

Sheffield Hallam Conference 15-17 June 2016

What Capability Brown did for Ecology: the legacy for biodiversity, landscapes & nature conservation

Research paper presented by Natural England

## **The contribution historic designed landscapes make to ecology, ecological connectivity, landscape character and ecosystem services based on a study of Capability Brown sites.**

### **1.0 Historic designed landscapes are an undervalued resource.**

1.1 Historic designed landscapes today contribute many environmental benefits yet they remain an undervalued resource. As part of the Capability Brown Festival 2016, Natural England reports on two research projects that support this concept, focusing on ecosystem services, ecology and ecological connectivity, including data collected from Brown sites, and makes suggestions for further action.

### **2.0 The contribution of parklands to ecosystem services**

2.1 The National Character Area (NCA) ecosystems framework, applied to historic designed landscapes in general, by a multi-disciplinary Natural England team, identified the many environmental opportunities they collectively provide that benefit our wellbeing and prosperity. It identified the most significant features or assets within historic designed landscapes which contribute to these environmental services and the management opportunities available to protect the services they provide, in keeping with the historic layout and character, see Table 1 The Contribution of historic designed landscapes to ecosystem services.

2.2 A further study of 5 Brown sites indicated their significance, in particular, for supplying the Provisioning services for Timber and Genetic Diversity; the Regulating services for Water Availability and Climate Regulation through carbon sequestration; the Regulating Services for Regulating Soil Quality, Regulating Water Quality, Pollination; the Cultural Services for Sense of Place and Inspiration, Sense of History, Tranquillity, Recreation and Biodiversity.

2.3 These are summarised as follows:

#### **Provisioning Services:**

2.3.1 Woodlands over 10 hectares, most likely plantations in the wider estate, provide **timber**. Main rivers and lakes, including Reservoir Act lakes, assist with **water availability** by replenishing ground water and soils in permeable areas.

2.3.2 Provision of **genetic diversity** is significant for paleo-biology and decomposition biology in undisturbed soils in ancient woodland, permanent pasture and semi-natural habitats; also for national botanic and arboriculture collections, for genetic survival of medieval deer herds, veteran trees over 500 years old, rare or pure native species and pedigree or rare breeds. Continuity of management for long term survival supports this service.

### **Regulating Services:**

2.3.3 **Regulation of climate change** is provided through carbon storage in large areas of areas of semi-natural habitats, grasslands, mature woodlands, heathland and waterbody sediment, Carbon is absorbed by woodlands and vegetation. Maintaining and restoring these features supports this service.

2.3.4 Permanent woodland and grassland contributes to **regulating soil quality**. Aerated and un-compacted soils assist water absorption and reduce run-off, especially where sward species diversity and levels of organic matter are high. Extensively managed permanent grassland, continuous cover woodland, avoiding clear felling and maintaining semi natural habitats in good condition help to reduce compaction and soil erosion, particularly soils vulnerable to erosion such as on steep slopes.

2.3.5 Large areas of extensively managed continuous cover woodland with a healthy understorey and ground cover, permanent grassland and semi-natural habitats contribute to **regulating water quality** through absorbing rainfall and through transpiration, thereby reducing sedimentation, nutrient loading and run off. On-line water bodies trap large amounts of sediment and pollutants carried by rivers and streams. These features prevent nutrient and sediment run off as does controlling livestock access and waste and providing woodland, or permanent grassland or 10m unploughed margins to watercourses. Areas managed as part of a catchment sensitive farming approach supports this service at a landscape scale.

2.3.6 Ornamental and semi-natural areas of historic designed landscapes with a wide range of flowering species attract and support pollinating insects over a much extended season. **Pollination** and pest species control contributes to the ecological and economic stability of the historic designed landscape and wider landscape especially where assisted by management to increase the number and diversity of flowering plants and connectivity between habitat mosaics.

### **Cultural Services:**

2.3.7 Historic designed landscapes have a strong **sense of place and inspiration**, particularly where they are high quality landscapes with well managed design elements. They have inspired notable political figures, artists and writers. The English Landscape style, including Brown's contribution has inspired landscape design all around the world. This service increases with the range of opportunities offered to experience, understand and enjoy the varied parkland features, learn about their management and the English Landscape design approach.

2.3.8 Historic designed landscapes are a cultural archive providing a strong **sense of history** particularly where there is ancestral ownership, association with historical figures and a rich understanding of change over time, based on an accessible archive with ongoing recording and new research, or opportunities to engage in cultural festivities and events. Archaeological and historic features conserved within them are an archive of past land use and land cover, notably medieval deer parks, ancient woodland and ancient habitats, as well as land ownership. Registered Parks and Garden (RPG), Scheduled Monument and Listed Building designation indicate national and sometimes international significance.

2.3.9 Originally designed as rural retreats, historic designed landscapes continue to provide a sense of **tranquillity**, particularly where there is a sense of wildness and peace, lack of intrusive new development and night lighting and opportunities for quiet enjoyment are provided.

2.3.10 Historic designed landscapes provide beneficial outdoor **recreation** along with endless possibilities to learn and experience the rich multi layered aspects of the place. Significant benefits are provided where there is good provision for public access via public rights of way, open access or permissive access which is connected to the surrounding network of paths and greenspaces. Also where a wide variety of open days, events, tours and physical activities are offered and where volunteers can engage in research, interpretation and hands on management.

2.3.11 Historic designed landscapes features support a wide range of habitats and species associated with wood pasture and parkland, grassland, veteran trees and deadwood, woodland, ancient woodland and waterbodies as well as undisturbed soils, old buildings and structures. Their **biodiversity** is most significant for supporting much of the UK's Wood Pasture and Parkland priority habitat important for niche species associated with deadwood, and collectively they provide the most important concentration of ancient oak trees in North West Europe. Their contribution is increased where habitats and species are well managed, can be extended and connectivity improved across the wider landscape and where new and restored habitats have local provenance native stock. Relatively easy access means historic designed landscapes provide good opportunities to observe species and provide opportunities for volunteering and engagement with species, habitat surveys and management.

### **3.0 Ecosystem Services provided by Parkland Feature**

3.1 A study of 25 historic designed landscapes with a range of historic periods and distribution across England, including five Brown Sites, identified those parkland features that contributed to ecosystem services; see Table 2 Ecosystem Services provided by Parkland Feature. It highlighted how most parkland features contribute to genetic diversity, regulation of climate, water quality and water flow, our sense of history and place and biodiversity. This data influenced how Countryside Stewardship funding in historic designed landscapes is prioritised. Ecosystems services provision is one of the assessment criteria for a successful application reflecting the value of protecting the services the environment provides.

### **4.0 Examples of management of Brown parklands that deliver ecosystem services.**

4.1 At **Syon**, Greater London, Brown made the river a focus of the landscape, pioneering views to and across the river as a new way to value the 'natural' landscape. The parkland is part of the Thames flood management network, providing seasonal, temporary water storage to reduce flooding in the surrounding urban area.

4.2 The RPG is part of the urban greenspace network and one of the few places in Greater London people can see cattle grazing and over wintering snipe. The parkland is the only area with tidal meadows on the Thames in Greater London with mudflats and natural banks designated Syon Park Site of Special Scientific Interest (SSSI) supporting a wide variety of habitats and species, some of them rare. Ancient trees and woodland are important for roosting sites for bats that use the River Thames for foraging and as a wildlife corridor connecting with other sites, including parklands along the river, and its tributaries. The species rich parkland grassland is managed by seasonal, limited inputs grazing, selective wet woodland scrub control maintains the designed views to focal points in the wider Thames and tidal debris that supports the rare German hairy snail is retained.

4.3 At **Croome**, Worcestershire, Brown excavated boggy farmland and reshaped the formal canal to create a long water body with feeder ponds and streams which combine to provide a number of wetland habitats across the parkland. At different stages in succession from

open water to willow carr and alder woodland, they currently support a wide range of wetland species. The lake was recently restored and a wetland with ponds created within the RPG to replace wetland habitat lost and to capture silt and water run-off from the M5 and adjacent intensively managed farmland to improve water quality.

4.4 Audience development and interpretation by the National Trust at Croome include an Eye catcher Walk leaflet to draw visitors around the Brown landscape, a bat cam and living history recordings. For the Capability Brown Festival 2016 they ran a poetry rap on Brown by inner city youth and created a sensory trail for people with physical and mental difficulties.

4.5 At **Moccas**, Herefordshire, Brown made small scale changes to the medieval deer park and natural lake which is designated Moccas Park SSSI and managed as an National Nature Reserve (NNR) for its collection of ancient trees and huge numbers of deadwood species including 30 national rarities, and all 16 UK bat species. To extend the Wood Pasture and Parkland habitat, part of the site is being restored within the RPG by felling a confer plantation. Sale of the timber helped fund the project. Acorns from the Old Man of Moccas 800 year oak and other tree species, grown by volunteers, will supply the site with parkland trees and native bluebell seed from the medieval deer park will be sown.

4.6 The restoration plan involved a design competition with student and professional landscape architects resulting in shared learning about the design of multi-functional landscapes and inspired a restoration plan that draws people around the site to experience its ecological, landscape and historic environment features.

## **5.0 The contribution of historic designed landscapes to ecology**

5.1 A study of 130 historic designed landscapes designed wholly or partly by Capability Brown, evenly spread across England, demonstrated their importance for biodiversity. Data from the RPG area for 117 Brown sites or a 0.5k radius circle centred on the remaining 13 non RPG Brown sites was compared to data for the surrounding landscape, defined as 5 km radius circle centred on the Brown site, extended where necessary to achieve a minimum of 1 km from the Brown site boundary.

5.2 Nationally, Brown sites support 12 of the 18 Biodiversity Priority habitats found in the area studied, those mostly associated with lowland inland England, see Table 3 Area of Priority Habitats.

5.3 They are significant for five Priority habitats occurring nationally at more than double their density there than in the surrounding landscape:

Wood Pasture and Parkland (57%:1.7%)

Deciduous Woodland (18% : 5.5%)

Lowland Heath (1.8% : 0.5%)

Undetermined Grassland (0.9% : 0.2%)

Reedbeds (0.4% : 0.1%)

5.4 Wood Pasture and Parkland Priority habitat is particularly significant being 30 times denser in Brown sites compared to the landscape as a whole underlining the importance of parkland for conserving this habitat, together with deciduous woodland and lowland heath. Priority habitats other than Wood Pasture and Parkland are about 2.4 times denser nationally within Brown sites compared to the landscape as a whole, a significant difference.

5.5 Ancient Woodland, Replanted Ancient Woodland and Woodland Inventory Broadleaved Woodland, Mixed Broadleaved Woodland, Coniferous Woodland and Mixed Coniferous Woodland as well as Surface Water Bodies occur more than twice as densely nationally in

Brown sites compared to the surrounding landscape, see Tables 4-6 Areas of Woodland Inventory, Ancient Woodland, Surface Water.

5.6 Of the 130 Brown sites, 42% had SSSI designations partly or wholly within them and SSSIs occurred nationally at more than double the density in them compared to the landscapes that surround them (11%: 5%). 12% had Special Area for Conservation (SAC) designations partly or wholly in them and SAC's occurred at a slightly higher density in them compared to the surrounding landscape (3.1%: 2.3%). Only 2% had NNR designations partly or wholly in them and NNRs occurred at a less than double the density in them compared to the surrounding landscape (0.5%: 1.4%), possibly relating to privacy or management control issues.

## 6.0 The contribution of parklands to ecological connectivity

6.1 Further analysis of 5 Brown sites demonstrated that ecological connectivity within Brown sites is generally high but connectivity to the wider landscape was not as strong and variable.

6.2 The following habitats and species were studied according to the condition and distribution of comparable predominant habitats and ability of species associated with them to move or be moved:

Brown site	Habitat	Species
Croome	ponds, grassland	Great Crested Newt, Lesser Horseshoe Bat
Moccas	veteran trees, lake	deadwood invertebrates, Greater Bladderwort
Syon	tidal meadows, wood pasture	German Hairy Snail, bats
Wrest	water margins, broad leaved woodland	Dragonflies and damselflies, bats
Highclere	ancient replanted broadleaved woodland, unimproved grassland	Dormouse, Duke of Burgundy butterfly

### Grassland habitats

6.3 Connectivity of grassland areas within historic designed landscapes is relatively unhindered. Formal grassland areas do not significantly reduce connectivity of flowering grassland meadow areas but connectivity reduces where they are small and scattered. Areas of species-rich grassland are in keeping with historic designed landscapes character but may take over 50 years to establish on improved pasture. Connectivity with the wider landscape is generally low as grassland sites tend to be scattered. Windfall will aid colonisation by some flora and fauna, but lack of direct connectivity will naturally exclude species with low dispersal rates. Road verges and field margins with appropriate soil conditions and management could offer opportunities for connectivity.

### Woodland and ancient woodland habitats

6.4 Connectivity between woodland habitats within historic designed landscapes is high due to the predominance of designed woodland. Improving connectivity mostly relies on woodland restoration, replacement of coniferous plantation with broadleaved woodland and varied age structure. Woodland, and particularly ancient woodland, takes more than 50 years to establish. In the wider landscape connectivity is relatively high where there are comparable woodland blocks less than 0.5 km apart and there is a network of well-established hedgerows with mature hedgerow trees that provide similar habitat to semi-natural woodland edge habitat, but less so where fragmented by intensive farmland.

### **Wood pasture and parkland and veteran tree habitats**

6.5 Connectivity between wood pasture and veteran tree habitats is generally high in historic designed landscapes for many species, but reduces as the number, density, quality and age structure of the trees diminish and is likely to be much lower for more sedentary and specialist species where requirement for dispersal is poorly understood. Improving the density and age structure of trees in historic designed landscapes, preferably by propagating existing trees, is easy to achieve but may require several hundred years to provide replacement ancient trees or bridge gaps in age structure.

6.6 Open grown trees amongst predominantly pastoral land with a similar age range and deadwood characteristics have a much more dispersed distribution in the wider landscape and replacement planting and management occurs much less frequently. Whilst connectivity for generalist mobile species dependant on this habitat may be relatively high, particularly where there are nearby historic designed landscapes, remnant wood pasture, or pockets of mature to over mature trees amongst arable fields, hedgerows, grassland or woodland, it is low elsewhere and for more sedentary species. Pockets of open-growing trees of similar age, size and deadwood characteristics could develop into suitable veteran trees or provide potential corridor for some species likely to take advantage of the belts of woodland that incorporate deadwood to move out from the parkland.

### **Waterbody habitats**

6.7 Connectivity is generally good where there are large water bodies and ponds with lengthy margins of relatively continuous and varied habitat. Management of waterbody margins to check successional processes and silting of lakes together with creation of new ponds can be achieved in keeping with historic designed landscape character with benefits achievable in the short term. Large bodies of open water are relatively infrequent in the wider landscape where connectivity is generally medium to low so they are important for species less able to disperse and provide important stepping stones to comparable wetland areas for mobile species such as waterfowl to move between them, carrying other species. The age of water bodies in parklands may be of significance to some species, limiting connectivity with the wider landscape. Rivers with natural and vegetated banks provide high connectivity for many species between parklands and the wider landscape, including green spaces in urban areas.

6.8 The combination of large water bodies, grassland, mature and veteran trees, woodland and historic buildings with good connectivity are important for a number of species such as dragon flies, damsel flies and bats providing life cycle, roosting and foraging habitats.

## **7.0 Conclusion**

7.1 Brown's designs resulted in loss of ancient trees and natural wetland systems; they also incorporated existing habitats and created new habitats such as species rich grassland, scattered parkland trees, woodlands and waterbodies. He created new parklands and expanded existing ones incorporating natural features and their habitats in the wider landscape conserving them from subsequent development and agricultural practice. Often his natural style landscapes provided a more varied habitat than the formal manicured gardens and arable land he replaced.

7.2 The data indicates the features Brown incorporated into his landscapes such as grassland, trees, waterbodies, woodland as well as buildings, arranged in an intricate design, created a mosaic of complementary habitats concentrated in one place, with lengthy edge habitat and good connectivity important to many species, some of them very rare.

7.3 His landscapes today provide oases for wildlife, particularly for less mobile species and niche species associated with ancient trees, dead-wood and long term management

continuity. Through habitat restoration or improved habitat management his landscapes offer good opportunities to improve ecological resilience and connectivity for a wider range of habitats and species. Their frequency across England, together with other historic designed landscapes and areas of wood pasture, indicates they have a role to play in strengthening ecological networks of their predominant habitats in the wider landscape where ecological connectivity is less strong.

7.4 Historic designed landscapes in urban and rural areas, including those designed by Brown, contribute many ecosystem services. These environmental benefits can be protected and strengthened compatibly with the historic layout and character. Ecosystem services provides a useful approach to understand how historic designed landscapes can be valued and how they can be managed to meet multiple outcomes and guide positive change, so they continue to be relevant in the 21<sup>st</sup> century to ensure conservation of their long term continuity.

**8.0 Recommendations for further action** to ensure historic designed landscapes are managed for future generations to provide multiple benefits:

- Long term Integrated Management Plans assess the wider landscape context of historic designed landscapes and includes management objectives to strengthen their contribution to ecosystem services.
- Survey, maintain and extend semi-natural habitats and species in good ecological condition within parklands and improve their connectivity in the wider landscape.
- NNR designation that is representative of the distribution and different types of parkland habitats including upland, coastal and more wooded areas.
- Ensure historic designed landscapes contribute to landscape scale projects and opportunity mapping aimed at multiple outcome management of land.
- Improve understanding and management of historic designed landscapes habitats for long term continuity of niche species and genetic diversity, particularly those associated with wood pasture and parkland.
- Address under recorded issues and features:
  - Distribution of surviving and lost historic designed landscapes and date and type of origin
  - Orchards, soil biology, semi natural habitats including grassland

#### **7.6 References:**

2013 Cookson & Tickner for Natural England: Environmental Stewardship and Historic Parklands: Evaluating the effectiveness of Environmental Stewardship agreements for the conservation and enhancement of historic parklands and developing a method of prioritisation for funding.

2013 Robert Harvey & Max Wade RPS for Natural England: Understanding the contribution of historic designed landscapes to landscape character, ecological connectivity and ecosystems services and, based on a selection of Capability Brown landscapes, communicating the benefits historic parklands provide to a wide range of audiences. RPS reference OXF7946.

**Table 1: The contribution of historic designed landscapes to ecosystem services**

An approach based on the Natural England National Character Area ecosystem services framework, focusing on assets and management opportunities

<b>Service</b>	<b>Asset/attributes main contributors to service</b>	<b>Analysis</b> Local/Regional/National Low/Medium/High contribution	<b>Opportunities</b> in keeping with the historic layout and character of the designed landscape
Food/ fibre provision	Food /fibre production	Production is limited in historic parklands – see section on genetic diversity	Produce premium foods such as venison, rare breeds meat and wool, honey, walled garden and orchard produce
Timber provision	Timber plantation over 10ha in the wider estate	Plantations in wider estate	<p>Selectively manage plantations in the wider estate as part of/backdrop to designed landscape and for high value markets eg furniture and wood turning</p> <p>Integrated woodland management throughout parkland to make best use of timber eg thinning for wood fuel, whilst retaining important dead wood component.</p>
Water availability	<p>Water - reservoirs, lakes, rivers, streams</p> <p>Ground water replenishment in permeable soils/ geology</p>	<p>Main rivers Lakes Reservoir Act lakes</p>	<p>Maintain historic water bodies and de-silt periodically, ensuring removal and disposal of silt protects sensitive designed landscape, historic and biodiversity interests and avoid run off into watercourses</p> <p>Restore permanent pasture parkland and woodland to increase permeability</p>
Genetic diversity	Paleo-biology and decomposition biology in undisturbed soils	<p>Undisturbed soils Ancient woodland, permanent pasture Semi natural habitats</p>	<p>Protect undisturbed soils in ancient woodland, semi-natural habitats, archaeological and historical remains</p> <p>Restore ancient woodland</p>
	Genetic survival – medieval deer herds, veteran trees and coppice stools, rare or pure native species	<p>Medieval deer herd Veterans trees over 500 years National botanical /arboricultural collections</p>	<p>Work with eg Royal Botanics Kew and UK Farm Animal Genetic Resource and [Cultivated] Plant Genetic Resources to record/manage in-situ/ex-site collections</p>
	<p>National botanical and arboricultural collections</p> <p>Rare breeds, game, fisheries, kitchen garden/orchards varieties</p>	<p>Rare or pure native species</p> <p>Pedigree/rare breeds</p> <p>Management for long term survival</p>	<p>Propagate trees species, grow from veteran tree seed or encourage natural regeneration, coppice and pollard</p> <p>Restore genetic diversity by sourcing from other parklands or habitats where appropriate eg native species seed and rare breeds</p>

<b>Service</b>	<b>Asset/attributes main contributors to service</b>	<b>Analysis</b> Local/Regional/National Low/Medium/High contribution	<b>Opportunities</b> in keeping with the historic layout and character of the designed landscape
Climate regulation -carbon storage  -carbon sequestration	Carbon stored in deep peat, semi-natural grasslands, woodlands, heathland, Waterbody sediment  Carbon absorbed by woodlands and vegetation	Large areas of: deep peat semi natural habitats grassland mature woodland lakes	Manage woodlands, trees and pasture for long-term retention of carbon Increase areas of woodland, parkland pasture and water bodies by restoration of historic landscape  Continuous cover woodland management and encourage natural regeneration  Manage wetlands and peat lands to prevent drying out, whilst ensuring appropriate vegetation cover eg active Sphagnum layer on raised and blanket bogs.
Climate regulation -renewable energy	Boilers fed by estate woodfuel	Estate wood fuel supply	Short term rotational coppice, hedgerow management and plantation thinning in the wider estate for wood fuel  Restore ancient woodland coppice
Regulating soil quality	Aerated un-compacted soil assists infiltration and reduce runoff.  Permanent pasture, semi-natural habitats and woodlands especially on vulnerable soils, managed to reduce compaction	Extensively managed especially on steep slopes: permanent pasture semi natural habitats woodland,	Restore permanent parkland pasture in areas susceptible to erosion with extensive grazing regimes  Manage land with grazing regimes that increase sward diversity and levels of organic matter  Manage woodland as continuous cover, avoid clear felling, restore woodland on steep valley sides
Regulating water quality	Large areas of unimproved and semi-improved habitats  Rivers and water bodies with good WFD ecological status  Waterbodies that trap sediments  Management approaches that reduce sedimentation, nutrient loading and run off	Large areas of extensively managed: semi-natural habitats permanent grassland woodland with healthy understorey and ground cover  Waterbodies on line holding large areas of sediment  Area of land managed by catchment sensitive farming approach	Extensively manage large areas of permanent grassland, prevent soil erosion by trampling and subsequent nutrient and sediment run off  Thin and selectively fell woodland and coppice for healthy understorey and ground cover especially on steep slopes  Manage sediment loads by periodically de-silting water bodies minimising the short term decrease in water quality. Provide buffers along watercourses of permanent grassland, woodland or 10m unploughed river margins to reduce run off.  Careful management of inputs, livestock access and waste management including fenced watercourses where appropriate

<b>Service</b>	<b>Asset/attributes main contributors to service</b>	<b>Analysis</b> Local/Regional/National Low/Medium/High contribution	<b>Opportunities</b> in keeping with the historic layout and character of the designed landscape
			to control access by stock
Regulating water flow	Extensive areas of unimproved and semi-improved habitats  Management to slow flows and reduce water run off	Extensive unimproved and semi- improved habitats  Capacity for temporary, seasonal water storage in the parkland  Historic water management water meadows, sluices, weirs	Restore water meadows, sluices, weirs etc and manage to regulate flows in the wider catchment  Allow areas of parkland to seasonally flood temporarily  Restore and manage parkland sward as extensive permanent grassland  Reconnect rivers with their flood plains
Pollination	Pollinator species rich areas – semi- natural habitats, woodlands and hedgerows, gardens	Range of flowering species, local crops requiring pollination such as orchards and ecological connectivity	Increase number and diversity of flowering plants and connectivity between habitat mosaics
Sense of place/ inspiration	High quality landscape with a clear sense of place  Association with and inspiration for notable political figures, artists, writers,  Brown's contribution to the development of the international English landscape style  Opportunity to experience the sense of place/inspiration of the Brown landscape	High quality landscapes, AONB/NP with well managed landscape design elements  Opportunity to: -explore the range of experiences in the parkland landscape intended by Brown  -and in the wider landscape  - learn about Brown's contribution to the English landscape design style	Management plan in place to guide management  Provide a range of experiences to access, understand and enjoy - the range of features in the historic parkland, the wider estate and wider landscape - the circulatory routes and drives around the parkland and wider estate taking in the features and viewpoints -associations with other notable and creative figures and parklands  Provide opportunities to learn and develop understanding about management of Brown landscapes and international English Landscape design approach
Sense of history	Heritage features  Past land use, land cover, land ownership, association with notable historical figures  Cultural heritage activities and cultural events	RPG, SMs, LBs, deer parks, ancient woodland and habitats  Understanding of -change over time -ancestral ownership and historical figures -historic archive  Access to historic features, records and cultural events	Historic elements managed in line with management plan  Parkland past and present well recorded in accessible archive with on-going records and new research  Provide opportunities to engage directly with historic features, historic records and their management  Provide opportunities to take part in cultural festivals and events

<b>Service</b>	<b>Asset/attributes main contributors to service</b>	<b>Analysis</b> Local/Regional/National Low/Medium/High contribution	<b>Opportunities</b> in keeping with the historic layout and character of the designed landscape
Tranquillity	Dark skies, Low level of intrusion	Access to areas that offer tranquillity and wildness	Minimise intrusion of new development Minimise night lighting outside visitor hours Provide opportunities for quiet enjoyment
Recreation	Access and recreation in the parkland and wider estate  Connection with the wider landscape and communities  Landscape, ecology, history based activity  Healthy outdoor recreation	Open access, rights of way Permissive access  Range of open days, events and beneficial outdoor activities appropriate to the parkland  Part of an interconnected network of paths/green spaces  Volunteering and community engagement	Opportunities for the public to understand, enjoy and engage with the rich and multi-layered aspects of the place through carefully designed routes, interpretation, events, installations, guided tours and virtual tours eg apps; walking, jogging, cycle trails, fishing, horse riding provision  Increase opportunities for volunteers to engage with landscape, ecological, geodiversity and historical research, interpretation and hands-on management  Engage with a range of community networks
Biodiversity	Niche habitats and species  Past and present ecology and land management practice  Ecological connectivity in the wider landscape	Habitats/species associated with wood pasture and parkland, veteran trees and deadwood ancient semi- natural woodland, woodland, grassland, water bodies  undisturbed soils  old buildings and structures  Opportunities to understand and experience species and habitats and their management	Habitats and species managed in line with management plan  Extend habitats and species and improve connectivity across the wider landscape  Provide opportunities for volunteering and engagement in species and habitat survey and management  Ensure new/restored habitats/species are sourced for local provenance native stock or by natural regeneration, translocation and propagation.  Control invasive species and manage disease
Geo-diversity	Geological features, historic mining/extraction, building materials	Geology SSSI Historic mining/extraction	Significant geology and historic remains conserved Appropriate use of local stone for structures

Leslie Pearman, Natural England June 2016

Feature category	Parkland feature	PROVISIONING SERVICES				REGULATING SERVICES				CULTURAL SERVICES			
		Food	Timber	Genetic diversity	Water	Climate	Soil quality	Water quality	Water flow	Sense of place / history	Bio-diversity	Recreation	Geo-diversity
Open parkland	Parkland trees			○		○			○	○	○		
	Tree clump			○		○			○	○	○		
	Tree avenue			○		○			○	○	○		
	Sward (grassland)	○		○		○	○	○	○	○	○		
Woodland	Designed woodland		○	○		○	○	○	○	○	○		
	Woodland belt		○	○		○	○	○	○	○	○		
Access & views	Approaches / Wider circulation									○		○	
	Designed views & vistas									○			
Waterbodies	Canals	○		○	○	○		○	○	○	○		
	Lakes	○		○	○	○		○	○	○	○	○	
	Streams	○		○	○			○	○	○	○	○	
	Fish ponds	○		○	○	○		○	○	○	○	○	
	Duck decoys	○		○	○	○		○	○	○	○		
	Water management structures	○			○			○	○	○			
Boundaries	Wall									○	○		○
	Timber Park Pale									○			
	Ha-ha									○	○		○

Table 2 Ecosystem Services provided by Parkland Feature

Feature category	Parkland feature	PROVISIONING SERVICES				REGULATING SERVICES				CULTURAL SERVICES			
		Food	Timber	Genetic diversity	Water	Climate	Soil quality	Water quality	Water flow	Sense of place / history	Bio-diversity	Recreation	Geo-diversity
	Iron railings									○	○		
	Hedge							○	○	○	○		
<b>Park-related archaeology</b>	Former park boundaries & features / False antiquities / Land use archaeology / Pre-park funerary & settlement archaeology / 20 <sup>th</sup> century archaeology									○			○
<b>Parkland architecture</b>	Lodges & entrance lodges, Stables & Kennels, Bridges, Ornamental parkland buildings, Obelisks / columns, Farm buildings, Cottage orneé, Ice houses, Churches, Boat houses, Ruins / follies / grottoes, Dovecotes									○	○	○	○
	Walled kitchen garden	○		○						○	○	○	○

**Table 2 Ecosystem Services provided by Parkland Feature**

**Table 3 Areas of Priority Habitats**

(Source: Natural England data)

HABITATS	Historic Parkland		Wider Landscape	
	Area (ha)	%	Area (ha)	%
Deciduous woodland	7641	18%	53,659	5.5%
Fens	46	0.1%	704	0.07%
Saline lagoons	0	0.0%	13	<0.01%
Mudflats	0.3	<0.01%	1167	0.1%
Maritime cliff and slopes	0	0.0%	0.01	<0.01%
Coastal sand dunes	0	0.0%	9.4	0.00%
Coastal floodplain and grazing marsh	78	0.2%	10,339	1.0%
Blanket bog	0	0.0%	350	0.04%
Lowland raised bog	0	0.0%	28	<0.01%
Reedbeds	<b>180</b>	<b>0.4%</b>	<b>940</b>	<b>0.1%</b>
Purple moorgrass and rush pasture	0	0.0%	1174	0.1%
Undetermined grassland	<b>383</b>	<b>0.9%</b>	<b>2205</b>	<b>0.2%</b>
Lowland heath	<b>744</b>	<b>1.8%</b>	<b>3559</b>	<b>0.5%</b>
Lowland acid dry grassland	<b>52</b>	<b>0.1%</b>	<b>3507</b>	<b>0.4%</b>
Lowland calcareous grass	<b>59</b>	<b>0.1%</b>	<b>2019</b>	<b>0.2%</b>
Lowland meadow	41	0.1%	1366	0.1%
Upland calcareous grass	0	0.0%	126	0.01%
Upland hay meadow	0	0.0%	27	<0.01%
Upland heath	114	0.3	5532	0.6%
Traditional orchard	24	0.06%	1511	0.2%
<b>SUBTOTAL</b> Priority habitats excluding woodpasture and parkland	<b>9364</b>	<b>22%</b>	<b>90,014</b>	<b>9.2%</b>
Wood pasture and parkland (does not include south-east and Greater London regions)	18,909	57%	11,613	1.7%
<b>TOTAL PRIORITY</b>	<b>28,273</b>	<b>67%</b>	<b>101,626</b>	<b>10.4%</b>
Total habitats excluding London and South East sites, for which wood pasture and parkland data are not available)	<b>25,897</b>	<b>79%</b>	<b>64,610</b>	<b>9.6%</b>

**Table 4 Areas of Woodland Inventory Types**

(Source: Forestry Commission data)

	Historic Parkland		Wider Landscape	
	Area (ha)	%	Area (ha)	%
Broadleaved woodland	12042	28%	88890	9%
Mixed broadleaved woodland	248	0.6%	1815	0.2%
Coniferous woodland	3325	7.9%	23620	2.4%
Mixed coniferous woodland	513	1.2%	2645	0.3%
Coppiced wood	4.11	0.01	492	0.05%
Shrub/scrub/sparse wood	338	0.8%	4843	0.5%
Other woodland	58	0.1%	2260	0.2%
<b>TOTAL woodland</b>	<b>16,528</b>	<b>40%</b>	<b>124,565</b>	<b>13%</b>

**Table 5 Areas of Ancient Woodland Types**

(Source: Natural England data)

	Historic Parkland		Wider Landscape	
	Area (ha)	%	Area (ha)	%
Ancient woodland	1935	4.6%	21,111	2.2%
Replanted ancient woodland	1663	3.9%	16,954	1.7%
<b>TOTAL Ancient Woodland</b>	<b>3598</b>	<b>8.5%</b>	<b>38065</b>	<b>3.9%</b>

**Table 6 Areas of Surface Water (Source: OS Vector Mapping)**

	Historic Parkland		Wider Landscape	
	Area (ha)	%	Area (ha)	%
<b>TOTAL Surface Water Bodies</b>	<b>1026</b>	<b>2.4%</b>	<b>10186</b>	<b>1.0%</b>

Tables 3–6 2013 Robert Harvey &amp; Max Wade RPS