0	0
2213	0	0	0	0	0	0	0	0	0	0	0
2221	0	0	0	0	0	0	1	0	0	0	0
2222	0	0	0	0	0	9	0	0	0	0	0
2223	0	0	0	0	0	0	1	0	0	0	0
2311	0	0	0	0	0	0	0	0	0	0	0
1312	0	0	0	0	0	27	0	0	0	0	0
2313	0	0	0	0	0	0	0	0	0	0	0
2321	0	0	0	0	0	0	1	0	0	0	0
2322	0	0	0	0	0	19	0	0	0	0	0
2323	0	0	0	0	0	0	1	0	0	0	0
3111	0	0	0	0	0	0	0	0	0	0	0
3112	0	0	0	1	0	0	0	0	0	0	0
3113	0	0	0	0	0	3	0	0	0	0	1

Reference No.	Moss - Rhytidiadelphus triqetrus	Moss- Rhynchostegium confertum	Moss spp.	Mountain Ash - Sorbus Aucuparia	Narrow buckler fern - Dryopteris carthusiana	Nettle - Urtica diocia	Oak- Quercus robur	Opposite leaved saxifrage - Chrysosplenium	Pedunculate oak- Quercus robur	Perrenial Rye Grass - Lolium perenne	Pignut - Conopodium majus
3121	0	0	0	0	0	0	0	0	0	0	0
3122	0	0	0	0	0	0	0	0	0	0	0
3123	0	0	0	0	0	0	0	0	0	0	2
3211	0	0	0	0	0	0	0	0	0	0	0
3212	0	0	0	0	0	0	0	0	0	0	0
3213	0	0	0	0	0	5	0	0	0	0	0
3221	0	0	0	0	0	0	0	0	0	0	0
3222	0	0	0	0	0	0	0	0	0	0	0
3223	0	0	0	0	0	0	0	0	0	0	0
3311	0	0	0	0	0	0	0	0	0	0	0
3312	0	0	0	0	0	0	0	0	0	0	0
3313	0	0	0	0	0	5	0	0	0	0	0
3321	0	0	5	0	0	0	0	0	0	0	0
3322	0	0	0	0	0	0	0	0	0	0	0
3323	0	0	0	0	0	0	0	0	0	0	0
4111	5	0	0	0	0	0	0	0	0	0	0
4112	0	0	0	0	3	0	0	0	0	0	0
4113	0	0	0	0	0	0	0	0	0	0	0
4121	0	0	0	0	0	0	0	0	0	0	0
4122	0	0	0	0	0	0	0	0	0	0	0
4123	0	0	0	0	0	0	0	40	0	0	0
4211	0	0	0	0	0	0	0	0	0	0	0
4212	0	0	0	0	5	0	0	0	0	0	0
4213	0	0	0	0	0	0	0	0	0	0	0
4221	0	0	1	0	0	0	0	0	0	0	0
4222	0	0	1	0	4	0	0	0	0	0	0
4223	0	0	0	0	0	0	0	0	0	0	0
4311	0	0	1	0	0	0	0	0	0	0	0
4312	0	0	0	0	5	0	0	0	0	0	0
4313	0	0	0	0	0	0	0	0	0	0	0
4321	0	0	1	0	0	0	0	0	0	0	0
4323	0	0	1	0	4	0	0	0	0	0	0
4323	0	0	0	0	0	0	0	0	0	0	0
5111	0	0	0	0	0	20	0	0	0	0	0
5112	0	0	0	0	0	20%	0	0	0	0	0
5113	0	0	0	0	0	0	0	0	0	0	0
5121	0	0	0	0	0	12	0	0	0	0	0
5122	0	0	0	0	0	30%	0	0	0	0	0
5123	0	0	0	0	0	0	0	0	0	0	0

Reference No.	Moss - Rhytidiadelphus triqetrus	Moss- Rhynchostegium confertum	Moss spp.	Mountain Ash - Sorbus Aucuparia	Narrow buckler fern – Dryopteris carthusiana	Nettle - Urtica diocia	Oak- Quercus robur	Opposite leaved saxifrage - Chrysosplenium	Pedunculate oak- Quercus robur	Perrenial Rye Grass - Lolium perenne	Pignut - Conopodium majus
5211	0	0	0	0	0	27	0	0	0	0	0
5212	0	0	0	0	0	80%	0	0	0	0	0
5213	0	0	0	0	0	0	0	0	0	0	0
5221	0	0	0	0	0	20	0	0	0	0	0
5222	0	0	0	0	0	20%	0	0	0	0	0
5223	0	0	0	0	0	0	0	0	0	0	0
5311	0	0	0	0	0	27	0	0	0	0	0
5312	0	0	0	0	0	80%	0	0	0	0	0
5313	0	0	0	0	0	0	0	0	0	0	0
5321	0	0	0	0	0	20	0	0	0	0	0
5322	0	0	0	0	0	20%	0	0	0	0	0
5323	0	0	0	0	0	0	0	0	0	0	0
6111	0	3	0	0	0	0	0	0	0	0	0
6112	0	0	0	0	0	0	0	0	0	0	0
6113	0	0	0	0	0	0	0	0	0	0	0
6121	0	1	0	0	0	0	0	0	0	0	0
6122	0	1	0	0	0	0	0	0	0	0	0
6123	0	0	0	0	0	0	0	0	0	0	0
6211	0	0	0	0	0	0	0	0	0	0	0
6212	0	0	0	0	0	0	0	0	0	0	0
6213	0	0	0	0	0	0	0	0	0	0	0
6221	0	0	0	0	0	0	0	0	0	0	0
6222	0	0	0	0	0	0	0	0	0	0	0
6223	0	0	0	0	0	0	0	0	0	0	0
6311	0	0	1	0	0	0	0	0	0	0	0
6312	0	0	4	0	0	0	0	0	0	0	0
6313	0	0	0	0	0	0	0	0	0	0	0
6321	0	0	0	0	0	0	0	0	0	0	0
6322	0	0	3	0	0	0	0	0	0	0	0
6323	0	0	0	0	0	0	0	0	0	0	0
7111	0	0	0	0	0	0	0	0	0	5	0
7112	0	0	0	0	0	0	0	0	0	0	0
7113	0	0	0	0	0	0	0	0	0	0	0
7121	0	0	0	0	0	0	0	0	0	5	0
7122	0	0	0	0	0	0	0	0	0	0	0
7123	0	0	0	0	0	0	0	0	0	5	0
7211	0	0	0	0	0	0	0	0	0	5	0
7212	0	0	0	0	0	0	0	0	0	10	0
7213	0	0	0	0	0	0	0	0	0	5	0

Reference No.	Moss - Rhytidiadelphus triqetrus	Moss- Rhynchostegium confertum	Moss spp.	Mountain Ash - Sorbus Aucuparia	Narrow buckler fern – Dryopteris carthusiana	Nettle - Urtica diocia	Oak- Quercus robur	Opposite leaved saxifrage - Chrysosplenium	Pedunculate oak- Quercus robur	Perrenial Rye Grass - Lolium perenne	Pignut - Conopodium majus
7222	0	0	0	0	0	0	0	0	0	5	0
7222	0	0	0	0	0	0	0	0	0	0	0
7223	0	0	0	0	0	0	0	0	0	5	0
7311	0	0	0	0	0	0	0	0	0	5	0
7312	0	0	0	0	0	0	0	0	0	10	0
7313	0	0	0	0	0	0	0	0	0	5	0
7321	0	0	0	0	0	0	0	0	0	5	0
7322	0	0	0	0	0	0	0	0	0	0	0
7323	0	0	0	0	0	0	0	0	0	5	0
8111	0	0	0	0	0	0	0	0	0	0	0
8112	0	0	0	0	0	0	0	0	0	0	0
8113	0	0	0	0	0	0	0	0	0	0	0
8121	0	0	0	0	0	0	0	0	0	0	0
8122	0	0	0	0	0	0	0	0	0	0	0
8123	0	0	0	0	0	0	0	0	0	0	0
8211	0	1	0	3	0	0	0	0	0	0	0
8212	0	1	0	2	0	0	0	0	0	0	0
8213	0	0	0	0	0	0	0	0	0	0	0
8222	0	1	0	12	0	0	0	0	0	0	0
8222	0	0	0	0	0	0	0	0	0	0	0
8223	0	0	0	0	0	0	0	0	0	0	0
8311	0	1	0	3	0	0	0	0	0	0	0
8312	0	1	0	2	0	0	0	0	0	0	0
8313	0	1	0	0	0	0	0	0	0	0	0
8321	0	1	0	12	0	0	0	0	0	0	0
8322	0	0	0	0	0	0	0	0	0	0	0
8323	0	0	0	0	0	0	0	0	0	0	0
9111	0	0	0	0	0	0	0	0	0	0	0
9112	0	0	0	0	0	0	0	0	0	0	0
9113	0	0	0	0	0	0	0	0	0	0	0
9121	0	0	0	0	0	0	0	0	0	0	0
9122	0	0	0	0	0	0	0	0	0	0	0
9123	0	0	0	0	0	0	0	0	0	0	0
9211	0	0	0	0	0	0	0	0	0	0	0
9212	0	0	0	0	0	0	0	0	0	0	0
9213	0	0	0	0	0	0	0	0	0	0	0
9221	0	0	0	0	0	0	0	0	0	0	0
9222	0	0	0	0	0	0	0	0	0	0	0
9223	0	0	0	0	0	0	0	0	0	0	0

Reference No.	Moss - Rhytidiadelphus triqetrus	Moss- Rhynchostegium confertum	Moss spp.	Mountain Ash - Sorbus Aucuparia	Narrow buckler fern – Dryopteris carthusiana	Nettle - Urtica diocia	Oak- Quercus robur	Opposite leaved saxifrage - Chrysosplenium	Pedunculate oak- Quercus robur	Perrenial Rye Grass - Lolium perenne	Pignut - Conopodium majus
9311	0	0	0	0	0	0	0	0	0	0	0
9312	0	0	0	0	0	0	0	0	0	0	0
9313	0	0	0	0	0	0	0	0	0	0	0
9321	0	0	0	0	0	0	0	0	0	0	0
9322	0	0	0	0	0	0	0	0	0	0	0
9323	0	0	0	0	0	0	0	0	0	0	0
10111	0	0	0	0	0	0	0	0	0	0	0
10112	0	0	0	0	0	0	0	0	0	0	0
10113	0	0	0	0	0	0	0	0	0	0	0
10121	0	0	0	0	0	0	0	0	0	0	0
10122	0	0	0	0	0	0	0	0	0	0	0
10123	0	0	0	0	0	0	0	0	0	0	0
10211	0	0	0	0	0	0	0	0	0	0	0
10212	0	0	0	0	0	0	0	0	0	0	0
10213	0	0	0	0	0	0	0	0	0	0	0
10221	0	0	0	0	0	0	0	0	0	0	0
10222	0	0	0	0	0	0	0	0	0	0	0
10223	0	0	0	0	0	0	0	0	0	0	0
10311	0	0	0	0	0	0	0	0	0	0	0
10312	0	0	0	0	0	0	0	0	0	0	0
10313	0	0	0	0	0	0	0	0	0	0	0
10321	0	0	0	0	0	0	0	0	0	0	0
10322	0	0	0	0	0	0	0	0	0	0	0
10323	0	0	0	0	0	0	0	0	0	0	0
11111	0	0	0	0	0	0	0	0	0	0	0
11112	0	0	0	0	0	0	0	0	0	0	0
11113	0	0	0	0	0	0	0	0	0	0	0
11121	0	0	0	0	0	0	0	0	0	0	0
11122	0	0	0	0	0	0	0	0	0	0	0
11123	0	0	0	0	0	0	0	0	0	0	0
11211	0	0	0	0	0	0	0	0	0	0	0
11212	0	0	0	0	0	0	0	0	0	0	0
11213	0	0	0	0	3	0	0	0	0	0	0
11221	0	0	0	0	0	0	0	0	0	0	0
11222	0	0	0	0	0	0	0	0	0	0	0
11223	0	0	0	0	1	0	0	0	0	0	0
11311	0	0	0	0	0	0	0	0	0	0	0
11312	0	0	0	0	0	0	0	0	0	0	0
11313	0	0	0	0	3	0	0	0	0	0	0

Reference No.	Moss - Rhytidiadelphus triqetrus	Moss- Rhynchostegium confertum	Moss spp.	Mountain Ash - Sorbus Aucuparia	Narrow buckler fern - Dryopteris carthusiana	Nettle - Urtica diocia	Oak- Quercus robur	Opposite leaved saxifrage - Chrysosplenium	Pedunculate oak- Quercus robur	Perrenial Rye Grass - Lolium perenne	Pignut - Conopodium majus
11321	0	0	0	0	0	0	0	0	0	0	0
11322	0	0	0	0	0	0	0	0	0	0	0
11323	0	0	0	0	1	0	0	0	0	0	0
12111	0	0	3	0	0	0	0	0	0	0	0
12112	0	0	0	0	0	0	0	0	0	0	0
12113	0	0	0	0	0	0	3	0	0	0	0
12121	0	0	1	0	0	0	0	0	0	0	0
12122	0	0	0	0	0	0	0	0	0	0	0
12123	0	0	1	1	0	0	0	0	0	0	0
12211	0	0	2	0	0	0	0	0	0	0	0
12212	0	0	1	0	0	0	0	0	0	0	0
12213	0	0	0	0	0	0	3	0	0	0	0
12221	0	0	1	0	0	0	1	0	0	0	0
12222	0	0	0	0	0	0	0	0	0	0	0
12223	0	0	1	0	0	0	0	0	0	0	0
12311	0	0	2	0	0	0	0	0	0	0	0
12312	0	0	1	0	0	0	0	0	0	0	0
12313	0	0	0	0	0	0	3	0	0	0	0
12321	0	0	1	0	0	0	1	0	0	0	0
12322	0	0	0	0	0	0	0	0	0	0	0
12323	0	0	1	0	0	0	0	0	0	0	0

Reference No.	Primrose - Primula vulgaris	Privet - Ligustrum vulgare	Prunus spp saplings	Raspberry – Rubus idaeus	Red Campion - Silene dioica	Red fescue- Festuca rubra	Ribwort plantain - Plantago lanceolata	Rose species- Rosa spp	Rough Hawkbit - Leontodon hispidus	Rough meadow-grass- Poa trivialis	Rowan-Sorbus aucuparia	Sanicle - Sanicle europaea
1111	0	0	0	0	0	0	0	0	0	0	0	0
1112	0	0	0	0	0	0	0	0	0	0	0	0
1113	0	0	0	0	0	0	0	0	0	0	0	0
1121	0	0	0	1	0	0	0	0	0	0	0	0
1122	0	0	0	0	0	0	0	0	0	0	0	0
1123	0	0	0	0	0	0	0	0	0	0	0	0
1211	0	0	0	0	0	0	0	0	0	0	0	0
1212	0	0	0	0	0	0	0	0	0	10	0	0
1213	0	0	0	0	0	0	0	2	0	0	0	0
1221	0	0	0	0	0	0	0	0	0	0	0	0
1222	0	0	0	0	0	0	0	0	0	0	0	0
1223	0	0	0	0	0	0	0	0	0	0	0	0
1311	0	0	0	0	0	0	0	0	0	0	0	0
1312	0	0	0	0	0	0	0	2	0	0	0	0
1313	0	0	0	0	0	0	0	0	0	0	0	0
1321	0	0	0	0	0	0	0	0	0	0	0	0
1322	0	0	0	0	0	0	0	0	0	0	0	0
1323	0	0	0	0	0	0	0	0	0	0	0	0
2111	0	0	0	0	0	0	0	0	0	0	0	0
2112	0	0	0	0	0	0	0	0	0	0	0	0
2113	0	0	0	0	2	0	0	0	0	0	0	0
2121	0	0	0	0	0	0	0	0	0	0	0	0
2122	0	0	0	0	9	0	0	0	0	0	0	0
2123	0	0	0	0	0	0	0	0	0	0	0	0
2211	0	0	0	0	1	0	0	0	0	0	0	0
2212	0	0	0	0	0	0	0	0	0	0	0	0
2213	0	0	0	0	2	0	0	0	0	0	0	0
2221	0	0	0	0	0	0	0	0	0	0	0	0
2222	0	0	0	0	0	0	0	0	0	0	0	0
2223	0	0	0	0	3	0	0	0	0	0	0	0
2311	0	0	0	0	1	0	0	0	0	0	0	0
1312	0	0	0	0	0	0	0	0	0	0	0	0
2313	0	0	0	0	2	0	0	0	0	0	0	0
2321	0	0	0	0	0	0	0	0	0	0	0	0
2322	0	0	0	0	0	0	0	0	0	0	0	0
2323	0	0	0	0	3	0	0	0	0	0	0	0
3111	0	0	0	0	0	0	0	0	0	0	0	0
3112	0	0	0	0	0	0	0	0	0	0	0	0
3113	0	0	0	0	1	0	0	0	0	0	0	0

Reference No.	Primrose - Primula vulgaris	Privet - Ligustrum vulgare	Prunus spp saplings	Raspberry – Rubus idaeus	Red Campion - Silene dioica	Red fescue- Festuca rubra	Ribwort plantain - Plantago lanceolata	Rose species- Rosa spp	Rough Hawkbit - Leontodon hispidus	Rough meadow-grass- Poa trivialis	Rowan-Sorbus aucuparia	Sanicle - Sanicle europaea
3121	0	0	0	0	0	0	0	0	0	0	0	0
3122	0	0	0	0	0	0	0	0	0	0	0	0
3123	0	0	0	0	2	0	0	0	0	0	0	0
3211	0	0	0	0	0	0	0	0	0	0	0	0
3212	0	0	0	0	0	0	0	0	0	0	1	0
3213	0	0	0	0	0	0	0	0	0	0	0	0
3221	0	0	0	0	0	0	0	0	0	0	0	0
3222	0	0	0	0	0	0	0	0	0	0	0	0
3223	0	0	0	0	0	0	0	0	0	0	0	0
3311	0	0	0	0	0	0	0	0	0	0	0	0
3312	0	0	0	0	0	0	0	0	0	0	1	0
3313	0	0	0	0	0	0	0	0	0	0	0	0
3321	0	0	0	0	0	0	0	0	0	0	0	0
3322	0	0	0	0	0	0	0	0	0	0	0	0
3323	0	0	0	0	0	0	0	0	0	0	0	0
4111	0	0	0	0	0	0	0	0	0	0	0	0
4112	0	0	0	0	0	0	0	0	0	0	0	0
4113	0	0	0	0	0	0	0	0	0	0	0	0
4121	0	0	0	0	0	0	0	0	0	0	0	0
4122	0	0	0	0	0	0	0	0	0	0	0	0
4123	0	0	0	0	0	0	0	0	0	0	0	0
4211	0	0	0	0	0	0	0	0	0	0	0	0
4212	0	0	0	0	0	0	0	0	0	0	0	0
4213	0	0	0	0	0	0	0	0	0	0	0	0
4221	0	0	0	0	0	0	0	0	0	0	0	0
4222	0	0	0	0	0	0	0	0	0	0	0	0
4223	0	0	0	0	0	0	0	0	0	0	0	0
4311	0	0	0	0	0	0	0	0	0	0	0	0
4312	0	0	0	0	0	0	0	0	0	0	0	0
4313	0	0	0	0	0	0	0	0	0	0	0	0
4321	0	0	0	0	0	0	0	0	0	0	0	0
4323	0	0	0	0	0	0	0	0	0	0	0	0
4323	0	0	0	0	0	0	0	0	0	0	0	0
5111	0	0	0	0	2	0	0	0	0	0	0	0
5112	0	0	0	0	0	0	0	0	0	0	0	0
5113	0	0	0	0	0	0	0	0	0	0	0	0
5121	0	0	0	0	5	0	0	0	0	0	0	0
5122	0	0	0	0	0	0	0	0	0	0	0	0
5123	0	0	0	0	0	0	0	0	0	0	0	0

Reference No.	Primrose - Primula vulgaris	Privet - Ligustrum vulgare	Prunus spp saplings	Raspberry – Rubus idaeus	Red Campion - Silene dioica	Red fescue- Festuca rubra	Ribwort plantain - Plantago lanceolata	Rose species- Rosa spp	Rough Hawkbit - Leontodon hispidus	Rough meadow-grass- Poa trivialis	Rowan-Sorbus aucuparia	Sanicle - Sanicle europaea
5211	0	0	0	0	3	0	0	0	0	0	0	1
5212	0	0	0	0	0	0	0	0	0	0	0	0
5213	0	0	0	0	0	1	0	0	0	0	0	0
5221	0	0	0	0	9	0	0	0	0	0	0	0
5222	0	0	0	0	0	0	0	0	0	0	0	0
5223	0	0	0	0	0	0	0	0	0	0	0	0
5311	0	0	0	0	3	0	0	0	0	0	0	1
5312	0	0	0	0	0	0	0	0	0	0	0	0
5313	0	0	0	0	0	1	0	0	0	0	0	0
5321	0	0	0	0	9	0	0	0	0	0	0	0
5322	0	0	0	0	0	0	0	0	0	0	0	0
5323	0	0	0	0	0	0	0	0	0	0	0	0
6111	0	0	0	0	0	0	0	0	0	0	0	0
6112	0	0	0	0	0	0	0	0	0	0	0	0
6113	0	0	0	0	0	0	0	0	0	0	0	0
6121	0	0	0	0	0	0	0	0	0	0	0	0
6122	0	0	0	0	0	0	0	0	0	0	0	0
6123	0	0	0	0	0	0	0	0	0	0	0	0
6211	0	0	0	0	0	0	0	0	0	0	0	0
6212	0	0	0	0	0	0	0	0	0	0	0	0
6213	0	0	0	0	0	0	0	0	0	0	0	0
6221	0	0	0	0	0	0	0	0	0	0	0	0
6222	0	0	0	0	0	0	0	0	0	0	0	0
6223	0	0	0	0	0	0	0	0	0	0	0	0
6311	0	0	0	0	0	0	0	0	0	0	0	0
6312	0	0	0	0	0	0	0	0	0	0	0	0
6313	0	0	0	0	0	0	0	0	0	0	0	0
6321	0	0	0	0	0	0	0	0	0	0	0	0
6322	0	0	0	0	0	0	0	0	0	0	0	0
6323	0	0	0	0	0	0	0	0	0	0	0	0
7111	0	0	0	0	0	0	0	0	0	0	0	0
7112	0	0	0	0	0	0	0	0	0	0	0	0
7113	0	0	0	0	0	0	1	0	0	0	0	0
7121	0	0	0	0	0	0	0	0	0	0	0	0
7122	0	0	0	0	0	0	4	0	0	0	0	0
7123	0	0	0	0	0	0	0	0	0	0	0	0
7211	0	0	0	0	0	0	5	0	3	0	0	0
7212	0	0	0	0	0	0	1	0	0	15	0	0
7213	0	0	0	0	0	0	1	0	12	0	0	0

Reference No.	Primrose - Primula vulgaris	Privet - Ligustrum vulgare	Prunus spp saplings	Raspberry – Rubus idaeus	Red Campion - Silene dioica	Red fescue- Festuca rubra	Ribwort plantain - Plantago lanceolata	Rose species- Rosa spp	Rough Hawkbit - Leontodon hispidus	Rough meadow-grass- Poa trivialis	Rowan-Sorbus aucuparia	Sanicle - Sanicle europaea
7222	0	0	0	0	0	0	0	0	10	0	0	0
7222	0	0	0	0	0	0	4	0	0	5	0	0
7223	0	0	0	0	0	0	0	0	20	0	0	0
7311	0	0	0	0	0	0	5	0	3	0	0	0
7312	0	0	0	0	0	0	1	0	0	15	0	0
7313	0	0	0	0	0	0	1	0	12	0	0	0
7321	0	0	0	0	0	0	0	0	10	0	0	0
7322	0	0	0	0	0	0	4	0	0	5	0	0
7323	0	0	0	0	0	0	0	0	20	0	0	0
8111	0	0	0	0	0	0	0	0	0	0	0	0
8112	0	0	0	0	0	0	0	0	0	0	0	0
8113	0	0	0	0	0	0	0	0	0	0	0	0
8121	0	0	0	0	0	0	0	0	0	0	0	0
8122	0	0	0	0	0	0	0	0	0	0	0	0
8123	0	0	0	0	0	0	0	0	0	0	0	0
8211	0	2	0	0	0	0	0	0	0	0	0	0
8212	3	0	0	1	0	0	0	0	0	0	2	0
8213	0	0	0	0	0	0	0	0	0	0	0	0
8222	0	0	0	0	0	0	0	0	0	0	0	0
8222	5	0	0	0	0	0	0	0	0	0	0	0
8223	0	0	0	0	0	0	0	0	0	0	0	0
8311	0	2	0	0	0	0	0	0	0	0	0	0
8312	3	0	0	1	0	0	0	0	0	0	2	0
8313	0	0	0	0	0	0	0	0	0	0	0	0
8321	0	0	0	0	0	0	0	0	0	0	0	0
8322	5	0	0	0	0	0	0	0	0	0	0	0
8323	0	0	0	0	0	0	0	0	0	0	0	0
9111	0	0	0	0	0	0	0	0	0	0	0	0
9112	0	0	0	0	0	0	0	0	0	0	0	0
9113	0	0	0	0	0	0	0	0	0	0	0	0
9121	0	0	0	0	0	0	0	0	0	0	0	0
9122	0	0	0	0	0	0	0	0	0	0	0	0
9123	0	0	0	0	0	0	0	0	0	0	0	0
9211	0	0	0	0	0	7	0	0	0	0	0	0
9212	0	0	0	0	0	0	0	0	0	0	0	0
9213	0	0	0	0	0	0	0	0	0	0	0	0
9221	0	0	0	0	0	0	0	0	0	0	0	0
9222	0	0	0	0	0	0	0	0	0	0	0	0
9223	0	0	0	0	0	0	0	0	0	0	0	0

Reference No.	Primrose - Primula vulgaris	Privet - Ligustrum vulgare	Prunus spp saplings	Raspberry – Rubus idaeus	Red Campion - Silene dioica	Red fescue- Festuca rubra	Ribwort plantain - Plantago lanceolata	Rose species- Rosa spp	Rough Hawkbit - Leontodon hispidus	Rough meadow-grass- Poa trivialis	Rowan-Sorbus aucuparia	Sanicle - Sanicle europaea
9311	0	0	0	0	0	7	0	0	0	0	0	0
9312	0	0	0	0	0	0	0	0	0	0	0	0
9313	0	0	0	0	0	0	0	0	0	0	0	0
9321	0	0	0	0	0	0	0	0	0	0	0	0
9322	0	0	0	0	0	0	0	0	0	0	0	0
9323	0	0	0	0	0	0	0	0	0	0	0	0
10111	0	0	0	0	0	0	0	0	0	0	0	0
10112	0	0	0	0	0	0	0	0	0	0	0	0
10113	0	0	0	0	0	0	0	0	0	0	0	0
10121	0	0	0	0	0	0	0	0	0	0	0	0
10122	0	0	0	0	0	0	0	0	0	0	0	0
10123	0	0	0	0	0	0	0	0	0	0	0	0
10211	0	0	0	0	0	0	0	0	0	0	0	0
10212	0	0	0	0	0	0	0	0	0	0	0	0
10213	0	0	0	0	0	0	0	0	0	0	0	0
10221	0	0	0	0	0	0	0	0	0	0	0	0
10222	0	0	0	0	0	0	0	0	0	0	0	0
10223	0	0	0	0	0	0	0	0	0	0	0	0
10311	0	0	0	0	0	0	0	0	0	0	0	0
10312	0	0	0	0	0	0	0	0	0	0	0	0
10313	0	0	0	0	0	0	0	0	0	0	0	0
10321	0	0	0	0	0	0	0	0	0	0	0	0
10322	0	0	0	0	0	0	0	0	0	0	0	0
10323	0	0	0	0	0	0	0	0	0	0	0	0
11111	0	0	0	0	0	0	0	0	0	0	0	0
11112	0	0	0	0	0	0	0	0	0	0	0	0
11113	0	0	0	0	0	0	0	0	0	0	0	0
11121	0	0	0	0	0	0	0	0	0	0	0	0
11122	0	0	0	0	0	0	0	0	0	0	0	0
11123	0	0	0	0	0	0	0	0	0	0	0	0
11211	0	0	0	0	0	0	0	0	0	0	0	0
11212	0	0	0	0	0	0	0	0	0	0	0	0
11213	0	0	0	0	0	0	0	0	0	0	0	0
11221	0	0	0	0	0	0	0	0	0	0	0	0
11222	0	0	0	0	0	0	0	0	0	0	0	0
11223	0	0	0	0	0	0	0	0	0	0	0	0
11311	0	0	0	0	0	0	0	0	0	0	0	0
11312	0	0	0	0	0	0	0	0	0	0	0	0
11313	0	0	0	0	0	0	0	0	0	0	0	0

Reference No.	Primrose - Primula vulgaris	Privet - Ligustrum vulgare	Prunus spp saplings	Raspberry – Rubus idaeus	Red Campion - Silene dioica	Red fescue- Festuca rubra	Ribwort plantain - Plantago lanceolata	Rose species- Rosa spp	Rough Hawkbit - Leontodon hispidus	Rough meadow-grass- Poa trivialis	Rowan-Sorbus aucuparia	Sanicle - Sanicle europaea
11321	0	0	0	0	0	0	0	0	0	0	0	0
11322	0	0	0	0	0	0	0	0	0	0	0	0
11323	0	0	0	0	0	0	0	0	0	0	0	0
12111	0	0	0	0	0	0	0	0	0	0	0	0
12112	0	0	0	0	0	0	0	0	0	0	0	0
12113	0	0	0	0	0	0	0	0	0	0	0	0
12121	0	0	0	0	0	0	0	0	0	0	0	0
12122	0	0	0	0	0	0	0	0	0	0	0	0
12123	0	0	0	0	0	0	0	0	0	0	0	0
12211	0	0	0	0	0	0	0	0	0	0	0	0
12212	0	0	0	0	0	0	0	0	0	0	0	0
12213	0	0	0	0	0	0	0	0	0	0	0	0
12221	0	0	0	0	0	0	0	0	0	0	0	0
12222	0	0	0	0	0	0	0	0	0	0	0	0
12223	0	0	0	0	0	0	0	0	0	0	1	0
12311	0	0	0	0	0	0	0	0	0	0	0	0
12312	0	0	0	0	0	0	0	0	0	0	0	0
12313	0	0	0	0	0	0	0	0	0	0	0	0
12321	0	0	0	0	0	0	0	0	0	0	0	0
12322	0	0	0	0	0	0	0	0	0	0	0	0
12323	0	0	0	0	0	0	0	0	0	0	1	0

Reference No.	Scaly male fern- Dryopteris affinis	Self Heal - Prunella vulgaris	Sharp flowered rush - Juncus acutiflorus	Short-fruited willowherb	Soft Rush - Juncus effusus	Soft Shied Fern - Polystichum setiferum	Sorrel - Rumex acetosa	Star sedge - Carex echinata	Strawberry-Fragaria vesca	Sweet vernal grass - Anthoxanum odoratum	Sycamore - Acer Psuedoplatanus	Tawny sedge - Carex hostiana
1111	0	0	0	0	0	0	0	0	0	0	0	0
1112	0	0	0	0	0	0	0	0	0	0	0	0
1113	0	0	0	0	0	0	0	0	0	0	0	0
1121	0	0	0	0	0	0	0	0	0	0	0	0
1122	0	0	0	0	0	0	0	0	0	0	0	0
1123	0	0	0	0	0	0	0	0	0	0	0	0
1211	0	0	0	0	0	0	0	0	0	0	0	0
1212	0	0	0	0	0	0	0	0	0	0	0	0
1213	0	0	0	0	0	0	0	0	4	0	0	0
1221	0	0	0	0	0	0	0	0	0	0	0	0
1222	0	0	0	0	0	0	0	0	0	0	0	0
1223	0	0	0	0	0	0	0	0	0	0	0	0
1311	0	0	0	0	0	0	0	0	0	0	0	0
1312	0	0	0	0	0	0	0	0	4	0	0	0
1313	0	0	0	0	0	0	0	0	0	0	0	0
1321	0	0	0	0	0	0	0	0	0	0	0	0
1322	0	0	0	0	0	0	0	0	0	0	0	0
1323	0	0	0	0	0	0	0	0	0	0	0	0
2111	0	0	0	0	0	0	0	0	0	0	0	0
2112	0	0	0	0	0	0	0	0	0	0	0	0
2113	0	0	0	0	0	0	0	0	0	0	0	0
2121	0	0	0	0	0	0	0	0	0	0	0	0
2122	0	0	0	0	0	0	0	0	0	0	0	0
2123	0	0	0	0	0	0	0	0	0	0	0	0
2211	0	0	0	0	0	0	0	0	0	0	0	0
2212	0	0	0	0	0	0	0	0	0	0	0	0
2213	0	0	0	0	0	0	0	0	0	0	0	0
2221	0	0	0	0	0	0	0	0	0	0	0	0
2222	0	0	0	0	0	0	0	0	0	0	0	0
2223	0	0	0	0	0	0	0	0	0	0	0	0
2311	0	0	0	0	0	0	0	0	0	0	0	0
1312	0	0	0	0	0	0	0	0	0	0	0	0
2313	0	0	0	0	0	0	0	0	0	0	0	0
2321	0	0	0	0	0	0	0	0	0	0	0	0
2322	0	0	0	0	0	0	0	0	0	0	0	0
2323	0	0	0	0	0	0	0	0	0	0	0	0
3111	0	0	0	0	0	0	0	0	0	0	0	0
3112	0	0	0	0	0	0	0	0	0	0	0	0
3113	0	0	0	0	0	0	0	0	0	0	1	0

Reference No.	Scaly male fern-Dryopteris affinis	Self Heal - Prunella vulgaris	Sharp flowered rush - Juncus acutiflorus	Short-fruited willowherb	Soft Rush - Juncus effusus	Soft Shied Fern - Polystichum setiferum	Sorrel - Rumex acetosa	Star sedge - Carex echinata	Strawberry-Fragaria vesca	Sweet vernal grass - Anthoxanum odoratum	Sycamore - Acer Psuedoplatanus	Tawny sedge - Carex hostiana
3121	0	0	0	0	0	0	0	0	0	0	0	0
3122	0	0	0	0	0	0	0	0	0	0	0	0
3123	0	0	0	0	0	0	0	0	0	0	1	0
3211	0	0	0	0	0	0	0	0	0	0	0	0
3212	0	0	0	0	0	0	0	0	0	0	0	0
3213	0	0	0	0	0	0	0	0	0	0	1	0
3221	0	0	0	0	0	0	0	0	0	0	0	0
3222	0	0	0	0	0	0	0	0	0	0	0	0
3223	0	0	0	0	0	0	0	0	0	0	1	0
3311	0	0	0	0	0	0	0	0	0	0	0	0
3312	0	0	0	0	0	0	0	0	0	0	0	0
3313	0	0	0	0	0	0	0	0	0	0	1	0
3321	0	0	0	0	0	0	0	0	0	0	0	0
3322	0	0	0	0	0	0	0	0	0	0	0	0
3323	0	0	0	0	0	0	0	0	0	0	1	0
4111	0	0	0	0	0	0	0	0	0	0	0	0
4112	0	0	0	0	0	0	0	0	0	0	0	0
4113	0	0	0	0	0	0	0	0	0	0	0	0
4121	0	0	0	0	0	0	0	0	0	0	0	0
4122	0	0	0	0	0	0	0	0	0	0	0	0
4123	0	0	0	0	0	0	0	0	0	0	0	0
4211	0	0	0	0	0	0	0	0	0	0	0	0
4212	0	0	0	0	0	0	0	0	0	0	0	0
4213	0	0	0	0	0	0	0	0	0	0	0	0
4221	0	0	0	0	0	0	0	0	0	0	0	0
4222	0	0	0	0	0	0	0	0	0	0	0	0
4223	0	0	0	0	0	0	0	0	0	0	0	0
4311	0	0	0	0	0	0	0	0	0	0	0	0
4312	0	0	0	0	0	0	0	0	0	0	0	0
4313	0	0	0	0	0	0	0	0	0	0	0	0
4321	0	0	0	0	0	0	0	0	0	0	0	0
4323	0	0	0	0	0	0	0	0	0	0	0	0
4323	0	0	0	0	0	0	0	0	0	0	0	0
5111	0	0	0	0	0	0	0	0	0	0	0	0
5112	0	0	0	0	0	0	0	0	0	0	0	0
5113	0	0	0	0	0	0	0	0	0	0	0	0
5121	0	0	0	0	0	0	0	0	0	0	0	0
5122	0	0	0	0	0	0	0	0	0	0	0	0
5123	0	0	0	1	0	0	0	0	0	0	0	0

Reference No.	Scaly male fern- Dryopteris affinis	Self Heal - Prunella vulgaris	Sharp flowered rush - Juncus acutiflorus	Short-fruited willowherb	Soft Rush - Juncus effusus	Soft Shied Fern - Polystichum setiferum	Sorrel - Rumex acetosa	Star sedge - Carex echinata	Strawberry-Fragaria vesca	Sweet vernal grass - Anthoxanum odoratum	Sycamore - Acer Psuedoplatanus	Tawny sedge - Carex hostiana
5211	0	0	0	0	0	0	0	0	0	0	0	0
5212	0	0	0	0	0	0	0	0	0	0	0	0
5213	0	0	0	0	0	0	0	0	0	0	0	0
5221	0	0	0	0	0	0	0	0	0	0	0	0
5222	0	0	0	0	0	0	0	0	0	0	0	0
5223	0	0	0	0	0	0	0	0	0	0	0	0
5311	0	0	0	0	0	0	0	0	0	0	0	0
5312	0	0	0	0	0	0	0	0	0	0	0	0
5313	0	0	0	0	0	0	0	0	0	0	0	0
5321	0	0	0	0	0	0	0	0	0	0	0	0
5322	0	0	0	0	0	0	0	0	0	0	0	0
5323	0	0	0	0	0	0	0	0	0	0	0	0
6111	0	0	0	0	0	0	0	0	0	0	0	0
6112	0	0	0	0	0	0	0	0	0	0	0	0
6113	0	0	0	0	0	0	0	0	0	0	0	0
6121	0	0	0	0	0	0	0	0	0	0	0	0
6122	0	0	0	0	0	0	0	0	0	0	0	0
6123	1	0	0	0	0	0	0	0	0	0	0	0
6211	0	0	0	0	0	0	0	0	0	0	0	0
6212	0	0	0	0	0	0	0	0	0	0	0	0
6213	0	0	0	0	0	0	0	0	0	0	0	0
6221	0	0	0	0	0	0	0	0	0	0	0	0
6222	0	0	0	0	0	0	0	0	0	0	0	0
6223	0	0	0	0	0	0	0	0	0	0	0	0
6311	0	0	0	0	0	0	0	0	0	0	0	0
6312	0	0	0	0	0	0	0	0	0	0	0	0
6313	0	0	0	0	0	0	0	0	0	0	0	0
6321	0	0	0	0	0	0	0	0	0	0	0	0
6322	0	0	0	0	0	0	0	0	0	0	0	0
6323	0	0	0	0	0	0	0	0	0	0	0	0
7111	0	3	0	0	0	0	1	0	0	5	0	0
7112	0	0	0	0	2	0	0	0	0	0	0	0
7113	0	6	0	0	0	0	2	0	0	5	0	0
7121	0	1	0	0	0	0	0	0	0	0	0	0
7122	0	0	1	0	6	0	0	0	0	0	0	0
7123	0	0	0	0	1	0	0	0	0	5	0	0
7211	0	0	0	0	7	0	1	0	0	2	0	0
7212	0	0	0	0	3	0	0	0	0	0	0	0
7213	0	0	0	0	0	0	1	0	0	5	0	0

Reference No.	Scaly male fern-Dryopteris affinis	Self Heal - Prunella vulgaris	Sharp flowered rush - Juncus acutiflorus	Short-fruited willowherb	Soft Rush - Juncus effusus	Soft Shied Fern - Polystichum setiferum	Sorrel - Rumex acetosa	Star sedge - Carex echinata	Strawberry-Fragaria vesca	Sweet vernal grass - Anthoxanum odoratum	Sycamore - Acer Psuedoplatanus	Tawny sedge - Carex hostiana
7222	0	0	0	0	0	0	0	0	0	0	0	0
7222	0	0	0	0	6	0	0	0	0	0	0	0
7223	0	0	0	0	1	0	0	0	0	5	0	0
7311	0	0	0	0	7	0	1	0	0	5	0	0
7312	0	0	0	0	3	0	0	0	0	0	0	0
7313	0	0	0	0	0	0	1	0	0	5	0	0
7321	0	0	0	0	0	0	0	0	0	10	0	0
7322	0	0	0	0	6	0	0	0	0	0	0	0
7323	0	0	0	0	1	0	0	0	0	5	0	0
8111	0	0	0	0	0	0	0	0	0	0	0	0
8112	0	0	0	0	0	0	0	0	0	0	0	0
8113	0	0	0	0	0	0	0	0	0	0	0	0
8121	0	0	0	0	0	0	0	0	0	0	0	0
8122	0	0	0	0	0	0	0	0	0	0	0	0
8123	0	0	0	0	0	0	0	0	0	0	0	0
8211	0	0	0	0	0	0	0	0	0	0	0	0
8212	0	0	0	0	0	0	0	0	0	0	0	0
8213	0	0	0	0	0	0	0	0	0	0	0	0
8222	0	0	0	0	0	0	0	0	0	0	0	0
8222	0	0	0	0	0	0	0	0	0	0	0	0
8223	0	0	0	0	0	0	0	0	0	0	0	0
8311	0	0	0	0	0	0	0	0	0	0	0	0
8312	0	0	0	0	0	0	0	0	0	0	0	0
8313	0	0	0	0	0	0	0	0	0	0	0	0
8321	0	0	0	0	0	0	0	0	0	0	0	0
8322	0	0	0	0	0	0	0	0	0	0	0	0
8323	0	0	0	0	0	0	0	0	0	0	0	0
9111	0	0	0	0	0	0	0	0	0	0	0	0
9112	0	0	0	0	0	0	0	0	0	0	0	0
9113	0	0	0	0	0	0	0	0	0	0	0	0
9121	1	0	0	0	0	0	0	0	0	0	0	0
9122	0	0	0	0	0	0	0	0	0	0	0	0
9123	0	0	0	0	0	0	0	0	0	0	0	0
9211	0	0	0	0	0	0	0	0	0	0	0	0
9212	0	0	0	0	0	0	0	0	0	0	0	0
9213	0	0	0	0	0	0	0	0	0	0	0	0
9221	0	0	0	0	0	0	0	0	0	0	0	0
9222	0	0	0	0	0	0	0	0	0	0	0	0
9223	0	0	0	0	0	0	0	0	0	0	0	0

Reference No.	Scaly male fern- Dryopteris affinis	Self Heal - Prunella vulgaris	Sharp flowered rush - Juncus acutiflorus	Short-fruited willowherb	Soft Rush - Juncus effusus	Soft Shied Fern - Polystichum setiferum	Sorrel - Rumex acetosa	Star sedge - Carex echinata	Strawberry-Fragaria vesca	Sweet vernal grass - Anthoxanum odoratum	Sycamore - Acer Psuedoplatanus	Tawny sedge - Carex hostiana
9311	0	0	0	0	0	0	0	0	0	0	0	0
9312	0	0	0	0	0	0	0	0	0	0	0	0
9313	0	0	0	0	0	0	0	0	0	0	0	0
9321	0	0	0	0	0	0	0	0	0	0	0	0
9322	0	0	0	0	0	0	0	0	0	0	0	0
9323	0	0	0	0	0	0	0	0	0	0	0	0
10111	0	0	0	0	0	0	0	0	0	0	0	0
10112	0	0	0	0	0	0	0	0	0	0	0	0
10113	0	0	0	0	0	0	0	0	0	0	0	0
10121	0	0	0	0	0	0	0	0	0	0	0	0
10122	0	0	0	0	0	0	0	0	0	0	0	0
10123	0	0	0	0	0	0	0	0	0	0	0	0
10211	0	0	0	0	0	0	0	0	0	0	0	0
10212	0	0	0	0	0	0	0	0	0	0	0	0
10213	0	0	0	0	0	0	0	0	0	0	0	0
10221	0	0	0	0	0	0	0	0	0	0	0	0
10222	0	0	0	0	0	0	0	0	0	0	0	0
10223	0	0	0	0	0	0	0	0	0	0	0	0
10311	0	0	0	0	0	0	0	0	0	0	0	0
10312	0	0	0	0	0	0	0	0	0	0	0	0
10313	0	0	0	0	0	0	0	0	0	0	0	0
10321	0	0	0	0	0	0	0	0	0	0	0	0
10322	0	0	0	0	0	0	0	0	0	0	0	0
10323	0	0	0	0	0	0	0	0	0	0	0	0
11111	0	0	0	0	0	0	0	0	0	0	0	0
11112	0	0	0	0	0	0	0	0	0	0	0	0
11113	0	0	0	0	0	0	0	0	0	0	0	0
11121	0	0	0	0	0	0	0	0	0	0	0	0
11122	0	0	0	0	0	0	0	0	0	0	0	0
11123	0	0	0	0	0	0	0	0	0	0	0	0
11211	0	0	0	0	0	0	0	0	0	0	0	0
11212	0	0	0	0	0	0	0	0	0	0	0	0
11213	0	0	0	0	0	0	0	0	0	0	0	0
11221	0	0	0	0	0	0	0	0	0	0	0	0
11222	0	0	0	0	0	0	0	0	0	0	0	0
11223	0	0	0	0	0	0	0	0	0	0	0	0
11311	0	0	0	0	0	0	0	0	0	0	0	0
11312	0	0	0	0	0	0	0	0	0	0	0	0
11313	0	0	0	0	0	0	0	0	0	0	0	0

Reference No.	Scaly male fern- Dryopteris affinis	Self Heal - Prunella vulgaris	Sharp flowered rush - Juncus acutiflorus	Short-fruited willowherb	Soft Rush - Juncus effusus	Soft Shied Fern - Polystichum setiferum	Sorrel - Rumex acetosa	Star sedge - Carex echinata	Strawberry-Fragaria vesca	Sweet vernal grass - Anthoxanum odoratum	Sycamore - Acer Psuedoplatanus	Tawny sedge - Carex hostiana
11321	0	0	0	0	0	0	0	0	0	0	0	0
11322	0	0	0	0	0	0	0	0	0	0	0	0
11323	0	0	0	0	0	0	0	0	0	0	0	0
12111	0	0	0	0	0	0	0	0	0	0	0	0
12112	0	0	0	0	0	0	0	0	0	0	0	0
12113	0	0	0	0	0	0	0	0	0	0	0	0
12121	0	0	0	0	0	0	0	0	0	0	0	0
12122	0	0	0	0	0	0	0	0	0	0	0	0
12123	0	0	0	0	0	0	0	0	0	0	0	0
12211	0	0	0	0	0	0	0	0	0	0	0	0
12212	0	0	0	0	0	0	0	0	0	0	0	0
12213	0	0	0	0	0	0	0	0	0	0	0	0
12221	0	0	0	0	0	0	0	0	0	0	0	0
12222	0	0	0	0	0	0	0	0	3	0	0	0
12223	0	0	0	0	0	0	0	0	0	0	0	0
12311	0	0	0	0	0	0	0	0	0	0	0	0
12312	0	0	0	0	0	0	0	0	0	0	0	0
12313	0	0	0	0	0	0	0	0	0	0	0	0
12321	0	0	0	0	0	0	0	0	0	0	0	0
12322	0	0	0	0	0	0	0	0	3	0	0	0
12323	0	0	0	0	0	0	0	0	0	0	0	0

Reference No.	Tussock/ Tufted hair Grass - Deschampsia caespitosa var parviflora	Tormentil- Potentila erecta	Velvet bent - Agrostis canina subsp.canina	Wavy hair grass- Deschampsia flexuosa	White clover - Trifolium repens	Wood avens- Geum urbanum	Wood Melick - Melica uniflora	Wood sage- teucrium scorodonia	Wood rush- Luzula sylvatica	Wood Sorrel - Oxalis acetosella	Wood Speedwell - Veronica montana
1111	0	0	0	0	0	0	0	0	0	0	0
1112	0	0	0	0	0	0	0	0	0	0	0
1113	0	0	0	0	0	0	0	0	0	5	0
1121	0	0	0	0	0	0	0	0	0	0	0
1122	0	0	0	0	0	0	0	0	0	0	0
1123	0	0	0	0	0	0	0	0	0	5	0
1211	0	0	0	0	0	0	0	0	0	0	0
1212	0	0	0	0	0	0	0	0	0	0	0
1213	0	0	0	0	0	0	0	0	0	30	0
1221	0	0	0	0	0	0	0	0	0	0	0
1222	0	0	0	0	0	0	0	0	0	0	0
1223	0	0	0	0	0	0	0	0	0	0	0
1311	0	0	0	0	0	0	0	0	0	0	0
1312	0	0	0	0	0	0	0	0	0	30	0
1313	0	0	0	0	0	0	0	0	0	0	0
1321	0	0	0	0	0	0	0	0	0	0	0
1322	0	0	0	0	0	0	0	0	0	0	0
1323	0	0	0	0	0	0	0	0	0	0	0
2111	0	0	0	0	0	0	0	0	0	0	0
2112	0	0	0	0	0	0	0	0	0	0	1
2113	0	0	0	0	0	0	0	0	0	0	0
2121	0	0	0	0	0	0	0	0	0	0	0
2122	0	0	0	0	0	0	0	0	0	0	0
2123	0	0	0	0	0	0	0	0	0	0	0
2211	0	0	0	0	0	0	0	0	0	0	0
2212	0	0	0	0	0	0	0	0	0	0	0
2213	0	0	0	0	0	0	0	0	0	0	0
2221	0	0	0	0	0	0	0	0	0	0	0
2222	0	0	0	0	0	0	0	0	0	0	0
2223	0	0	0	0	0	0	0	0	0	0	0
2311	0	0	0	0	0	0	0	0	0	0	0
1312	0	0	0	0	0	0	0	0	0	0	0
2313	0	0	0	0	0	0	0	0	0	0	0
2321	0	0	0	0	0	0	0	0	0	0	0
2322	0	0	0	0	0	0	0	0	0	0	0
2323	0	0	0	0	0	0	0	0	0	0	0
3111	0	0	0	0	0	0	0	0	0	0	0
3112	0	0	0	0	0	0	0	0	0	0	0
3113	0	0	0	0	0	0	15	0	0	0	0

Reference No.	Tussock/ Tufted hair Grass - Deschampsia caespitosa var parviflora	Tormentil- Potentila erecta	Velvet bent - Agrostis canina subsp.canina	Wavy hair grass- Deschampsia flexuosa	White clover - Trifolium repens	Wood avens- Geum urbanum	Wood Melick - Melica uniflora	Wood sage- teucrium scorodonia	Wood rush- Luzula sylvatica	Wood Sorrel - Oxalis acetosella	Wood Speedwell - Veronica montana
3121	0	0	0	0	0	0	0	0	0	0	0
3122	0	0	0	0	0	0	0	0	0	0	0
3123	0	0	0	0	0	0	40	0	0	0	0
3211	0	0	0	0	0	0	0	0	0	0	0
3212	0	0	0	0	0	0	0	0	0	0	0
3213	0	0	0	0	0	9	3	0	0	0	0
3221	0	0	0	0	0	0	0	0	0	0	0
3222	0	0	0	0	0	0	0	0	0	0	0
3223	0	0	0	0	0	7	40	0	0	0	0
3311	0	0	0	0	0	0	0	0	0	0	0
3312	0	0	0	0	0	0	0	0	0	0	0
3313	0	0	0	0	0	9	3	0	0	0	0
3321	0	0	0	0	0	0	0	0	0	0	0
3322	0	0	0	0	0	0	0	0	0	0	0
3323	0	0	0	0	0	7	40	0	0	0	0
4111	0	0	0	0	0	0	80	0	0	0	0
4112	0	0	0	0	0	0	0	0	0	0	0
4113	0	0	0	0	0	0	3	0	0	0	0
4121	0	0	0	0	0	0	60	0	0	0	0
4122	0	0	0	0	0	0	0	0	0	2	0
4123	0	0	0	0	0	0	0	0	0	0	0
4211	0	0	0	0	0	0	80	0	0	0	0
4212	0	0	0	0	0	0	0	0	0	10	0
4213	0	0	0	0	0	0	1	0	0	0	0
4221	0	0	0	0	0	0	60	0	0	0	0
4222	0	0	0	0	0	0	0	0	0	5	0
4223	0	0	0	0	0	0	0	0	0	0	0
4311	0	0	0	0	0	0	80	0	0	0	0
4312	0	0	0	0	0	0	0	0	0	10	0
4313	0	0	0	0	0	0	1	0	0	0	0
4321	0	0	0	0	0	0	60	0	0	0	0
4323	0	0	0	0	0	0	0	0	0	5	0
4323	0	0	0	0	0	0	0	0	0	0	0
5111	0	0	0	0	0	0	0	0	0	0	0
5112	0	0	0	0	0	0	0	0	0	0	0
5113	0	0	0	0	0	0	0	0	0	0	0
5121	0	0	0	0	0	0	0	1	0	0	0
5122	0	0	0	0	0	0	0	0	0	0	0
5123	0	0	0	0	0	0	0	0	0	0	0

Reference No.	Tussock/ Tufted hair Grass - Deschampsia caespitosa var parviflora	Tormentil- Potentila erecta	Velvet bent - Agrostis canina subsp.canina	Wavy hair grass- Deschampsia flexuosa	White clover - Trifolium repens	Wood avens- Geum urbanum	Wood Melick - Melica uniflora	Wood sage- teucrium scorodonia	Wood rush- Luzula sylvatica	Wood Sorrel - Oxalis acetosella	Wood Speedwell - Veronica montana
5211	0	0	0	0	0	6	0	0	0	0	0
5212	0	0	0	0	0	0	0	0	0	0	0
5213	0	0	0	0	0	0	0	0	0	0	0
5221	0	0	0	0	0	2	0	0	0	0	0
5222	0	0	0	0	0	0	0	0	0	0	0
5223	0	0	0	0	0	0	0	0	0	0	0
5311	0	0	0	0	0	3	0	0	0	0	0
5312	0	0	0	0	0	0	0	0	0	0	0
5313	0	0	0	0	0	0	0	0	0	0	0
5321	0	0	0	0	0	4	0	0	0	0	0
5322	0	0	0	0	0	0	0	0	0	0	0
5323	0	0	0	0	0	0	0	0	0	0	0
6111	0	0	0	0	0	0	0	0	0	0	0
6112	0	0	0	0	0	0	0	0	0	0	0
6113	0	0	0	0	0	0	0	0	0	0	0
6121	0	0	0	0	0	0	0	0	0	0	0
6122	0	0	0	0	0	0	0	0	0	0	0
6123	0	0	0	0	0	0	0	0	0	0	0
6211	0	0	0	0	0	0	0	0	0	0	0
6212	0	0	0	0	0	0	0	0	0	0	0
6213	0	0	0	0	0	0	0	0	0	0	0
6221	0	0	0	0	0	0	0	0	0	0	0
6222	0	0	0	0	0	0	0	0	0	0	0
6223	0	0	0	0	0	0	0	0	0	0	0
6311	0	0	0	0	0	0	0	0	0	0	0
6312	0	0	0	0	0	0	0	0	0	0	0
6313	0	0	0	0	0	3	0	0	0	0	0
6321	0	0	0	0	0	0	0	0	0	0	0
6322	0	0	0	0	0	0	0	0	0	0	0
6323	0	0	0	0	0	1	0	0	0	0	0
7111	0	0	1	0	2	0	0	0	0	0	0
7112	0	0	0	0	0	0	0	0	0	0	0
7113	0	0	2	0	5	0	0	0	0	0	0
7121	0	0	1	0	3	0	0	0	0	0	0
7122	0	0	0	0	0	0	0	0	0	0	0
7123	0	0	0	0	1	0	0	0	0	0	0
7211	0	0	1	0	2	0	0	0	0	0	0
7212	0	5	15	0	0	0	0	0	0	0	0
7213	0	0	2	0	0	0	0	0	0	0	0

Reference No.	Tussock/ Tufted hair Grass - Deschampsia caespitosa var parviflora	Tormentil- Potentila erecta	Velvet bent - Agrostis canina subsp.canina	Wavy hair grass- Deschampsia flexuosa	White clover - Trifolium repens	Wood avens- Geum urbanum	Wood Melick - Melica uniflora	Wood sage- teucrium scorodonia	Wood rush- Luzula sylvatica	Wood Sorrel - Oxalis acetosella	Wood Speedwell - Veronica montana
7222	0	0	1	0	3	0	0	0	0	0	0
7222	0	0	0	0	0	0	0	0	0	0	0
7223	0	0	0	0	0	0	0	0	0	0	0
7311	0	0	1	0	0	0	0	0	0	0	0
7312	0	5	15	0	0	0	0	0	0	0	0
7313	0	0	0	0	0	0	0	0	0	0	0
7321	0	0	1	0	0	0	0	0	0	0	0
7322	0	0	0	0	0	0	0	0	0	0	0
7323	0	0	0	0	0	0	0	0	0	0	0
8111	0	0	0	0	0	0	0	0	0	0	0
8112	0	0	0	0	0	0	0	0	0	0	0
8113	0	0	0	0	0	0	0	0	0	0	0
8121	0	0	0	0	0	0	0	0	0	0	0
8122	0	0	0	0	0	0	0	0	0	0	0
8123	0	0	0	0	0	0	0	0	0	0	0
8211	0	0	0	0	0	0	0	0	0	0	0
8212	0	0	0	0	7	0	0	0	0	0	0
8213	0	0	0	0	0	0	0	0	0	0	0
8222	0	0	0	0	0	0	0	0	0	0	0
8222	0	0	0	0	2	0	0	0	0	0	0
8223	0	0	0	0	0	0	0	0	0	0	0
8311	0	0	0	0	0	0	0	0	0	0	0
8312	0	0	0	0	7	0	0	0	0	0	0
8313	0	0	0	0	5	0	0	0	0	0	0
8321	0	0	0	0	0	0	0	0	0	0	0
8322	0	0	0	0	2	0	0	0	0	0	0
8323	0	0	0	0	0	0	0	0	0	0	0
9111	0	0	0	0	0	0	0	0	0	0	0
9112	0	0	0	0	0	0	0	0	1	0	0
9113	0	0	0	0	0	0	0	0	0	0	0
9121	0	0	0	0	0	0	0	0	0	0	0
9122	0	0	0	0	0	0	0	0	0	0	0
9123	0	0	0	0	0	0	0	0	0	0	0
9211	0	0	0	0	0	0	0	0	0	0	0
9212	8	0	0	0	0	0	0	0	0	0	0
9213	0	0	0	0	0	0	0	0	0	0	0
9221	0	0	0	0	0	0	0	0	0	0	0
9222	1	0	0	0	0	0	0	0	0	0	0
9223	0	0	0	0	0	0	0	0	0	0	0

Reference No.	Tussock/ Tufted hair Grass - Deschampsia caespitosa var parviflora	Tormentil- Potentila erecta	Velvet bent - Agrostis canina subsp.canina	Wavy hair grass- Deschampsia flexuosa	White clover - Trifolium repens	Wood avens- Geum urbanum	Wood Melick - Melica uniflora	Wood sage- teucrium scorodonia	Wood rush- Luzula sylvatica	Wood Sorrel - Oxalis acetosella	Wood Speedwell - Veronica montana
9311	0	0	0	0	0	0	0	0	0	0	0
9312	8	0	0	0	0	0	0	0	0	0	0
9313	0	0	0	0	0	0	0	0	0	0	0
9321	0	0	0	0	0	0	0	0	0	0	0
9322	1	0	0	0	0	0	0	0	0	0	0
9323	0	0	0	0	0	0	0	0	0	0	0
10111	0	0	0	0	0	0	0	0	0	0	0
10112	0	0	0	0	0	0	0	0	0	0	0
10113	0	0	0	0	0	4	0	0	0	0	0
10121	0	0	0	0	0	0	0	0	0	0	0
10122	0	0	0	0	0	0	0	0	0	0	0
10123	0	0	0	0	0	1	0	0	0	0	0
10211	0	0	0	0	0	0	0	0	0	0	0
10212	0	0	0	0	0	1	0	0	0	0	0
10213	0	0	0	0	0	1	0	0	0	0	0
10221	0	0	0	0	0	0	0	0	0	0	0
10222	0	0	0	0	0	2	0	0	0	0	0
10223	0	0	0	0	0	2	0	0	0	0	0
10311	0	0	0	0	0	0	0	0	0	0	0
10312	0	0	0	0	0	4	0	0	0	0	0
10313	0	0	0	0	0	1	0	0	0	0	0
10321	0	0	0	0	0	0	0	0	0	0	0
10322	0	0	0	0	0	1	0	0	0	0	0
10323	0	0	0	0	0	1	0	0	0	0	0
11111	0	0	0	0	0	0	0	0	0	0	0
11112	0	0	0	0	0	0	0	0	0	0	0
11113	0	0	0	0	0	0	0	0	0	0	0
11121	0	0	0	0	0	0	0	0	0	0	0
11122	0	0	0	0	0	0	0	0	0	0	0
11123	0	0	0	0	0	0	0	0	0	0	0
11211	0	0	0	0	0	0	0	0	0	0	0
11212	35	0	0	0	0	0	8	0	0	0	0
11213	35	0	0	0	0	0	0	0	0	5	0
11221	0	0	0	0	0	0	0	0	0	0	0
11222	45	0	0	0	0	0	2	0	0	0	0
11223	45	0	0	0	0	0	0	0	0	1	0
11311	0	0	0	0	0	0	0	0	0	0	0
11312	35	0	0	0	0	0	8	0	0	0	0
11313	35	0	0	0	0	0	0	0	0	5	0

Reference No.	Tussock/ Tufted hair Grass - Deschampsia caespitosa var parviflora	Tormentil- Potentila erecta	Velvet bent - Agrostis canina subsp.canina	Wavy hair grass- Deschampsia flexuosa	White clover - Trifolium repens	Wood avens- Geum urbanum	Wood Melick - Melica uniflora	Wood sage- teucrium scorodonia	Wood rush- Luzula sylvatica	Wood Sorrel - Oxalis acetosella	Wood Speedwell - Veronica montana
11321	0	0	0	0	0	0	0	0	0	0	0
11322	45	0	0	0	0	0	2	0	0	0	0
11323	45	0	0	0	0	0	0	0	0	1	0
12111	0	0	0	5	0	0	0	0	0	0	0
12112	4	0	0	0	0	0	0	0	0	0	0
12113	1	0	0	0	0	0	0	0	0	0	0
12121	0	0	0	5	0	0	2	0	0	0	0
12122	1	0	0	0	0	0	0	0	0	0	0
12123	1	0	0	0	0	0	0	0	0	0	0
12211	0	0	0	10	0	0	3	0	0	0	0
12212	4	0	0	0	0	0	0	0	0	0	0
12213	1	0	0	0	0	0	0	0	0	0	0
12221	0	0	0	3	0	0	2	0	0	0	0
12222	5	0	0	0	0	0	0	0	0	0	0
12223	1	0	0	0	0	0	0	0	0	0	0
12311	0	0	0	10	0	0	3	0	0	0	0
12312	4	0	0	0	0	0	0	0	0	0	0
12313	1	0	0	0	0	0	0	0	0	0	0
12321	0	0	0	4	0	0	0	0	0	0	0
12322	5	0	0	0	0	0	0	0	0	0	0
12323	1	0	0	0	0	0	0	0	0	0	0

Reference No.	Wood Stitchwort - Stellaria nemorum	Woodruff - Gallium odoratum	Yarrow - Asteracae millefolium	Yellow archangel - Lamiastrum galeobdolon subsp monatanum	Yorkshire Fog - Holcus lanatus
1111	0	0	0	0	0
1112	0	0	0	0	0
1113	0	0	0	0	0
1121	0	0	0	0	0
1122	0	0	0	4	0
1123	0	0	0	0	0
1211	0	0	0	0	0
1212	0	0	0	0	0
1213	0	0	0	0	0
1221	0	0	0	0	0
1222	0	0	0	0	0
1223	0	0	0	4	0
1311	0	0	0	0	0
1312	0	0	0	0	0
1313	0	0	0	0	0
1321	0	0	0	0	0
1322	0	0	0	0	0
1323	0	0	0	0	0
2111	0	0	0	0	0
2112	0	0	0	0	0
2113	0	0	0	0	0
2121	0	0	0	0	0
2122	0	0	0	0	0
2123	0	0	0	0	0
2211	0	0	0	0	0
2212	0	0	0	0	0
2213	0	0	0	0	0
2221	0	0	0	0	0
2222	0	0	0	0	0
2223	0	0	0	0	0
2311	0	0	0	0	0
1312	0	0	0	0	0
2313	0	0	0	0	0
2321	0	0	0	0	0
2322	0	0	0	0	0
2323	0	0	0	0	0
3111	0	0	0	0	0
3112	0	6	0	1	0
3113	0	0	0	0	0

Reference No.	Wood Stitchwort - Stellaria nemorum	Woodruff - Gallium odoratum	Yarrow - Asteracae millefolium	Yellow archangel - Lamiastrum galeobdolon subsp monatanum	Yorkshire Fog - Holcus lanatus
3121	0	0	0	0	0
3122	0	0	0	3	0
3123	0	0	0	0	0
3211	0	0	0	0	0
3212	0	7	0	20	0
3213	0	0	0	0	0
3221	0	0	0	0	0
3222	0	0	0	3	0
3223	0	0	0	0	0
3311	0	0	0	0	0
3312	0	7	0	20	0
3313	0	0	0	0	0
3321	0	0	0	0	0
3322	0	0	0	3	0
3323	0	0	0	0	0
4111	0	0	0	0	0
4112	0	0	0	0	0
4113	0	0	0	0	0
4121	0	0	0	0	0
4122	0	0	0	0	0
4123	0	0	0	0	0
4211	0	0	0	0	0
4212	0	0	0	0	0
4213	0	0	0	0	0
4221	0	0	0	0	0
4222	0	0	0	0	0
4223	0	0	0	0	0
4311	0	0	0	0	0
4312	0	0	0	0	0
4313	0	0	0	0	0
4321	0	0	0	0	0
4323	0	0	0	0	0
4323	0	0	0	0	0
5111	0	0	0	0	0
5112	0	0	0	0	0
5113	0	0	0	0	0
5121	0	0	0	0	0
5122	0	0	0	0	0
5123	0	0	0	0	0

Reference No.	Wood Stitchwort - Stellaria nemorum	Woodruff - Gallium odoratum	Yarrow - Asteracae millefolium	Yellow archangel - Lamiastrum galeobdolon subsp monatanum	Yorkshire Fog - Holcus lanatus
5211	0	0	0	0	0
5212	0	0	0	0	0
5213	0	0	0	0	0
5221	0	0	0	0	0
5222	0	0	0	0	0
5223	0	0	0	0	0
5311	0	0	0	0	0
5312	0	0	0	0	0
5313	0	0	0	0	0
5321	0	0	0	0	0
5322	0	0	0	0	0
5323	0	0	0	0	0
6111	20	0	0	0	0
6112	0	0	0	0	0
6113	0	0	0	0	0
6121	3	0	0	0	0
6122	0	0	0	0	0
6123	0	0	0	0	0
6211	0	0	0	0	0
6212	0	0	0	0	0
6213	0	0	0	0	0
6221	0	0	0	0	0
6222	0	0	0	0	0
6223	0	0	0	0	0
6311	22	0	0	0	0
6312	0	0	0	0	0
6313	0	0	0	0	0
6321	0	0	0	0	0
6322	0	0	0	0	0
6323	0	0	0	0	0
7111	0	0	0	0	40
7112	0	0	0	0	0
7113	0	0	0	0	5
7121	0	0	0	0	15
7122	0	0	0	0	0
7123	0	0	0	0	3
7211	0	0	8	0	40
7212	0	0	0	0	0
7213	0	0	0	0	15

Reference No.	Wood Stitchwort - Stellaria nemorum	Woodruff - Gallium odoratum	Yarrow - Asteracae millefolium	Yellow archangel - Lamiastrum galeobdolon subsp monatanum	Yorkshire Fog - Holcus lanatus
7222	0	0	0	0	0
7222	0	0	0	0	0
7223	0	0	0	0	3
7311	0	0	8	0	40
7312	0	0	0	0	0
7313	0	0	0	0	50
7321	0	0	0	0	15
7322	0	0	0	0	0
7323	0	0	0	0	3
8111	0	0	0	0	0
8112	0	0	0	0	0
8113	0	0	0	0	0
8121	0	0	0	0	0
8122	0	0	0	0	0
8123	0	0	0	0	0
8211	0	0	0	0	0
8212	0	0	0	0	0
8213	0	0	0	0	0
8222	0	0	0	0	0
8222	0	0	0	0	0
8223	0	0	0	0	0
8311	0	0	0	0	0
8312	0	0	0	0	0
8313	0	0	0	0	0
8321	0	0	0	0	0
8322	0	0	0	0	0
8323	0	0	0	0	0
9111	0	0	0	0	0
9112	0	0	0	0	0
9113	0	0	0	0	0
9121	0	0	0	0	0
9122	0	0	0	0	0
9123	0	0	0	0	0
9211	0	0	0	0	0
9212	0	0	0	0	0
9213	0	0	0	0	0
9221	0	0	0	0	0
9222	0	0	0	0	0
9223	0	0	0	0	0

Reference No.	Wood Stitchwort - Stellaria nemorum	Woodruff - Gallium odoratum	Yarrow - Asteracae millefolium	Yellow archangel - Lamiastrum galeobdolon subsp monatanum	Yorkshire Fog - Holcus lanatus
9311	0	0	0	0	0
9312	0	0	0	0	0
9313	0	0	0	0	0
9321	0	0	0	0	0
9322	0	0	0	0	0
9323	0	0	0	0	0
10111	0	0	0	0	0
10112	0	0	0	0	0
10113	0	0	0	0	0
10121	0	0	0	0	0
10122	0	0	0	0	0
10123	0	0	0	0	0
10211	0	0	0	0	0
10212	0	0	0	0	0
10213	0	0	0	0	0
10221	0	0	0	0	0
10222	0	0	0	2	0
10223	0	0	0	2	0
10311	0	0	0	0	0
10312	0	0	0	0	0
10313	0	0	0	0	0
10321	0	0	0	0	0
10322	0	0	0	0	0
10323	0	0	0	0	0
11111	0	0	0	0	0
11112	0	0	0	0	0
11113	0	0	0	0	0
11121	0	0	0	0	0
11122	0	0	0	0	0
11123	0	0	0	0	0
11211	0	0	0	0	0
11212	0	0	0	0	0
11213	0	0	0	0	0
11221	0	0	0	0	0
11222	0	0	0	0	0
11223	0	0	0	0	0
11311	0	0	0	0	0
11312	0	0	0	0	0
11313	0	0	0	0	0

Reference No.	Wood Stitchwort - Stellaria nemorum	Woodruff - Gallium odoratum	Yarrow - Asteraceae millefolium	Yellow archangel - Lamiastrum galeobdolon subsp montanum	Yorkshire Fog - Holcus lanatus
11321	0	0	0	0	0
11322	0	0	0	0	0
11323	0	0	0	0	0
12111	0	0	0	0	0
12112	0	0	0	0	0
12113	0	0	0	0	0
12121	0	0	0	0	0
12122	0	0	0	0	0
12123	0	0	0	0	0
12211	0	0	0	0	0
12212	0	0	0	0	0
12213	0	0	0	0	0
12221	0	0	0	0	0
12222	0	0	0	0	0
12223	0	0	0	0	0
12311	0	0	0	0	0
12312	0	0	0	0	0
12313	0	0	0	0	0
12321	0	0	0	0	0
12322	0	0	0	0	0
12323	0	0	0	0	0

Serial	Wood	Exclosure	Fenced or Unfenced	Vegetation type	Dryweight (g/m2)
1	Bailey Einon	1	Fenced	moss	20.28
2	Bailey Einon	1	Fenced	bramble	97.16
3	Bailey Einon	1	Unfenced	moss	135.96
4	Bailey Einon	1	Fenced	bramble	78.08
5	Bailey Einon	2	Fenced	bramble	151.96
6	Bailey Einon	2	Unfenced	moss	114.36
7	Bailey Einon	2	Fenced	herb	20.24
8	Bailey Einon	2	Fenced	bramble	114.08
9	Bailey Einon	3	Fenced	fern	37.6
10	Bailey Einon	3	Unfenced	fern	65.28
11	Bailey Einon	3	Fenced	herb	169.96
12	Big Pool Wood	1	Unfenced	herb	108.52
13	Big Pool Wood	1	Fenced	bramble	11.24
14	Big Pool Wood	1	Fenced	ivy	199.92
15	Big Pool Wood	1	Fenced	herb	43.84
16	Big Pool Wood	1	Fenced	bramble	158.6
17	Big Pool Wood	2	Unfenced	ivy	69.16
18	Big Pool Wood	2	Unfenced	nettle	33.8
19	Big Pool Wood	2	Unfenced	herb	66.76
20	Big Pool Wood	2	Fenced	ivy	45.96
21	Big Pool Wood	2	Fenced	nettle	35.2
22	Big Pool Wood	2	Fenced	herb	105.12
23	Big Pool Wood	3	Unfenced	ivy	263.68
24	Big Pool Wood	3	Unfenced	herb	10.12
25	Big Pool Wood	3	Unfenced	hawthron	9.84
26	Big Pool Wood	3	Fenced	ivy	252.76
27	Big Pool Wood	3	Fenced	herb	41.6
28	Coed Cilycroeslwyd	1	Unfenced	moss	55.32
29	Coed Cilycroeslwyd	1	Unfenced	bramble	45.2
30	Coed Cilycroeslwyd	1	Unfenced	herb	43.24
31	Coed Cilycroeslwyd	1	Fenced	herb	26.6
32	Coed Cilycroeslwyd	1	Fenced	bramble	72.48
33	Coed Cilycroeslwyd	3	Unfenced	leaf litter	396
34	Coed Cilycroeslwyd	3	Unfenced	bramble	139.04
35	Coed Cilycroeslwyd	3	Fenced	bramble	166.64
36	Coed Cilycroeslwyd	3	Unfenced	herb	16.92
37	Coed Cilycroeslwyd	3	Unfenced	grass	19.84
38	Coed Cilycroeslwyd	3	Fenced	herb	60
39	Coed Cilycroeslwyd	3	Fenced	bramble	52.88
40	Coed Drysiog	2	Fenced	leaf litter	153.08
41	Coed Drysiog	2	Fenced	bramble	47.4
42	Coed Drysiog	2	Unfenced	leaf litter	76.92
43	Coed Drysiog	2	Unfenced	grass	25.72
44	Coed Drysiog	2	Unfenced	herb	39.6
45	Coed Drysiog	2	Unfenced	bramble	44.36
46	Coed Drysiog	2	Unfenced	moss	134.04

Serial	Wood	Exclosure	Fenced or Unfenced	Vegetation type	Dryweight (g/m2)
47	Coed Drysiog	3	Fenced	herb	170
48	Coed Drysiog	3	Fenced	moss	181.4
49	Coed Drysiog	3	Unfenced	herb	426.88
50	Coed Drysiog	3	Unfenced	moss	110.52
51	Coed Drysiog	1	Fenced	fern	29.56
52	Coed Drysiog	1	Fenced	grass	36.28
53	Coed Drysiog	1	Fenced	moss	48.56
54	Coed Drysiog	1	Fenced	leaf litter	182.48
55	Coed Drysiog	1	Unfenced	moss	512.32
56	Coed Drysiog	1	Unfenced	leaf litter	60.4
57	Coed Drysiog	1	Unfenced	grass	53.56
58	Croes Roberts	1	Unfenced	moss	367.36
59	Croes Roberts	1	Unfenced	herb	45
60	Croes Roberts	1	Fenced	moss	306.52
61	Croes Roberts	1	Fenced	herb	55.08
62	Croes Roberts	2	Unfenced	deadwood	587.88
63	Croes Roberts	2	Unfenced	herb	16.64
64	Croes Roberts	2	Unfenced	moss	78.4
65	Croes Roberts	2	Fenced	moss	510.76
66	Croes Roberts	2	Fenced	herb	5.36
67	Croes Roberts	2	Fenced	deadwood	295.28
68	Croes Roberts	3	Unfenced	bramble	855.08
69	Croes Roberts	3	Fenced	moss	156.6
70	Croes Roberts	3	Fenced	bramble	297.32
71	Cwm Byddog	1	Unfenced	nettle	52.88
72	Cwm Byddog	1	Fenced	herb	211.96
73	Cwm Byddog	2	Fenced	nettle	181.68
74	Cwm Byddog	2	Unfenced	herb	112
75	Cwm Byddog	3	Fenced	nettle	500.44
76	Cwm Byddog	3	Unfenced	nettle	681.04
77	Cwm Oergwm	2	UnFenced	herb	26
78	Cwm Oergwm	2	UnFenced	grass	73.8
79	Cwm Oergwm	2	Fenced	grass	339.36
80	Cwm Oergwm	2	Fenced	herb	34.44
81	Cwm Oergwm	2	Fenced	moss	176.36
82	Cwm Oergwm	1	Fenced	grass	337.4
83	Cwm Oergwm	1	Fenced	moss	153.2
84	Cwm Oergwm	1	Unfenced	grass	268.6
85	Cwm Oergwm	1	Unfenced	moss	142.2
86	Dyfnant	1	Unfenced	grass	506
87	Dyfnant	1	Fenced	grass	671.92
88	Dyfnant	1	Fenced	herb	275.24
89	Dyfnant	2	Unfenced	grass	117.76
90	Dyfnant	2	Fenced	grass	767.84
91	Dyfnant	3	Unfenced	grass	116.88
92	Dyfnant	3	Fenced	grass	407.64

Serial	Wood	Exclosure	Fenced or Unfenced	Vegetation type	Dryweight (g/m2)
93	Dyfnant	3	Fenced	herb	163.28
94	Nantporth	1	Unfenced	fern	396.8
95	Nantporth	1	Fenced	fern	240.92
96	Nantporth	2	Unfenced	ivy	120
97	Nantporth	2	Fenced	ivy	38.88
98	Nantporth	2	Fenced	bramble	175.68
99	Nantporth	3	Unfenced	herb	57.6
100	Nantporth	3	Unfenced	bramble	3.6
101	Nantporth	3	Fenced	herb	66
102	Nantporth	3	Fenced	hazel	11.2
103	Pendugwm	1	Fenced	herb	1.84
104	Pendugwm	1	Unfenced	herb	2.56
105	Pendugwm	1	Unfenced	bramble	100.16
106	Pendugwm	2	Fenced	herb	9.8
107	Pendugwm	2	Fenced	bramble	88.84
108	Pendugwm	2	Unfenced	herb	23.12
109	Pendugwm	2	Unfenced	bramble	87.56
110	Pendugwm	3	Unfenced	herb	35.44
111	Pendugwm	3	Fenced	herb	38.08
112	Prisk	1	Unfenced	moss	55.88
113	Prisk	1	Unfenced	grass	26.4
114	Prisk	1	Fenced	fern	103.6
115	Prisk	1	Fenced	herb	19.24
116	Prisk	2	Unfenced	moss	284.08
117	Prisk	2	Unfenced	herb	11.44
118	Prisk	2	Fenced	moss	273.96
119	Prisk	2	Fenced	grass	210.24
120	Prisk	3	Unfenced	herb	35.96
121	Prisk	3	Fenced	bramble	76.4
122	Prisk	3	Fenced	moss	34.24
123	Prisk	3	Fenced	herb	39.76
124	Pwll-y-Wrach	1	Fenced	moss	293.56
125	Pwll-y-Wrach	1	Unfenced	moss	219.52
126	Pwll-y-Wrach	2	Fenced	herb	143.92
127	Pwll-y-Wrach	2	Fenced	leaf litter	177.16
128	Pwll-y-Wrach	2	Unfenced	moss	61.96
129	Pwll-y-Wrach	2	Unfenced	herb	22.76
130	Pwll-y-Wrach	2	Unfenced	leaf litter	188.72
131	Pwll-y-Wrach	2	Unfenced	bramble	57.12
132	Pwll-y-Wrach	2	Unfenced	holly	125.72
133	Pwll-y-Wrach	3	Unfenced	moss	24.48
134	Pwll-y-Wrach	3	Unfenced	ivy	15.72
135	Pwll-y-Wrach	3	Unfenced	bracken	49
136	Pwll-y-Wrach	3	Unfenced	herb	58.48
137	Pwll-y-Wrach	3	Unfenced	bramble	100.52
138	Pwll-y-Wrach	3	Unfenced	leaf litter	194.72

Serial	Wood	Exclosure	Fenced or Unfenced	Vegetation type	Dryweight (g/m2)
139	Pwll-y-Wrach	3	Unfenced	grass	17.84
140	Pwll-y-Wrach	3	Fenced	oak	59.52
141	Pwll-y-Wrach	3	Fenced	grass	11.48
142	Pwll-y-Wrach	3	Fenced	bramble	11.24
143	Pwll-y-Wrach	3	Fenced	moss	136.72
144	Pwll-y-Wrach	3	Fenced	herb	33.08

Wood	Exclosure	Fenced or Unfenced	Water Content (%)	ph	Soil description
Bailey Einon	1	Fenced	11.84	5.06	Brown sandy loam
Bailey Einon	1	Unfenced	37.33	4.82	brown sandy clay loam
Bailey Einon	2	Fenced	7.17	5.09	dark brown sandy loam
Bailey Einon	2	Unfenced	10.31	5.41	brown sandy silt
Bailey Einon	3	Fenced	7.91	5.6	brown sandy loam
Bailey Einon	3	Unfenced	6.94	5.37	brown sandy clay loam
Big Pool Wood	1	Fenced	12.09	7.35	brown loamy sand
Big Pool Wood	1	Unfenced	14.12	7.45	brown sand
Big Pool Wood	2	Fenced	10.65	5.98	dark brown sandy loam
Big Pool Wood	2	Unfenced	12.57	5.92	brown sand
Big Pool Wood	3	Fenced	9.54	7.43	brown sand
Big Pool Wood	3	Unfenced	12.52	7.56	brown sandy loam
Coed Cilycroeslwyd	1	Fenced	21.35	6.56	dark brown sandy clay
Coed Cilycroeslwyd	1	Unfenced	6.08	5.92	Brown Loamy sand
Coed Cilycroeslwyd	2	Fenced	25.8	5.71	red clay
Coed Cilycroeslwyd	2	Unfenced	6.78	6.52	light brown sandy silt
Coed Cilycroeslwyd	3	Fenced	20.47	6	brown loamy sand
Coed Cilycroeslwyd	3	Unfenced	9.83	6.25	brown sandy silt
Coed Dysiog	1	Fenced	14.5	4.61	red/brown sandy silt
Coed Dysiog	1	Unfenced	12.12	6.59	dark brown silty clay
Coed Dysiog	2	Fenced	10.05	4.45	Red/Brown Silty Clay
Coed Dysiog	2	Unfenced	8.33	5.47	red/brown silty clay
Coed Dysiog	3	Fenced	11.44	5.34	red/brown silty clay
Coed Dysiog	3	Unfenced	13.03	6.29	dark brown silty clay loam
Croes Roberts	1	Fenced	9.71	5.46	red/brown silty clay
Croes Roberts	1	Unfenced	15.18	5.69	red/brown silty clay loam
Croes Roberts	2	Fenced	14.59	4.5	red/brown Silty clay loam
Croes Roberts	2	Unfenced	8.58	4.48	red/brown sandy silt
Croes Roberts	3	Fenced	8.42	5.3	red/brown silty clay
Croes Roberts	3	Fenced	10.13	5.07	red/brown sandy silt
Cwm Byddog	1	Fenced	10.58	4.93	brown sandy clay loam
Cwm Byddog	1	Unfenced	9.01	5.75	brown silty clay
Cwm Byddog	2	Fenced	10.5	5.4	red silty clay
Cwm Byddog	2	Unfenced	10.54	5.54	light brown loamy sand
Cwm Byddog	3	Fenced	14.04	5.17	brown loamy sand
Cwm Byddog	3	Unfenced	8.51	5.55	Brown sandy silt
cwm oergwm	1	Fenced	8.08	3.95	red/brown sandy silt
cwm oergwm	1	Unfenced	9.06	4.11	red/brown sandy silt
cwm oergwm	2	Fenced	10.28	5.42	red/brown silty loam
cwm oergwm	2	Unfenced	9.79	5.69	red/brown loamy sand
Dyfnant	1	Unfenced	18.73	5.52	brown silty clay
Dyfnant	1	Unfenced	14.11	5.6	light brown loamy sand
Dyfnant	2	Fenced	14.9	5.11	brown sandy clay
Dyfnant	2	Unfenced	15.53	5.48	brown silty clay loam
Dyfnant	3	Fenced	8.25	5.7	brown silty clay loam

Appendix 5.3. Exclosure Soil Survey Data

Wood	Exclosure	Fenced or Unfenced	Water Content (%)	ph	Soil description
Nantporth	1	Unfenced	8.57	7.28	brown sandy clay loam
Nantporth	3	Fenced	25.49	7.87	brown silty clay loam
Nantporth	3	Unfenced	8.82	7.9	brown silty clay loam
Pendugwm	1	Fenced	10.79	3.94	brown sandy loam
Pendugwm	1	Unfenced	7.38	4.78	light brown loamy sand
Pendugwm	2	Fenced	15.32	5.45	light brown silty loam
Pendugwm	2	Unfenced	15.54	5.2	light brown silty loam
Pendugwm	3	Fenced	18.57	4.96	brown loamy sand
Pendugwm	3	Unfenced	17.23	5.09	light brown loamy sand
Prisk	1	Fenced	8.83	4.92	red/brown sandy loam
Prisk	1	Unfenced	19.37	5.91	brown sandy loam
Prisk	2	Fenced	9.49	4.17	red/brown loamy sand
Prisk	2	Unfenced	11.53	4.44	red/brown sandy silt
Prisk	3	Fenced	9.53	4.58	red/brown sandy silt
Prisk	3	Unfenced	7.92	6.36	brown silty loam
Pwll-y-Wrach	1	Fenced	9.33	4.23	red/brown Silty clay loam
Pwll-y-Wrach	1	Unfenced	12.01	4.41	brown sandy clay
Pwll-y-Wrach	2	Fenced	5.86	5.8	brown sandy loam
Pwll-y-Wrach	2	Unfenced	9.49	5.73	red/brown sandy clay
Pwll-y-Wrach	3	Fenced	19.07	4.77	red brown silty clay loam
Pwll-y-Wrach	3	Unfenced	11.93	4.85	red silty clay

Wood	Fenced or Unfenced	Exclosure	Canopy cover (%)
Bailey Einon	Fenced	1	75
Bailey Einon	Unfenced	1	75
Bailey Einon	Fenced	2	75
Bailey Einon	Unfenced	2	75
Bailey Einon	Fenced	3	75
Bailey Einon	Unfenced	3	75
Big Pool Wood	Fenced	1	90
Big Pool Wood	Unfenced	1	75
Big Pool Wood	Fenced	2	90
Big Pool Wood	Unfenced	2	90
Big Pool Wood	Fenced	3	75
Big Pool Wood	Unfenced	3	90
Coed Cilycroeslwyd	Fenced	1	75
Coed Cilycroeslwyd	Unfenced	1	75
Coed Cilycroeslwyd	Fenced	2	75
Coed Cilycroeslwyd	Unfenced	2	75
Coed Cilycroeslwyd	Fenced	3	75
Coed Cilycroeslwyd	Unfenced	3	75
Coed Drysiog	Fenced	1	50
Coed Drysiog	Unfenced	1	50
Coed Drysiog	Fenced	2	50
Coed Drysiog	Unfenced	2	50
Coed Drysiog	Fenced	3	50
Coed Drysiog	Unfenced	3	50
Croes Roberts	Fenced	1	20
Croes Roberts	Unfenced	1	20
Croes Roberts	Fenced	2	100
Croes Roberts	Unfenced	2	80
Croes Roberts	Fenced	3	100
Croes Roberts	Unfenced	3	90
Cwm Byddog	Fenced	1	90
Cwm Byddog	Unfenced	1	90
Cwm Byddog	Fenced	2	75
Cwm Byddog	Unfenced	2	40
Cwm Byddog	Fenced	3	75
Cwm Byddog	Unfenced	3	50
Cwm Oergwm	Fenced	1	80
Cwm Oergwm	Unfenced	1	50
Cwm Oergwm	Fenced	2	40
Cwm Oergwm	Unfenced	2	40
Dyfnant	Fenced	1	0
Dyfnant	Unfenced	1	0
Dyfnant	Fenced	2	0
Dyfnant	Unfenced	2	0
Dyfnant	Fenced	3	0

Appendix 5.4. Exclosure Canopy Cover Survey Data

Wood	Fenced or Unfenced	Exclosure	Canopy cover (%)
Dyfnant	Unfenced	3	0
Nantporth	Fenced	1	90
Nantporth	Unfenced	1	90
Nantporth	Fenced	2	90
Nantporth	Unfenced	2	90
Nantporth	Fenced	3	0
Nantporth	Unfenced	3	0
Pendugwm	Fenced	1	90
Pendugwm	Unfenced	1	90
Pendugwm	Fenced	2	80
Pendugwm	Unfenced	2	90
Pendugwm	Fenced	3	90
Pendugwm	Unfenced	3	70
Prisk	Fenced	1	90
Prisk	Unfenced	1	100
Prisk	Fenced	2	75
Prisk	Unfenced	2	75
Prisk	Fenced	3	100
Prisk	Unfenced	3	75
Pwll-y-Wrach	Fenced	1	50
Pwll-y-Wrach	Unfenced	1	75
Pwll-y-Wrach	Fenced	2	90
Pwll-y-Wrach	Unfenced	2	90
Pwll-y-Wrach	Fenced	3	50
Pwll-y-Wrach	Unfenced	3	40

Bailey Einon	
Ash	6
Hazel	4
Oak	10
Damage	0
T Length	350m

Big Pool Wood	
Ash	8
Alder	15
Damage	0
T Length	325m

Coed Drysiog	
Ash	13
Damage	0
T Length	340m

Cwm Byddog	
Ash	12
Elder	3
Damage	0
T Length	350m

Coed Cily	
Ash	15
Sycamore	3
Damage	0
T Length	325m

Croes Roberts	
Ash	8
Hazel	36
Damage	8 browsed hazel
T Length	350m

Dyfnant	
no trees in transect	
Damage	0
T Length	250m

Nantporth	
Ash	6
Damage	0
T Length	250m

Prisk		
Ash		15
Oak		3
Damage	1 browsed ash	
T Length	310m	

Pwll-y Wrach	
Ash	17
Oak	23
Damage	0
T Length	275m

Appendix 5.6. Cooke Survey Data.

Woodland	Canopy closure				Difference in ground flora in/out canopy		Is ground flora inside exclosure higher than outside?		If seedlings are over 50cm high are any of them a favoured species		Is seedling or bramble above 50cm only in 5m of rides		Are non-palatable species browsed/		Total Score
	75-100% minus 3	50-75% minus 2	25-50% minus 1	0-25% zero	no plus 3	yes zero	no minus 1	yes zero	no zero	yes minus 3	no zero	yes plus 1	no zero	yes plus 1	
Nantporth	0	-2	0	0	0	0	-1	0	0	0	0	0	0	0	-3
Cwm Oergwm	0	-2	0	0	0	0	-1	0	0	0	0	0	0	0	-3
Coed Dryslog	0	0	-1	0	3	0	-1	0	0	0	0	0	0	0	1
Cwm Byddog	-3	0	0	0	0	0	-1	0	0	0	0	0	0	0	-4
Pwll y Wrack	0	-2	0	0	3	0	0	0	0	0	0	0	0	0	2
Croes Roberts	0	-2	0	0	0	0	-1	0	0	-3	0	0	0	0	8
Bailey Einon	0	0	-1	0	3	0	-1	0	0	0	0	0	0	0	3
Coed Pendugwm	0	0	-1	0	3	0	0	0	0	0	0	0	0	0	2
Dyfnant	0	0	0	0	0	0	0	0	0	0	0	1	0	0	-1
Prisk Wood	-3	0	0	0	0	0	-1	0	0	-3	0	1	0	0	4
Coed Cilycroeslwyd	0	-2	0	0	0	0	-1	0	0	0	0	0	0	0	-3
Big Pool Wood	0	-2	0	0	0	0	-1	0	0	0	0	1	0	0	-1