1 Introduction

1.1 Over time our use of land and the natural resources that land provides, has shaped and re-shaped our environment, leaving us with the English landscapes and semi-natural habitats that are so valued today. The use of land has also shaped the patterns of settlements, buildings and other elements such as transport routes in rural areas leaving us with todays rural landscapes. Each has its own history with evidence from different time periods giving each a distinctive character. Our landscapes today reflect this diversity of historical pathways which range from recreational landscapes such as the New Forest to transformed landscapes such as the Fens. Today, about four-fifths of our land area is used for agriculture or forestry. These industries now use systems and techniques that directly affect the character of our landscapes with the potential to change them rapidly and to affect the condition of the underlying natural resources. We need to incorporate as an integral part approaches that will maintain the desired character of the landscape and the condition of the natural resources used and affected by modern agriculture and forestry.

1.2 This report sets out the evidence for impacts, both positive and negative, of a number of management activities routinely carried out by operators in the farming, forestry, and game management sectors. The aim is to understand how current routine practices impact on natural resources - water, soils, air - and the ecosystem services our landscapes support. Farming, forestry and game management businesses themselves depend on these natural resources and the ecosystem services they provide, so there is a direct interest in understanding how their activities affect their future as a result of these impacts. Society as a whole also benefits from ecosystem services provided by rural landscapes and has an interest in understanding the degree to which these are at risk as a result of current practices, and in supporting changes that will secure these services into the future.

1.3 The report is a presentation of the evidence around activities that are part of mainstream commercial operations, rather than a discussion of optimal management of key landscape features and habitats. The evidence presented should be used as the basis for developing improved practices and policies to support adoption of systems that deliver ecosystems services into the future. In the light of this, the challenge is to develop practices that reduce impacts that can be adopted by commercially viable farming, forestry and game management businesses and to integrate the management required to deliver our landscapes, wildlife and other ecosystem services valued by society. This report provides evidence to underpin the developments required.

Managing key natural resources - identification and management of impacts

1.4 There are two main ways in which farming, forestry and game management impact on the environment:

- Direct impacts on the immediate environment where they are practised and on the surrounding areas: for example, effects on the soil, watercourses, wildlife and habitats.
- Direct and indirect impacts on the wider environment: for example greenhouse gas emissions, flood control or mitigation, and cultural development.

1.5 This report presents evidence about those management activities that may have a significant impact on the main natural resources:

- habitat
- species
- water
- soils
- air
- landscape.

1.6 The industry sectors on which the report concentrates are:

- farming
- forestry
- game management.

Natural and semi-natural habitats

1.7 Many semi-natural habitats in England were created through farming, forestry and game management practices over time. We have seen significant reductions in the areas of these habitats in recent decades. Those that remain are under pressure from inappropriate management and possible destruction. The diversity and quality of these habitats is one of the main elements of biological diversity that the UK government has committed itself to protecting. Healthy habitats are essential to maintaining species and genetic diversity, and to delivering ecosystem services relating to soils, water, air and climate, as well as being significant elements in our landscapes and having aesthetic and cultural value for a high proportion of the population.

Individual species

1.8 Individual species can be comparatively robust in their ability to survive change, but equally, they can be extremely sensitive to specific influences. In many cases a seemingly minor activity, which could be avoidable, may be a critical trigger for the decline of one or more species. The Farmland Birds Index (an indicator of the health of farmland wildlife) shows a decline in the overall numbers of 19 key farmland species, which has been shown to be closely linked with the development of modern agricultural practices. This trend continues, despite positive measures being implemented which encompass a number of management systems.

1.9 Conversely, management for gamebird production has been a major contributor to the continued presence or dominance of some species (such as grouse and heather moorland) where other activities such as grazing by livestock might have led to their demise.

Water

1.10 Water has often been overlooked as a vital commodity in this country. Environment Agency maps show that south east England, and parts of East Anglia are already described as ‘water stressed’, due largely to rising population demands, and reduced summer rainfall. Although use of water for irrigation in agriculture is relatively small it can have important local impacts.

1.11 More importantly agriculture has a huge impact on water quality: while there are currently programmes in place which are addressing nitrate and phosphate pollution in England, 60% of nitrates, and up to 40% of phosphates in water are attributable to agriculture. Inappropriate use or disposal of pesticides is also a significant issue, again attributable largely to the agriculture industry which now has in place a number of initiatives to address this. All these forms of pollution are not acceptable in domestic water supplies, they can also unbalance and critically alter natural ecosystems, compromising important habitats, and threatening the future of individual species.

1.12 Whilst the way land is managed can exacerbate flood events, it can play a key role in flood mitigation. Changes in vegetation cover and soil function can affect soil water retention. Land drainage in the uplands and lowlands may speed water through a catchment - possibly exacerbating flash-flooding - but in many cases it can increase infiltration, and improve storage potential. Despite these benefits, land drainage has been a key component in the loss of our wetlands.

Air

1.13 Air quality is affected by land managers in a more complex way. There is increasing pressure to modify activities which add to greenhouse gas emissions, and aerial nutrient deposition.

1.14 Agriculture is the biggest source of ammonia emissions in the UK. Nearly 90% of ammonia emissions in the UK come from agriculture - mostly livestock manure and slurry. The net effect of carbon dioxide emissions from agriculture is not easy to calculate: growing crops absorb CO_2, but the manufacture of inorganic fertilisers releases large quantities of the gas. Use of organic or inorganic nutrients, and management of soil organic matter will determine the carbon budget of most agricultural products. Forestry in general is seen as being effective at sequestering CO_2, whilst wood products can substantially reduce or offset the carbon costs of a number of diverse products and activities.

1.15 Methane and nitrous oxide are much more potent greenhouse gases than CO_2. Agricultural emissions of both have been reduced in recent years, though for different reasons: methane is emitted by grazing livestock, and by slurry. A reduction in livestock numbers over the past ten years has reduced total emissions, though a bigger reduction in other non-agricultural sources has resulted in a rise in the proportion of total emissions due to agriculture. Nitrous oxide emissions from agriculture have reduced by over 20% since 1990, largely due to a reduction in the use of inorganic nitrogen fertiliser.

Soils

1.16 Soils are crucial to forestry and agriculture, and the good management of them is crucial to freshwater and coastal fisheries. Whilst the cost of poor forestry and agricultural management of air and water quality may not have an immediate effect on the land manager, the management of soil does.

1.17 Soil is not only the growing medium for crops and timber, but soil organic matter is also a major sink for carbon, and, if not managed correctly, a potential major source of CO_2 emissions. Soils are often extremely complex ecosystems, whilst potentially being host to equally complex ecosystems above ground. A change in physical conditions within the soil (such as drainage or ploughing) may destroy much of the mycorrhizal and bacterial activity, so that attempts at above-ground habitat restoration on that area are hampered by the below-ground changes. The ability of soils to hold water is also vital to our water supplies, and to flood management.

1.18 Below-ground conditions may also be crucial to the preservation of archaeological evidence, and hence our understanding of local, possibly national historical heritage. These can be seriously affected by drainage, cultivations, or scrub and tree root development.

Landscape character

1.19 The distinct, recognisable and consistent pattern of elements in a landscape make one place different from another and give it its ‘sense of place’. It results from a combination of geology, landform, soils, vegetation, land use, field patterns and human settlement.

1.20 The historic and present day activities of farming have both formed and shaped the character of the English landscape. Recent trends in agriculture, including increasing crop and livestock specialisation, a decline in mixed farming systems; and increasing intensity and mechanisation, have led to a dramatic loss of semi-natural habitats and increasing landscape homogeneity, with a decline in many of the features that once characterised individual localities.

1.21 The impact of forestry on the landscape is most significant in relation to planting new areas with trees. Historically, this has been significant, particularly in the uplands where conifer plantations were established. Stronger controls are now in place and many existing plantations are being removed or converted to mixed broadleaf woodlands as they reach the end of their commercial life. Even broadleaf woodland creation can transform landscape character and needs to be undertaken sensitively. Management of existing woodland is often important in maintaining the existing character of wooded landscapes.