Space for Nature, A Wildlife Prospectus for Clinton Devon Estates
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space for nature

A Wildlife Prospectus for Clinton Devon Estates

[Page 1] On the verge of extinction 50 years ago, otters (*Lutra lutra*) have returned to much of the English landscape, with the well-named River Otter now supporting a healthy population.

[Pages 2–3] Linnets (*Carduelis cannabina*) and goldfinches (*Carduelis carduelis*) flock around in a field of planted bird seed mixture within an arable landscape. These mixes support farmland birds over winter.

[Pages 4–5] Bales of straw ready for collection for use as livestock bedding.

[Pages 6–7] The delicate flowers of ragged robin (*Lychnis flos-cuculi*) brighten the Otter Meadows County Wildlife Site at dawn.

[Pages 8–9] Female beaver (*Castor fiber*) on the River Otter with her two kits, snacking on willow bark at dusk.

[Previous] A lone farmland tree at sunset, North Devon. Veteran trees provide excellent habitats for birds, bats, fungi, lichens and invertebrate communities.

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FOREWORD

Farmers, foresters and land managers are beginning to realise that for their businesses to be sustainable, they must establish a new social contract delivering what society wants. As the United Kingdom leaves the European Union, one of the emerging opportunities is for those managing the countryside to adapt existing business models to reflect the very special role and responsibility they have in delivering so many benefits for which there are currently no markets. A new agricultural policy will likely highlight what is expected from the private sector. At Clinton Devon Estates we are preparing ourselves to be ready to play our part in delivering a countryside that reflects society's preferences, whether this be new homes, rural jobs, food, fibre, renewable energy or recreational spaces. We can be certain that caring for the countryside and protecting habitats and wildlife will be one of the top demands.

Across the Estate in North and East Devon we have landscapes rich in habitats and places where wildlife is both abundant and scarce. Whilst we are proud of what we have achieved, in terms of supporting some of the most remarkable biodiversity in Europe, we know that we have much more to do in terms of addressing some of the challenges many species and habitats face. These include being given sufficient well-managed space to thrive, and corridors to move through the landscape. Having well-connected landscapes will be critical to the survival of many species as the impacts of climate change are increasingly felt.

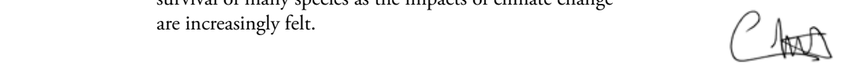
The shelduck (*Tadorna tadorna*) is found mainly at coastal sites, and can be seen all year round feeding on invertebrates in the mud of the Otter Estuary.

This Wildlife Prospectus identifies the key natural assets under our care, and how we can enhance them further for the nation. It forms the basis of a wider strategy across all areas of the Estate: to embed the principles of enhancing the environment and nature into day-to-day business activities, and hand over to future generations a richer countryside than we inherited.

Our Prospectus will inform us about how we can continue to make a positive difference for wildlife. How we go about it is just as important as the outcomes we seek. We wish to use this Prospectus to inform discussions about new partnerships with our tenants, local communities and stakeholders in nature conservation and other disciplines.

In preparing this work we were keen to ensure that it was both accessible and engaging. I hope that you find it is, and it stimulates you to help the Estate play its part in delivering better wildlife outcomes in the coming years.

I should like to thank John Varley, Estates Director, for commissioning this Prospectus, Dr Sam Bridgewater, Head of Biodiversity and Conservation, for providing the evidence and leading on its production, and Matt Maran, one of the country's most accomplished wildlife photographers, for taking the iconic images and publishing it.



– Lord Clinton

INTRODUCTION

Under the 2021 Estate Strategy, Responsible Stewardship is one of five key principles of working embedded into the culture of the Estate. A critical element of this is ensuring that the wildlife and habitats (or 'Natural Capital') of which the Estate is a custodian are not only conserved, but enhanced through our business activities. Our aspiration is to hand over a countryside more diverse, resilient, functional and ecologically valuable than we have today.

Estate Mission Statement:

'*To secure the long-term prosperity of the Estate and the people who live and work on it in ways which care for the countryside and engage with the wider community.*'

For generations, the Estate has looked after the countryside through its day-to-day activities, with the conservation of wildlife being one of many land management aims. Its key conservation focus since the 1990s has been the East Devon Pebblebed Heaths. Covering over 1,000 hectares (ha) of Open Access common land, the Pebblebed Heaths form a distinctive part of the East Devon landscape. The rarity of this habitat and the richness of its wildlife have earned the core area of the heaths important European and national conservation designations. These include Site of Special Scientific Interest (SSSI), Special Protection Area (SPA) and Special Area of Conservation (SAC). In 2006 the Estate established its own conservation charity, the East Devon Pebblebed Heaths Conservation Trust, to oversee the management of this site.

However, the Pebblebed Heaths are by no means the only area of conservation importance, or significant element of 'Natural Capital' for which the Estate is responsible. Within its boundaries lie additional European sites of conservation interest, three further SSSIs and 18 County Wildlife Sites (CWSs). All statutory and non-statutory (County Wildlife) sites combined cover 1,462 ha, or 14% of the Estate's land holdings. In addition, the broader non-designated working landscape supports a range of habitats of high conservation worth. These include sea cliffs, streams, rivers, ponds, woodland, parkland, orchards, hedgerows, wetland, saltmarsh and species-rich grassland. They support a high diversity of protected and non-protected species, as well as delivering a range of provisioning (e.g. food), regulating (e.g. purification of water), cultural (e.g. recreation) and supporting (e.g. crop pollination) services for broader society.

The Estate recognises that to truly deliver landscape-scale conservation, at a level demanded by society, wildlife conservation must not be restricted to discrete reserves, however large, but embedded across all aspects of Estate business. The biggest gains for wildlife in the countryside will be achieved through appropriate management of our in-hand, share and tenanted farms (8,000 ha) and woodlands (1,800 ha). It is across the broader Estate that we can achieve the connectivity and resilience our species and habitats require.

England's recent Natural Environment White Paper (2011) and associated Strategy for Wildlife and Ecosystem Services (2011) (Biodiversity 2020) highlighted the need to strengthen landscape-scale conservation, with the *State of Nature Report* (2016) bringing into focus the high rate of species decline in the UK. The National Ecosystem Assessment (2011) and findings of the Natural Capital Committee have demonstrated the consistent under-valuing of the many ecosystem services provided by nature in national and local decision-making. Nationally, failure to recognise this value has resulted in rapidly degrading natural environments, weakening the ecological life support systems upon which society depends.

This document provides a landscape-scale wildlife prospectus, vision and strategy for wildlife across Clinton Devon Estates. It articulates and quantifies the key elements and importance of our natural assets and outlines a broad roadmap and priorities for their improvement. Highlighting challenges, opportunities and pathways for delivery, it significantly strengthens the Estate's approach to wildlife conservation, and will help ensure that we fulfil our commitment to remain a responsible steward of the land under our care. Directed by this Prospectus, we believe we can meet key demands made on landowners by government and society: the delivery of landscape-scale conservation, safeguarding essential ecosystem services and ensuring that as a business we work within safe environmental limits.

Table 1. Primary Estate Land Uses

Description	Percentage of Holdings (10,000 hectares)
Multipurpose woodlands (coniferous/broadleaf)	17
Open Access heathland SSSI/SAC/SPA	11
In-hand agriculture, including share farms	20
Tenanted agriculture	37
Paddocks and miscellaneous lettings	8
Equestrian arena	<1
Sports facilities (fields, etc.)	<1
Solar sites	<1
Allotments	<1
Quarries	<1
Beaches	<1
Housing, industrial and business lettings, development sites	<1
Total	**100**

View towards the Exe Estuary across the East Devon landscape. The mosaic of farmland, hedgerow and woodland provides a range of habitats where wildlife can thrive.

PRIORITY HABITATS FOR CONSERVATION ON ESTATE LAND

Table 2. Designated and Non-Designated Sites of High Conservation Value on Estate

Site	Habitat	Area (Hectares)	Management Responsibility
Special Area of Conservation/Special Protection Area			
East Devon Pebblebed Heaths	Heathland	990 (of 1,112)	In-hand (81%) RSPB (19%)
Beer Quarry and Caves	Caves	31	Tenants
Sites of Special Scientific Interest			
East Devon Pebblebed Heaths	Heathland	990 (of 1,112)	In-hand (81%) RSPB (19%)
Sidmouth to Beer Coast	Coastal cliff	1 (of 11)	Tenants
Beer Quarry and Caves	Caves	31	Tenants
Hunshaw Woods	Oak woodland	16 (of 18)	In-hand
County Wildlife Sites			
Black Hill Quarry	Heathland	58	Tenants
Dalditch Plantation	Heathland	27	In-hand
Squabmoor Reservoir	Open water/unimproved grassland/heathland	3	Tenants/South West Lakes
Shortwood Heath	Heathland	3	In-hand
Hayes Wood	Plantation on Ancient Woodland Site (PAWS)	44	In-hand
Knowle Hill Embankment	Woodland	2	East Devon District Council
West Down Golf Course	Mixed	60	East Devon Golf Course
Orcombe Point to Straight Point	Coastal cliff/mixed	13 (3 managed in-hand)	In-hand (23%) National Trust (77%)
The Floors	Coastal cliff	31 (16 managed in-hand)	In-hand (52%) National Trust/Devon Cliffs Holiday Park (48%)
Knowle	Marsh	6	Tenants
Rockham Wood	Woodland	14	Tenants
Otter Meadows	Grazing marsh	52	Tenants
Otter Estuary to Green Point	Coastal cliff	5	Tenants
Wingate Cliffs	Coastal cliff	23 (15 managed in-hand)	In-hand (65%) National Trust (35%)
Peak Hill	Mixed	23 (18 managed by Estate tenants)	Tenants (78%) National Trust (22%)
Mutter's Moor	Heathland	54	In-hand
Beer Quarry and Caves	Calcareous grasslands/ scrub	32	Tenants
Bovey Lane Fields	Calcareous grasslands	5	Tenants
Bovey Lane Quarries		15	Tenants
Beer Fields	Calcareous grasslands	8	Tenants
Beer Brook Fields	Calcareous grasslands	2	Tenants
Total		**1,464**	

Table 3. Summary of Habitats of High Conservation Value

Habitat	Area/length (hectares/kilometres)	Management responsibility
Mixed deciduous woodland	450	Predominantly in-hand
Hedgerows	1,378 km	In-hand/tenants
Saltmarsh and mudflats	30	In-hand
Grazing marsh	52	Tenants
Calcareous grassland	28	Tenants
Heathland	990	In-hand/tenants
Reedbeds	3	In-hand/tenants
Historic parkland	32	In-hand
Rivers	60 km	In-hand/tenants
Maritime cliff and slope	5 km	In-hand/tenants
Traditional orchards	2	In-hand/tenants
TOTAL	**1,587 ha**	

These broad habitats are listed as Priority Habitats for Conservation under the UK Biodiversity Action Plan. They also represent Key Habitats of Wildlife Importance under the Devon Biodiversity Action Plan.

Common carder bee *(Bombus pascuorum)* visiting a foxglove (*Digitalis purpurea*) on calcareous grassland, Beer.

Hedgerows

Hedgerows and associated trees are some of the Estate's key natural assets. Functioning as stock-proof barriers, reservoirs of biodiversity providing wildlife connectivity through the landscape, and helping to prevent soil erosion, these historic landscape elements are one of Devon's most precious wildlife features. With an estimated length of 53,000 km, Devon has more hedges remaining than any other county in the UK. This represents about 20% of all the species-rich hedges. There is little information on the condition of Devon's hedges, although random sample surveys of 1,308 hedges from ten parishes in Devon between 2007 and 2009 deemed only 38% to be in favourable condition for wildlife. The Estate is responsible for the management and protection of 1,378 km of hedgerow across its holdings, with 918 km managed by tenants, and 460 km managed in-hand.

[Right] Farmland on the Estate is typified by small fields with a high density of hedgerows and hedgerow trees. These provide havens for wildlife and connectivity through the landscape.

[Overleaf] A species-rich Devon bank flowering in June near Otterton. Hedgerows and hedgebanks are among the Estate's key natural assets.

Saltmarsh and Mudflats

Saltmarsh and mudflats are coastal habitats whose ecological character is defined by tidal cycles, with vegetation consisting of salt-tolerant species adapted to regular immersion by the sea. They are important feeding and breeding sites for waders and wildfowl, are highly productive nursery grounds for numerous fish species, and serve as filters to remove sediments and toxins from the water. Marshes also buffer the mainland by slowing and absorbing storm surges, thereby reducing erosion of the coastline.

Across Devon there are an estimated 359 ha of saltmarsh and 3,442 ha of mudflat with 16 SSSIs (5,234 ha) containing these habitats. The Estate is responsible for the management of 30 ha (combined saltmarsh and mudflat) which all fall within the River Otter Site of Special Scientific Interest (SSSI).

A redshank (*Tringa totanus*) feeding on mudflats in the Otter Estuary at low tide. The site supports significant populations of wading birds in winter.

Reedbeds

Reedbeds are dominated by stands of common reed (*Phragmites australis*) with a water table at or above ground level for most of the year. They can tolerate brackish water and are therefore frequently found at the upper edges of estuaries, including those of the Exe, Teign and Otter rivers. Reedbeds are especially important for birds such as reed bunting (*Emberiza schoeniclus*), reed warbler (*Acrocephalus scirpaceus*), Cetti's warbler (*Cettia cetti*) and invertebrates such as the wainscot grass-veneer moth (*Chilo phragmitella*). Loss of reedbed habitat across the UK has been estimated at 40% since 1945, with management neglect of remaining areas also a cause for concern. This often involves an abandonment of traditional harvesting regimes.

Devon supports an estimated 781 ha of reedbed, with the majority being less than 10 ha in size. The Estate is responsible for the management of 3 ha of reedbed associated with the Lower Otter Valley. Half are located within the Otter Estuary SSSI, and half within the Otter Meadows County Wildlife Site.

[Right] Common reed (*Phragmites australis*).

[Overleaf] Reedbed, Otter Estuary.

Grazing Marsh

Grazing marsh is periodically inundated pasture or meadow, often browsed by livestock and usually with ditches controlling water levels. This habitat is particularly associated with estuaries where frequent flooding with freshwater in winter and spring creates ideal feeding conditions for a range of overwintering birds. Grazing marshes can also support a diverse flora.

In Devon 6,537 ha of grazing marsh has been identified, with key sites including Braunton, Exminster and Axmouth Marshes. Several Sites of Special Scientific Interest (SSSI) include grazing marsh as part of the designation, with an additional 37 County Wildlife Sites (CWS) across the county also supporting this habitat type. The Estate owns the Otter Meadows grazing marsh (52 ha), which is listed as a County Wildlife Site. This is farmed by tenants with grazing forming part of the management regime.

Dew on marshland grass, Otter Meadows.

Lowland Calcareous Grasslands

Lowland calcareous grasslands develop on shallow lime-rich soils. They support a highly diverse flora and invertebrate fauna including many nationally rare and scarce species, and provide feeding and breeding habitat for a number of threatened birds such as the skylark (*Alauda arvensis*). They represent one of Western Europe's most important and rarest plant communities. Before World War II, calcareous grasslands were widespread wherever there was limestone or chalk bedrock, but their extent has greatly declined as traditional management practices have disappeared. Across their range under-grazing and abandonment are the main causes of unfavourable condition. This commonly results in scrub encroachment.

Quaking grass (*Briza media*), Beer. The pendulous, trembling flowering heads of this plant are a typical feature of calcareous grassland in early summer.

There is an estimated 775 ha of lowland calcareous grassland in Devon, with four SSSIs and 55 County Wildlife Sites (CWS) containing this vegetation type. The Estate's holdings of calcareous grasslands are concentrated around the Beer Estate. Over 28 ha have currently been identified at this site, occurring within four County Wildlife Sites (Beer Brook Fields; Beer Fields; Bovey Lane Fields; Bovey Lane Quarries).

[Left] Southern marsh orchid (*Dactylorhiza praetermissa*), calcareous grassland, Beer.

[Above] Species-rich calcareous grassland, Beer. This habitat represents one of Europe's rarest plant communities.

Farmland, Parkland and Ancient Trees

In addition to trees associated with hedgerows and woodlands, the Estate's farmland and parkland holdings support significant numbers of mature broadleaf trees, many of which are veteran or ancient. Over 500 individual trees have been identified as occurring within parkland or fields. The majority are veteran, if not necessarily ancient. Within 30 ha of the historic Grade I listed parkland of Bicton Arena alone, over 60 heritage trees (those having cultural significance) and associated clumps have a history dating back to the late 1700s. Indeed, many of the Estate's woodlands in East Devon, including the famous beeches of Woodbury Castle, also date back to this time. Additional parkland areas also occur, comprising wood pasture forged through historic grazing systems, with many trees including ancient pollards.

A veteran sweet chestnut (*Castanea sativa*) approaching 200 years of age. Many of the trees in the Grade I listed parkland of Bicton Arena were planted in the 1820s and 1830s by Lady Louisa Rolle.

The conservation, historic and landscape value of trees, and particularly of veteran trees, are well documented, with these providing excellent habitats for fungi, lichens and invertebrate communities. Over 2,000 different invertebrate species in Britain, for example, are known to be dependent on decaying wood in order to complete their life cycles. A wide range of birds are also supported by the habitats and food provided by veteran trees, with tree cavities and bark features also supporting bats.

[Left] Veteran sycamore (*Acer pseudoplatanus*), East Devon. Originally native to continental Europe, this species was introduced to the UK in the Middle Ages and has been widely planted as an ornamental tree. It has become naturalised.

[Above] Veteran turkey oak (*Quercus cerris*). Due to its striking form, this species, which is native to south-eastern Europe, was popular in English landscape designs of the early 19th century.

Heathland

The UK has 58,000 ha of lowland heath, representing about 20% of the European total. Approximately 25% (14,500 ha) of these are in South West England, with 4,000 ha in Devon. At 1,112 ha, the East Devon Pebblebed Heaths represent the single largest expanse of lowland heathland in Devon. The core area of this site (990 ha) is owned by the Estate, with the majority managed by its own conservation charity, the East Devon Pebblebed Heaths Conservation Trust. Smaller areas of heathland under Estate ownership are leased to the RSPB. The East Devon Pebblebed Heaths represent the Estate's largest and most significant landscape-scale conservation site, and historically the focus of the conservation effort has been on its management for the benefit of wildlife and recreation.

Due to the rarity of habitats and species supported, the East Devon Pebblebed Heaths have been designated a Special Area of Conservation, a Special Protection Area and a Site of Special Scientific Interest. It is also designated Open Access Common Land. Key species of high conservation value include silver-studded blue butterfly (*Plebejus argus*), southern damselfly (*Coenagrion mercuriale*), nightjar (*Caprimulgus europaeus*) and Dartford warbler (*Sylvia undata*).

Isolated Scots pines (*Pinus sylvestris*) on the East Devon Pebblebed Heaths provide popular churring locations for the nightjar (*Caprimulgus europaeus*).

Lowland Mixed Deciduous Woodland and Orchards

Devon supports over 77,000 ha of woodland representing 12% of its land area. Of this, 60% is broadleaf or mixed, predominantly broadleaf woodland. Estate land supports 1,747 ha of multipurpose woodland (17% of its land area), with these managed largely for timber, wildlife and public access. Approximately 75% are mixed coniferous woodlands (although with an average of 25% broadleaf recruitment), with the remainder being broadleaf. Species compositions vary according to aspect, soil type and hydrology with oak (*Quercus*), hazel (*Corylus avellana*), ash (*Fraxinus excelsior*), birch (*Betula*), willow (*Salix*) and beech (*Fagus sylvatica*) being particularly common broadleaf species. Wet woodlands occur on waterlogged soils adjacent to bogs and in tributary and river valley bottoms. Some of these support rare species such as black poplar (*Populus nigra*). Small woodland mosaics, frequently inter-connected by hedgerows, occur across the farming landscape and associated with the East Devon Pebblebed Heaths. Only a minority of the Estate's broadleaf woodlands have historically been managed by coppicing.

Broadleaf woodlands support a highly diverse flora and fauna across all groups, including many rare or threatened species of high conservation value including the hazel dormouse (*Muscardinus avellanarius*). Many of the predominantly coniferous woodlands also have considerable wildlife value with remnant ancient woodland floras. Woodland holdings include the ancient oak coppice woodlands of Hunshaw Site of Special Scientific Interest, and Hayes Wood County Wildlife Site, which also retains ancient woodland plant species. A number of other non-designated woodlands have high wildlife value, supporting ancient woodland flora including bluebells (*Hyacinthoides non-scripta*).

Associated with individual farm holdings are dozens of orchards consisting of standard fruit and nut trees of an unknown number of cultivars. These are generally small in size and abandoned to a greater or lesser degree.

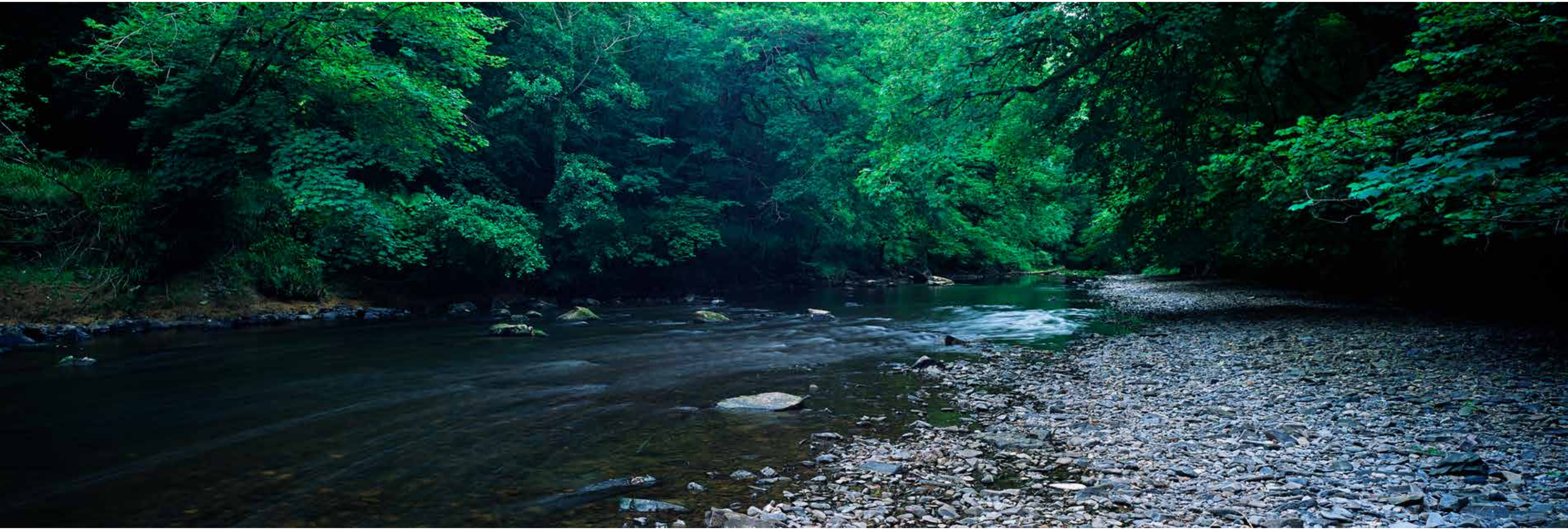
Bluebells (*Hyacinthoides non-scripta*) within an ancient semi-natural woodland, Woodbury.

Rivers, Streams and Standing Open Water

Devon supports thousands of kilometres of watercourses ranging from fast flowing upland tributaries to slow flowing meandering lowland rivers. Over 60 km of watercourse flow across the three primary landholdings of the Estate, including significant sections of the River Torridge in North Devon, and the River Otter in East Devon, together with their tributaries. Both rivers are rich in wildlife, supporting a diverse range of plants and animals. These include species of European and national significance such as the highly threatened freshwater pearl mussel (*Margaritifera margaritifera*), Atlantic salmon (*Salmo salar*) and brown trout (*Salmo trutta*). The River Otter is the location of the Lower Otter Beaver Trial. In addition, numerous natural and semi-natural lakes and ponds are scattered across the Estate, with many of these important for freshwater invertebrates, birds and amphibians including the great crested newt (*Triturus cristatus*).

[Right] Heavily wooded section of the River Otter.

[Overleaf] Low summer flow in the River Torridge.

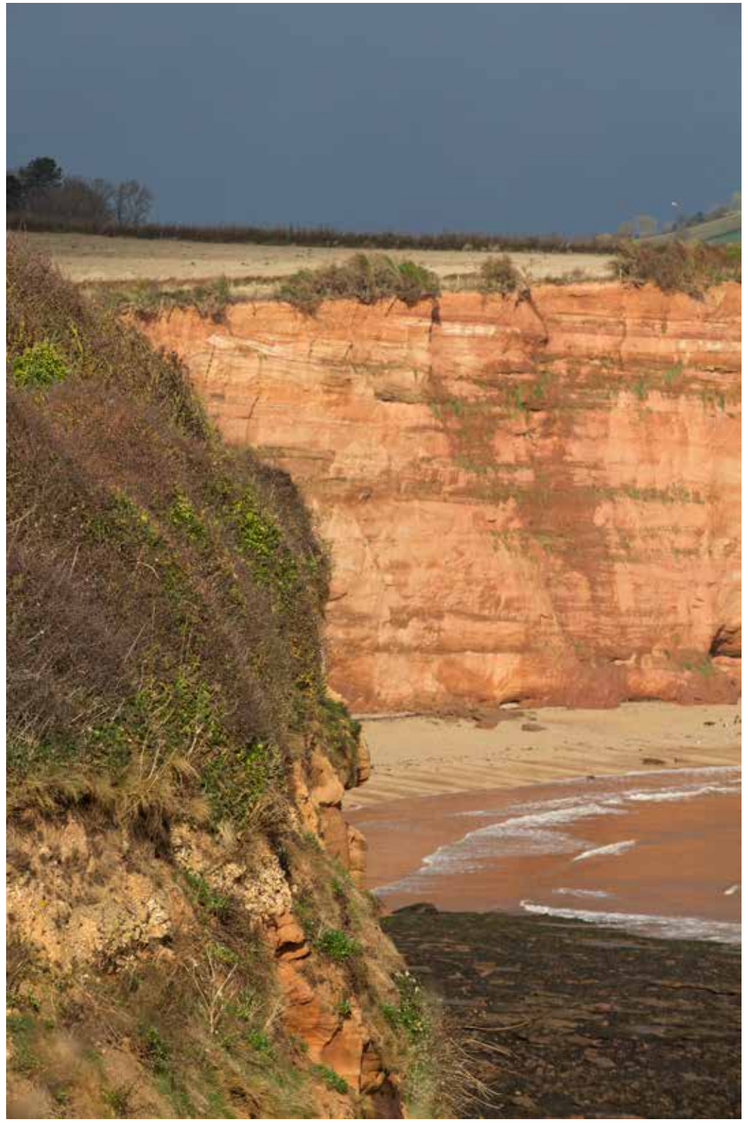


The rivers Torridge and Otter flow through a predominantly agricultural landscape, with significant sections currently failing to meet water quality standards outlined under the EU's Water Framework Directive. Elevated sediment loads from soil erosion, manure, fertilisers and pesticides are all significant pollutants. In addition, historical artificial structures such as weirs undermine the ecological integrity of the rivers by impeding the movement of migrating fish, with invasive species including Himalayan balsam (*Impatiens glandulifera*) and signal crayfish (*Pacifastacus leniusculus*) also threatening the rivers' ecological health.

The Lower River Otter lies within an important area for groundwater, with the East Devon Pebblebed Heaths representing a vital aquifer supplying villages in the Otter Valley. The valley and its surrounding catchment lie within Groundwater and Nitrate Protection Zones.

[Left] Colaton Brook, a tributary of the River Otter, close to its source on the East Devon Pebblebed Heaths.

[Overleaf] View westwards at dusk towards Budleigh Salterton from the mouth of the Otter Estuary.



Maritime Cliff and Slope

The Estate owns over 5 km of maritime cliff and slope in East Devon, with these supporting a diverse range of habitats including grassland, scrub and woodland. All are County Wildlife Sites. These highly dynamic habitats are exposed to frequent erosion and landslides, salt spray and severe winds which together help forge the special ecological character of these sites. The largely inaccessible nature of these habitats enables a range of lichens, insects, plants and seabirds to thrive, with a population of cirl bunting (*Emberiza cirlus*) associated with coastal farmland east of the River Otter.

[Left] The Triassic sandstone cliffs of East Devon were formed 250–260 million years ago and are the oldest on the Jurassic Coast World Heritage Site.

[Above] Sea beet (*Beta vulgaris* ssp. *maritima*), a common plant found in coastal cliff vegetation.

THE EAST DEVON PEBBLEBED HEATHS

The East Devon Pebblebed Heaths are named after the Budleigh Salterton (Bunter) Pebblebeds that underlie them. The rock that formed the sandstone pebbles originated 440 million years ago, with the pebbles themselves forged and deposited by riverine erosion in the Triassic period in a mountainous, arid landscape at a time when all the world's continents were joined as the supercontinent Pangaea. The vegetation present after the last glacial era ca. 11,000 years ago was treeless tundra and covered in snow during the winter. At that time in history sea levels were lower and Devon's earliest settlers could have walked across from the continent to colonise a landscape that was quickly becoming clothed in trees – at first birch and pine and then hazel and oak. Most heathlands are derived from the clearance of woodland on light soils by Neolithic or later Bronze or Iron Age farmers. Use of the land for arable and pastoral farming, often accompanied by burning to provide fresh grazing kept the land open. Over time, this impoverished the original soils and left light, acid, freely draining ground, ideal for the growth of heather (*Calluna vulgaris*) and other heathland plants. Down the centuries, continued grazing and burning, removal of turf, bracken and scrub for fuel and animal bedding, cutting of timber and exploitation of other heathland products, prevented woodland from re-establishing. These activities also resulted in the continual removal of nutrients from the system, maintaining the poor soils and their heathland vegetation.

The cultural landscape of the Pebblebed Heaths is now amongst the most important conservation sites in Europe. The main core of the site was notified as a Site of Special Scientific Interest between 1952 and 1986, and designated as a Special Protection Area and Special Area of Conservation in June 1996 under the EU Habitats Directive. The primary reasons for selection were the occurrence of significant areas of North Atlantic wet and dry heaths, and the existence of populations of southern damselfly, nightjar and Dartford warbler. A recent report undertaken by the Estate (East Devon Pebblebed Heaths: Providing Space for Nature, 2016) has revealed the presence of over 3,000 species from the site, with 372 (12%) having conservation designations.

In addition to their high wildlife value, the heaths support a range of ecosystem services. They provide a much-visited recreational landscape of high archaeological value, supporting an estimated 1.9 million visits annually. The pebblebeds themselves are also one of the region's most stable aquifers, with the drinking water for a number of communities in the Otter Valley abstracted from them.

The East Devon Pebblebed Heaths represent the Estate's most important conservation site, and management is undertaken by staff from its own Conservation Trust. A range of management techniques are used to support wildlife, with scrub clearance, swailing (burning) and conservation grazing being the most important. Threats to the heathland come predominantly from recreational pressure and climate change.

[Right] Dartmoor pony browsing on purple moor grass (*Molinia caerulea*). The browsing and grazing behaviour of ponies and rare-breed cattle form an important part of the management of the East Devon Pebblebed Heaths.

[Overleaf] Autumn view across a heathland valley mire, Bicton Common, East Devon Pebblebed Heaths. Over 3,000 species have been recorded from the mosaic of habitats that make up this site of European conservation significance.

The East Devon Pebblebed Heaths Conservation Trust

Until the early 1980s, lowland heathland was generally perceived as a wasteland of little human or wildlife value. As a result great tracts were destroyed through development, including being planted with conifers, or transformed to arable land through the application of inorganic fertilisers.

The East Devon Pebblebed Heaths Conservation Trust was established by Clinton Devon Estates in 2006 in response to increasing national and European recognition that lowland heathlands are a habitat rich in wildlife, are highly threatened, and require professional management to maximise their wildlife value. This recognition was accompanied by legislation to protect heathlands. This included the Directive on Conservation of Wild Birds (1979), which led to establishment of Special Protection Areas across Europe, the Wildlife and Countryside Act (1981), which established Sites of Special Scientific Interest in the UK, and the EC Habitats Directive (1992) resulting in a European network of Special Areas of Conservation.

Prior to the establishment of the Pebblebed Heaths Conservation Trust the heathlands were managed by Clinton Devon Estate's staff for conservation and recreation. The formation of the Conservation Trust has ensured that a modern approach is taken, and that the appropriate governance and expertise are in place to maximise the effectiveness of conservation work and public education. It is a declaration of the Estate's ongoing commitment to looking after the heathlands it owns. Funding for the Conservation Trust comes from contributions from the Estate and grant support through agri-environment schemes, including Higher Level Stewardship and Countryside Stewardship.

Overall governance of the Conservation Trust is overseen by a Board of Trustees and Directors of the associated Land Management Company.

ESTATE AGRICULTURE, WOODLANDS AND OTHER LAND USES

Coniferous and Mixed Woodland

Managed woodlands occupy 1,800 ha, accounting for 17% of the Estate area. They comprise a rich mosaic of species and age classes that have been crafted by past, present and future demands for timber products, historically sourced from the Estate through two small-scale sawmills, and for the last 25 years from the wider timber market.

In the majority of cases, woodlands are of plantation origin with 690 ha being Plantations on an Ancient Woodland Site (PAWS). These are primarily located in the Torridge Valley where traditional oak coppice, managed for charcoal and tanning bark, were converted to mixed conifer species between the late 1800s and mid-1980s. In East Devon the extensive PAWS of Harpford and Hayes Woods date from the early 1800s when oak, beech and sweet chestnut (*Castanea sativa*) were planted during the Napoleonic War. The disappearance of the intended market – wooden naval shipping – indifferent quality from growing on free-draining sandy soil, and ravages of the grey squirrel (*Sciurus carolinensis*) since the 1970s have driven the conversion of three quarters of these woods to conifer species, notably Douglas fir (*Pseudotsuga menziesii*).

Across the Estate, woodlands typically occupy steeply sloping and poorly draining land as is often the case in lowland England land use. In East Devon, pine plantations buffer the Pebblebed Heaths along its eastern boundary where poor land, once in agricultural production, was converted to trees and secondary woodland from the late 1700s as part of the Bicton Parkland designed landscape. The Estate's practice of establishing new woodland continued until the 1990s with on average 40 ha planted per decade.

[Left] Healthy regeneration of beech (*Fagus sylvatica*) and oak (*Quercus robur*) in a mixed broadleaf and coniferous woodland, East Devon.

[Overleaf] The beeches of Woodbury Castle Scheduled Monument are a prominent landscape feature in East Devon, and were planted in the early 19th century.

The current species mix reflects the fundamentals of soil type, rainfall and marketability and has produced a broad mix of 75% commercial conifers suited to the South West's climate and 25% native broadleaves. Historically the Estate has practised a clearfell/replant silvicultural system, with small felling coupe sizes influenced by the Estate's annual timber demand. The harvesting of extensive areas planted during the 1960s, and impacts of recent tree disease in Larch (*Larix*) has seen an increase in felling activity and coupe size. A key feature of the Estate's woodland management has been the long-term implementation of timely thinning, particularly first and second interventions, which historically have often been cost operations. This early and frequent opening of plantation canopies, and avoidance of unthinned, 'over-stood' stands stimulates the recovery of the ground flora. It also ensures long-term retention of ancient woodland species that can remain present through three conifer rotations.

Since 2000 woodland management has focused on becoming a specialist grower of high quality, large dimension Douglas fir timber. Initially this was achieved by lengthening crops' rotations from 45 years to a time when trees reach a target diameter (60–70 years plus). Ongoing management of these crops, through crown thinning, has stimulated natural regeneration of a wider range of species and is adding age, height structure and diversity of habitats to even aged stands.

Recent experience of re-establishing quality crops following the forced removal of substantial areas of diseased larch has raised questions on the financial sustainability of clearfell/restock silviculture on fertile, free-draining sites where rooting depth would support more sustainable, continuous cover systems. Such sites mirror our PAWS woodlands and where suitable species are present, single tree selection is being adopted as the silvicultural system of choice to produce a more diverse, resilient and sustainable woodland.

Some 5% of Estate woodlands are managed with biodiversity outputs as the main objective. Such areas are largely old planting of native broadleaves from the early and mid-1800s, such as the cliff woodlands along the River Otter. These are rich in standing and fallen deadwood habitat and dependent wildlife. Within commercial plantations, deadwood is actively accumulated through the retention of standing dead and windblown trees during timber harvesting operations. Current and future veteran trees are identified, recorded and proactively managed to ensure a continuum of this niche habitat.

[Previous] Continuous cover silviculture in a stand of Western hemlock (*Tsuga heterophylla*). Estate forests include those where selection forestry rather than clear-felling is undertaken. In such a system, individual high quality trees are harvested when they reach maturity.

[Right] Western hemlock seedling. Natural regeneration within a multi-aged production woodland.

[Left] Restocking a recently felled plantation. Over 17% of the Estate is covered with woodlands that are managed for timber, wildlife and public access.

[Right] A young planted seedling of Douglas fir (*Pseudotsuga menziesii*). With the dual threats of tree disease and climate change, providing the timber of the future is a challenge.

[Left] Larch (*Larix decidua*) thinning, North Devon. Thinning activities allow the remaining trees more space and light to grow, and stimulate ground vegetation.

[Right] Timber stacked ready for haulage.

New and existing tree pests and diseases have a significant impact on Estate woodlands. The fungal diseases of *Phytophthora ramorum* and *Dothistroma septosporum* have effectively compromised the larches, sweet chestnut and Corsican pine (*Pinus nigra*) as constituent species of the future woodland. Ash dieback, which is present in East Devon and rapidly spreading across the region, will have major impacts as high mortality of an important constituent of our mixed woodland is inevitable. These impacts will be magnified by the increased presence ash has achieved in our mixed woodlands as grey squirrel bark-stripping has effectively halted the recruitment of beech, oak, birch and sycamore regeneration since the 1970s.

Tackling the grey squirrels, at a landscape scale wider than the Estate, is an urgent priority if West Country broadleaved woodlands are to regain sustainability and provide future space for nature.

Agricultural Land

The permanent pastures and arable fields of agricultural land form the predominant land use of the lowland UK. Approximately 70% of Estate land is farmland (including hedgerow and farm tree elements), with a third managed in-hand or as share farms. The remainder is tenanted across 33 holdings. Building positive partnerships with tenants to create new agricultural approaches that follow best environmental practice and deliver wildlife objectives, is both a key challenge and opportunity moving forward.

The primary driver of historical and current wildlife decline in the UK relates to agricultural intensification. Over the last 50 years an estimated 60% of wildlife species have declined, with 31% declining strongly. An essential part of the delivery of conservation objectives on the Estate is helping to reverse this national trend through embedding wildlife support into 'business-as-usual' farming practices. The challenge is ensuring that the Estate's farming and wildlife strategies are complementary, fully integrated and result in benefits for biodiversity and water catchment protection across the landscape. Any progressive integrated strategy must also have a sound financial footing to be sustainable.

Although land use and cropping patterns change annually, approximately 70% of the Estate's agricultural holdings comprise permanent pasture, with 30% made up of arable crops including grass and clover leys, wheat, barley, oats and maize. The permanent pasture is grazed, with dairy and beef farming being particularly important, although other livestock including sheep are maintained.

The focus of the Estate's in-hand Home Farm is an organic dairy centred on the Lower Otter Valley. Although dairy farming supplies society's demands for essential food products and can support wildlife – organic cow dung can support the dung beetles needed to support greater horseshoe bats (*Rhinolophus ferrumequinum*), for example – this activity undeniably also has potential for negative environmental impacts. This includes the production of greenhouse emissions, including methane, and the reliance on expansive improved areas of species-poor grassland, especially where dairy operations are large. Farming practices must recognise and address these weaknesses, including being sensitive to the water catchments in which they occur to ensure that local aquifers are protected from the build-up of nitrates, and that watercourses do not suffer from diffuse pollution.

Soil loss through erosion, depletion of organic matter and soil compaction from heavy machinery is also environmentally damaging. Maize has been highlighted as a crop of particular concern in East Devon due to its adverse impacts on the water quality of streams and rivers if husbandry practices are not appropriate for the landscape. The water quality of the River Otter and the Torridge is currently poor, with sediment, phosphate and nitrate levels from agriculture being the primary causes. This can impact on a range of freshwater wildlife species, including species of national (e.g. salmon) and international (e.g. fresh water pearl mussel) importance.

To ensure the negative environmental footprint is minimised, the Estate is constantly investing in and modernising its farming operations. In recent years this has included the creation of a 20,000-cubic-metre slurry lagoon that ensures that organic, liquid fertiliser is stored safely until it is required, thereby reducing the risk of watercourse pollution. It is also investing in research partnerships with academic institutions to improve its understanding of the impacts of its own agricultural practice on soil quality and ecosystem services.

[Previous] The focus of the Estate's in-hand Home Farm is an organic dairy located in the Otter Valley.

[Above] Farmland, East Devon. Society is increasingly placing demands on the farming sector to provide landscapes where wildlife flourishes. One of the great challenges of this industry is to embed the support for nature into business-as-usual activity.

[Right] Spreading slurry on organic dairy land, East Devon. Slurry collected from the herd is recycled as natural fertiliser.

[Opposite] To help safeguard watercourses from pollution, slurry from the Estate's Home Farm dairy is safely stored in a 20,000-cubic-metre slurry lagoon until it is needed for fertiliser on the farm.

There has been much focus on the environmental negatives of farming across the UK with farmland birds having halved in number since the 1970s and butterflies declining by over 30%. However, agriculture can be wildlife friendly, and the Estate strives to reconcile its conservation and production activities. On a broad level, the practicalities of wildlife delivery on farmland are well understood with the following practices all known to be beneficial: planting and rotational cutting of hedgerows; use of over-wintering stubbles, wildflower and nectar mixes; the creation of broad field margins and beetle banks; woodland creation and good pond/ditch management. Over the last few decades various manifestations of agri-environment schemes have attempted to reverse wildlife decline through the promotion of such activities. The Estate continues to engage with its farming tenants on all aspects of responsible land management, and encourages entry into agri-environment schemes.

In addition to the optional uptake of agri-environment schemes, basic good environmental management in England is also promoted through statutory cross-compliance related to agricultural subsidies. Additional protection comes through the Wildlife and Countryside Act (WACA) 1981 (as amended) and associated protected species legislation. Cross-compliance includes, for example, prescriptions to ensure that soil and hedgerow management, grazing regimes and the use of pesticides and fertilisers do not impact adversely on the environment. The Estate recognises that the delivery of ecosystem benefits will be one of the foundations of government continuing to support agriculture in the future.

Development and Housing

East Devon's Local Plan sets out a spatial planning vision for the district for 2013–2031, and highlights the requirement for 15,000 new homes to be built during that period. By investing in new housing developments and business parks, the Estate is committed to assisting the local authority to deliver the Local Plan. This includes an aspiration of building 800 new homes and the provision of related local employment opportunities. As a significant regional landowner with interests in farming, forestry, conservation, public access, renewable energy, housing and business, the Estate is uniquely positioned to help design landscapes that allow both local communities and wildlife to thrive.

Development sites can come at the expense of the environment, but this is not necessarily so. With imaginative planning, and by building habitats and wildlife into site designs from the start of the planning process, including through the creation of allotments and orchards, the extent and quality of wildlife habitats can be enhanced. This is especially true where developments are sited in species-poor grassland or arable land.

The Estate aspires to deliver developments based on landscape-scale spatial planning of the countryside that seeks to enhance, rather than erode, ecological diversity and connectivity, and to reinvest funds in ways that support the local community and environment.

Plan of Plumb Park, Exmouth. This development has been designed to provide local housing, recreational green space, allotments and community orchards within a wildlife-rich setting.

Renewable Energy and Quarries

The Estate seeks to promote the use of renewable energy. Woodfuel derived from its own forestry plantations heats the main Estate Office, with a number of domestic houses powered through small district heating schemes. The Estate has trialled solar energy, and has invested in a six-megawatt solar farm adjacent to Liverton Business Park, Exmouth. This 10-hectare site generates sufficient energy to power 1,000 homes. Solar parks have a role to play in supplying Devon's future clean energy needs. The Estate's policy is to pursue opportunities on a small scale, and only on land of low agricultural value and where aesthetic landscape considerations allow. Dependent on management, solar parks can provide wildlife-rich environments where farmland birds such as skylarks can thrive undisturbed. The Estate is committed to understanding how wildlife benefits can be maximised on solar parks, and monitoring wildlife at these sites.

The Estate owns several quarries including Blackhill (70 ha), Merton (75 ha) and Beer (6 ha), which have been processing aggregates (Blackhill), ball clay (Merton) and Beer stone (Beer) for many decades. Mining activities at Blackhill and Beer quarries have now ceased, with the former site now in a ten-year restoration programme to create rare lowland heathland habitat. Blackhill Quarry is a County Wildlife Site, with Beer Quarry designated a Special Area of Conservation due to it supporting internationally important populations of bats.

Liverton's solar park covers 10 ha of low-grade agricultural land near Exmouth, and can provide energy for more than 1,000 homes. Such schemes can also support threatened wildlife such as skylarks (*Alauda arvensis*).

Game Management

If best practice and legal guidelines are followed, game management, including of deer, pheasant, squirrel and wildfowl can be beneficial to the environment. It can support the creation and long-term management of habitats, and protect and assist a broad range of species, including those that are nationally declining such as lapwing (*Vanellus vanellus*), grey partridge (*Perdix perdix*) and brown hare (*Lepus europaeus*). The Estate is involved in game management across its holdings and aims for this activity to enhance rather than erode biodiversity, and to generate local employment.

Deer management is a core activity across the Estate. Native roe deer (*Capreolus capreolus*) and red deer (*Cervus elaphus*), and non-native species including sika (*Cervus nippon*), fallow (*Dama dama*) and Reeves' muntjac (*Muntiacus reevesi*) have catastrophic consequences on the regeneration of native broadleaf woodland through their grazing activity when their populations remain unchecked by natural predators. Estate policy on deer management is impact based, with numbers of roe deer only reduced sufficiently to allow woodland regeneration, whilst maintaining healthy deer populations. Where non-native species occur, there is a policy of eradication. Culled deer are processed to supply venison to local markets.

The Estate has a policy of localised control only of corvids (crow, magpie, etc.) where natural numbers are elevated artificially due to certain land management practices (such as pig farming, for example), or in close proximity to key game shooting locations. At dense populations these species can impact adversely on populations of other native farmland and song birds. Red fox (*Vulpes vulpes*) is another important native species with a critical ecological role, including in the natural management of rabbits. Limited management of foxes is undertaken around key game shooting locations.

Pheasant and wildfowl shooting is undertaken across the Estate, with this activity managed by the Estate's gamekeepers, or by independent shooting syndicates. This economic activity provides very significant benefits to a broad range of wildlife through the creation and management of new habitats such as ponds, and the planting of seed-bearing agricultural cover crops that support a diverse range of declining farmland birds through winter months.

Fishing for brown trout and salmon is allowed under licence on both the Torridge and Otter rivers, with annual catch counts monitored to ensure this activity does not impact significantly on the health of these key native species. Both rivers have fish stock restoration programmes, with compulsory and voluntary capture-and-release protocols in place, dependent on the location.

[Previous] Roe deer (*Capreolus capreolus*).

[Left] In the absence of natural predators, an important part of the Estate Ranger's work is to ensure that roe deer populations are maintained at a level where their browsing does not prevent native woodland tree species from regenerating.

[Above] Some Estate woodlands are used for pheasant shooting. If stocked at low densities, management of pheasants can occur side-by-side with conservation activities.

The non-native grey squirrel represents one of the greatest risks to woodland biodiversity due to its bark-stripping impacts on juvenile trees, many of which will not reach maturity as a result. The impact is long-lasting and if left uncontrolled the continued presence of grey squirrels will fundamentally change the nature of the lowland British landscape. Few new broadleaf plantings will attain good form and survive to replace our decreasing number of veteran trees. The Estate is trialling grey squirrel control in several woodlands, although the effective management of this species requires coordinated national effort.

[Left] An English oak, killed by grey squirrels.

[Right] The bark-stripping activity of the non-native grey squirrel (*Sciurus carolinensis*) presents one of the greatest threats to the long-term health and regeneration of native broadleaf woodlands.

CONSERVATION PROJECTS

In addition to its own in-hand woodland, heathland and farming conservation work, the Estate partners with a range of conservation organisations to strengthen the integrity of habitats and wildlife across its holdings.

Cirl Bunting Project

Project partner: RSPB.

The rare red-listed cirl bunting was nearly lost from the UK in the latter part of the 20th century. Its decline was associated with changes in farming practices, particularly reduction in the growing of spring-sown cereal crops and the consequent loss of weedy winter stubbles. In particular, this species benefits from the presence of rough grassland associated with field margins to support its summer diet of insects (especially grasshoppers and crickets), and seed-rich weedy stubbles in the winter.

Until 2015 Stantyway Farm (East Devon Coast) was tenanted and managed primarily for the production of arable crops. The tenancy period saw the arrival of cirl buntings at the site. At the time, the small population at Stantyway was believed to be the eastern-most breeding population. A number of other locally rare wildlife species are also known from the site, including brown hare. After retirement of the tenant, in 2014, the 100 ha farm was taken back by the Estate's own in-house Farm Partnership with a view to re-letting as an environmentally benchmarked tenancy at a later date.

A cirl bunting (*Emberiza cirlus*), East Devon. Populations of this species are dependent on traditional farming practices, including the maintenance of over-wintering stubble fields.

In addition to continuing to manage the farm productively, it was also important to the Estate to build on the cirl bunting success. To this end an agri-environment scheme was applied for, and awarded in 2016. This will facilitate the planting of 4 km of hedgerows, the expansion of wildlife buffer strips along field margins, the planting of bird feed mixes, ensuring that the choice of crops supports cirl buntings and other threatened farmland birds. The farm has since been the focus of more intensive biological recording, including a BioBlitz in 2016, which highlighted the presence of over 800 species, including a number that are nationally vulnerable or scarce.

[Left] Weedy winter stubble field, East Devon. Its presence helps support many farmland bird species by providing a source of seed through the winter months.

[Above] Field margins support a broad range of invertebrate, reptile and mammal species. Cirl buntings feed there on grasshoppers and crickets during the summer.

River Otter Beaver Trial

Project Partner: Devon Wildlife Trust.

European beaver (*Castor fiber*) is a native British species that was hunted to extinction 400 years ago for its meat, fur and scent (castoreum). Although the species still occurs on mainland Europe and many other countries have commenced reintroduction programmes, it has only been present in England in an assortment of zoos and wildlife parks. In 2014, a wild breeding population of beavers was discovered on the River Otter, either having been introduced illegally or escaped from nearby captivity. Although the initial response from government was to remove them, a campaign led by the Devon Wildlife Trust was mounted for them to stay and to act as an officially sanctioned reintroduction trial, with the Estate subsequently becoming a critical partner. Key aims of the trial include identifying and assessing the positive and negative impacts of beavers on habitats, wildlife, built infrastructure and local communities, and developing effective management frameworks.

A beaver (*Castor fiber*) swims upstream on the River Otter.

Many ecological benefits are claimed for beavers: that they support a broad range of wildlife through the diversification of wetland habitats caused by their damming and tree-felling activity; that their dams have the potential to regulate water, maintaining base levels in rivers in times of drought and reducing peak flows in times of high rainfall; that their dams remove sediments caused by agricultural run-off, and absorb pollutants such as nitrogen and phosphorus. The scientific evidence for these positive impacts is conclusive. Indeed, these impacts scaled up across a catchment scale might even provide cost effective, natural solutions to environmental problems such as flooding and pollution. However, beavers can also cause flooding of agricultural land, can block drainage ditches and undermine flood-defence works, and fell trees of amenity importance.

Their dams can also impede the passage of migrating salmonids in certain circumstances when water levels are low, with redds (spawning grounds) occurring above dams in danger of being damaged by silt. The negative impacts cited for fish have to be weighed against those that are beneficial, such as the creation of better habitats, cleaner water and the provision of more food through an increase in prey diversity and numbers.

[Left] A beaver grooms her kits on the edge of a bank on the River Otter.

[Above] A chiffchaff (*Phylloscopus collybita*) uses the edge of a beaver dam as a base to hunt for insects.

The Estate recognises both the benefits and potential risks of beaver reintroductions. We are working with project partners to fully understand their impacts and to ensure that pragmatic management and licensing regimes are developed should they be required in the future. Lessons learnt from all other countries where beavers have been reintroduced are that management is always eventually required where their activities threaten local livelihoods or regional infrastructure.

[Above and right] Goat willow (*Salix caprea*) felled by a Eurasian beaver. The riverside tree will re-sprout with the new shoots supplying a source of food for the beavers in the years to come.

[Overleaf] An early-19th-century embankment prevents the lower reaches of the River Otter from connecting with and being able to drain the full extent of its natural floodplain.

The Lower Otter Restoration Project

Project Partner: Environment Agency.

A long-term Estate vision for the improvement of wildlife on its holdings focuses on 120 ha of the Lower Otter Valley. Against a background threat of climate change, we are seeking to restore the ecological health and functionality of an estuary that is currently disconnected from its natural floodplain. The aim is to address the adverse impacts of historical flood defences and create over 50 ha of rare intertidal and wetland habitat, enhancing the wildlife value of the Lower Otter from local to international significance. By allowing natural processes and flooding cycles to re-assert themselves, we believe that the resultant environment can be enriched for wildlife, made more resilient to climate change and can be more sustainably managed.

The project area includes: the Otter Estuary Site of Special Scientific Interest (SSSI), which comprises rare mudflat, saltmarsh and reedbed habitats of high conservation value supporting important over-wintering wading bird communities; the Otter Meadows County Wildlife Site (traditional grazing marsh); several public footpaths including one of the busiest public access routes in Devon (part of the South West Coastal Path); South Farm Road; a disused and highly threatened municipal dump; Budleigh Salterton Cricket Club; a flood embankment (dating back to the early 19th century).

In addition to improving the ecological health of the estuary, we also aim to safeguard and improve existing access infrastructure, and re-locate recreational facilities whose long-term survival is compromised.

The River Otter and its estuary are key features of the East Devon landscape and form part of the East Devon Area of Outstanding Natural Beauty. The project area extends from the estuary mouth at Budleigh Salterton to Otterton and represents one of the most visited recreational sites in East Devon.

Devon Freshwater Pearl Mussel Project

Project partner: Devon Wildlife Trust.

The freshwater pearl mussel is similar to common marine mussels (*Mytilus*) but grows much larger and lives for much longer, often in excess of 100 years. It is a critically endangered, European Protected Species, with much of its historical decline attributable to exploitation as an occasional source of pearls. As a filter feeder, this species is also highly vulnerable to water pollution, with engineering works such as the construction of weirs or deepening of pools also contributing to its decline. It has a complex life cycle and in its first year, the early life stage requires the hyper-oxygenated habitat of the gills of young salmon or trout to survive. Some of the last remaining populations occur on rivers within Estate ownership.

The Devon project to protect freshwater pearl mussels on the River Torridge is led by the Devon Wildlife Trust and forms part of the 'Restoring Freshwater Mussel Rivers in England' project. This is led nationally by the Freshwater Biological Association (FBA) with partners including West Cumbria Rivers Trust, South Cumbria Rivers Trust and North York Moors National Park, with the support of the Environment Agency and Natural England. The principal aim of this project is to safeguard the future of some of the most important freshwater pearl mussel populations remaining in England through river restoration and by engagement of local communities. Work on the Torridge has included population surveys and water quality monitoring. Support and advice has been given to farming tenants to reduce their contribution to poor water quality, which impacts on the species. Captive breeding has also been undertaken, with a view to inoculating the gills of salmonids within the Torridge to increase the size and range of existing populations.

Freshwater pearl mussels (*Margaritifera margaritifera*). The last remaining populations in Devon of this rare, long-lived species are threatened by poor water quality due to farming and forestry activities.

Greater Horseshoe Bat Project

Project partner: Devon Wildlife Trust.

The greater horseshoe bat is one of the UK's most threatened bat species. Female greater horseshoes gather in large maternity roosts, with the Estate-owned Beer Quarry caves being an important site for this species. The bats depend entirely on traditional cultural landscapes when foraging for insects, and depend on significant areas of grazed pasture and broad-leaved woodland, connected by well-managed hedgerows and other linear features. British numbers of this species have fallen by at least 90% within a century, and its range has contracted dramatically, now being restricted to South West England and South Wales. Devon hosts a third of Britain's greater horseshoes.

Led by the Devon Wildlife Trust, the Devon Greater Horseshoe Bat Project focuses on the county's remaining maternity roosts and key hibernation sites, together with the surrounding sustenance zones on which the bats depend for most of their foraging. It aims to increase public awareness and scientific understanding of this species and to encourage bat-friendly landscape-scale management. The Estate has been a recipient of an agri-environment scheme since 2014 to support this species on agricultural holdings in proximity to Beer Quarry caves. This has facilitated the enrichment of hedgerow trees, appropriate cattle management to support dung beetles (an important food source) and the creation of bat-friendly ponds. In addition, a number of smaller bat hibernacula supporting greater horseshoe bats are managed and monitored in East Devon, in collaboration with the Devon Bat Group.

Devon is one of the last UK strongholds of the greater horseshoe bat (*Rhinolophus ferrumequinum*).

River Otter Himalayan Balsam Project, and Other Invasives

The Estate is part of the Devon Invasive Species Initiative, which is a steering group seeking to raise awareness of the impacts of invasive species, share good practice guidelines on their management, and promote good biosecurity measures that can prevent their spread. Invasive species are a very significant threat to Devon's environment and associated wildlife through the transmission of disease, competition with native species and predation. A number of invasive species occur on Estate land, including Japanese knotweed (*Fallopia japonica*) and Himalayan balsam, with work to control these species undertaken annually. The control of Himalayan balsam is part of a catchment-wide endeavour to reduce the extent and impact of this species.

Himalayan balsam originates from Asia. It was introduced to the UK in 1839 as an ornamental plant, but has since escaped from gardens. It aggressively colonises river banks, hedgerows and woodlands across the UK, out-competing native species and resulting in a serious threat to native biodiversity. Himalayan balsam is listed under Schedule 9 of the Wildlife and Countryside Act 1981.

Since 2012 the Estate has been working with a broad alliance of partners, including the Otter Valley Association, to control this species. The plant has a persistent seedbank, can re-sprout and can readily be transferred by human activity, or downstream by water flow. Its managment requires a long-term vision and sustained action.

The Estate's strategy follows broad recommendations made by DEFRA's Invasive Non-Native Species Framework (2008). This outlines key actions to strengthen prevention, detection, surveillance, monitoring, control, and eradication of this species. The local approach is to start at the source of each of the tributaries of this river and work down to the confluence where they enter the River Otter. Once these tributaries have been cleared, control on the main river and on farmland within the Otter Valley will be considerably more effective and sustainable.

Now a highly invasive species in the British landscape, Himalayan balsam (*Impatiens glandulifera*) was introduced from Asia by the horticultural industry.

East Devon Catchment Partnership

The Estate is represented on the East Devon Catchment Partnership, which was established in 2014 to deliver improved water quality and encourage local collaboration and more transparent and improved decision-making related to land management practices. A number of key areas have been identified to support the enhancement and delivery of a range of 'ecosystem services' including water quality improvement, flood mitigation, carbon storage and biodiversity. Projects supported by the partnership in its first years have included research into diffuse pollution and the development of management advice on maize husbandry for farmers. Across East Devon maize-growing represents one of the agricultural practices having the greatest negative impact on water quality. This in turn impacts adversely on wildlife.

The East Devon catchment has a varied landscape and stretches from Exmoor and the Blackdown Hills in the north, to Exmouth, the Jurassic coast and west Dorset in the south. At approximately 750 sq. km, the East Devon catchment drains the rivers Exe, Otter, Sid, Axe and Lim, with 103 river water bodies in the catchment as well as four lakes, four estuaries, ten groundwater bodies and coastal waters to the south. East Devon is predominantly agricultural, with lowland cattle and sheep farms constituting 38% of the farming practice. The Estate manages a significant part of the catchment (ca. 5,000 ha) of the Lower Otter Valley.

Rivers, groundwater and coastal waters are used for drinking water and recreation and should support healthy fisheries and wildlife. There are a number of water problems affecting the River Otter mainly related to manures, slurry and soil entering the river. There are also water quality problems related to sewage and run-off from urban areas. Rivers are monitored regularly to meet standards set out in the Water Framework Directive, with continued widespread non-compliance against framework objectives.

Otter Estuary Site of Special Scientific Interest.

Public Engagement and Education

The long-term future of the Estate depends on it earning and maintaining public support. For our business to be valued, we recognise that we must understand, reflect and implement the values and priorities of local society.

Devon faces many challenges in the 21st century. These include: the growing of local food; the management of healthy ecosystems; the sustainable supply of timber products; the support of wildlife; the creation of a beautiful landscape for public enjoyment and recreation; the delivery of affordable housing and renewable energy; ensuring the landscape is resilient to climate change and forest diseases. With its significant land holdings, the Estate shoulders great responsibility in managing its land to respond to these challenges and shape future landscapes that are valued by those that live and work on them.

Volunteers undertaking a farmland bird survey at dawn, East Devon.

The Estate has long promoted environmental and land-based education through adopting a progressive approach to public access, and delivering, facilitating and financially supporting curriculum-focused educational trips on the lands it manages. In 2013, it strengthened its commitment through the creation of a full-time Countryside Learning position. The focus of this role is to communicate the work and values of the Estate to society more broadly than had previously been possible, and to improve the organisation's own ability to engage with, learn from and reflect society's priorities. Key to this work has been improving local awareness and understanding of the special wildlife qualities of East Devon, and the practices of wildlife management and environmental stewardship. Promoting dialogue between the Estate and the external parties that maintain an interest in our land strengthens our ability to reconcile multiple, and sometimes conflicting land management objectives. In addition to delivering an annual programme of themed educational visits at primary, secondary and tertiary levels, our outreach also involves engagement with local communities through the delivery of wildlife-themed events and the provision of conservation volunteer, and work placement opportunities. This strengthens local community connections with their surrounding wildlife, and provides opportunities to become involved in its management and care.

[Above] Examining the wildlife from a pond-dipping session, East Devon. Supporting environmental education is a key activity of Estate staff.

[Right] Volunteer undertaking scrub clearance on the East Devon Pebblebed Heaths.

WILDLIFE VISION AND STRATEGY

The Estate's strengths are its landscape-scale holdings, its diverse business structure, which allows flexibility in management and cross-support. Its view on land stewardship is long term, stretching forward generations.

Between 2017 and 2027 we will:

- Improve the quality of baseline habitat and wildlife data across the Estate
- Secure funding and attain favourable status for the East Devon Pebblebed Heaths
- Strengthen management of statutory (SAC/SPA/SSSI) and non-statutory (CWS) wildlife sites
- Enhance our woodlands for wildlife, including changing management from clear felling to continuous cover systems where appropriate
- Improve integrated spatial planning of wildlife delivery, including enhancement of landscape connectivity
- Investigate the environmental, social and financial costs and benefits of re-connecting the River Otter to its floodplain to ensure more sustainable management and improved wildlife provision and public access in the face of climate change
- Strengthen invasive species control, including of grey squirrels
- Develop new models of business decision-making that reflect the true value of Natural Capital
- Introduce environmental benchmarking of farms as Key Performance Indicators
- Develop collaborative, landscape-scale strategic wildlife enhancement partnerships with tenants, surrounding land owners and environmental bodies
- Monitor and improve the extent, connectivity and quality of hedgerows
- Strengthen collaboration with citizen science and wildlife interest groups
- Strengthen public engagement on wildlife management in the countryside

The economic rationale of our Wildlife Strategy is that we recognise that society and government will increasingly demand higher levels of transparency and improved environmental delivery from all businesses. The Estate trades on its reputation and we believe that the investment we make now will be matched by financial returns through enhanced and sustained environmental performance, protection of the Natural Capital on which our business depends, and strengthened business reputation and brand in the marketplace.

Our Wildlife Vision: '*To embed wildlife improvement into all business activities and hand over to future generations a countryside more diverse, resilient, functional, and ecologically valuable than we have today*'.

Delivery of our Vision will be through improvements in business decision-making, increased internal and external investment and through partnership working.

[Pages 116–117] Ringing migrant warblers, chiffchaff (*Phylloscopus collybita*), reed warbler (*Acrocephalus scirpaceus*) and common whitethroat (*Sylvia communis*) in reedbeds on the Otter Estuary to improve understanding of their ecology and life cycle.

[Previous] View across the Otter Valley to the East Devon Pebblebed Heaths at sunrise.

[Above] Western gorse (*Ulex gallii*), one of the defining plant species of the East Devon Pebblebed Heaths, which flowers almost all year round.

PRIORITIES FOR ACTION

↳ *Improve the quality of baseline habitat and wildlife data across the Estate*

Why? To ensure Estate-wide decision-making is based on good ecological information.
How? Through sharing of datasets with the Devon Biodiversity Records Centre and other wildlife organisations; development of volunteer monitoring and citizen science surveys; commissioning of in-house and professional ecological surveys.
Monitoring of progress? Collate existing habitat and wildlife data for internal mapping systems by 2018 and annual reporting on additional surveys undertaken.

↳ *Secure funding and attain favourable status for the East Devon Pebblebed Heaths*

Why? To ensure well-resourced management of this internationally important conservation site so that its wildlife can thrive in the face of increasing visitor pressure.
How? Improve public awareness and profile of the site, diversification of funding models and strengthened management models.
Monitoring of progress? The development of a funding strategy, income generated and status attained in quinquennial reviews.

↳ *Strengthen management of statutory (SAC/SPA/SSSI) and non-statutory (CWS) wildlife sites*

Why? To improve quality and conservation value of all notable wildlife sites.
How? Through working in partnership with tenants and external bodies providing specialist advice.
Monitoring of progress? Areas of statutory reserves attaining favourable status, and County Wildlife Sites awarded green status.

↳ *Enhance our woodlands for wildlife, including changing management from clear felling to continuous cover systems where appropriate*

Why? To develop more diverse, resilient and economically and environmentally sustainable woodlands.
How? Through adaptation of management practices of plantations where selective felling is the most appropriate management regime.
Monitoring of progress? Tracking of areas converted from clear felling to selective felling.

↳ *Improve integrated spatial planning of wildlife delivery, including enhancement of landscape connectivity*

Why? To understand strengths and weaknesses of existing habitats, wildlife populations and ecosystem services delivery within a multi-use landscape and to identify and cost a programme of enhancement works.
How? Through spatial planning by in-house ecological team, through partnerships with external wildlife organisations, and through commissioning of further professional advice when required.
Monitoring of progress? Publication of wildlife enhancement plans for Beer Estate (2018), North Devon Estate (2019) and East Devon Estate (2020).

↳ *Deliver sustainable management and improved ecological health to the Lower Otter Valley*

Why? To improve the value and ecosystem function of wildlife habitats, and safeguard the recreational and landscape value of one of Devon's primary tourist locations against a backdrop of the threats of a rapidly changing climate.
How? Through partnership working with external parties and procurement of funds.
Monitoring of progress? Improvement of connectivity between the river and its floodplain and the delivery of habitat restoration schemes.

↳ *Strengthen invasive species control, including of grey squirrels*

Why? To minimise the threat of invasive species to the environment.
How? Annual control programmes of key species with local partners, including of Himalayan balsam, Japanese knotweed and grey squirrels.
Monitoring of progress? Mapping of annual works undertaken, invasive populations reduced and staff time committed.

↳ *Develop new models of business decision-making that reflect the true value of Natural Capital*

Why? To ensure wildlife and ecosystem services are strengthened rather than eroded through business activities.
How? Building partnerships with academic institutions specialising in Natural Capital and trialling of new decision-making models.
Monitoring of progress? Tracking creation of research partnerships and incorporation of Natural Capital accounting into business models.

↳ *Introduce environmental benchmarking of farms as Key Performance Indicators*

Why? To understand key qualities of soil, habitats and wildlife to enable enhancement and/or deterioration to be monitored and evaluated over time.
How? Soil, habitat and wildlife surveys undertaken in-house or through partnership models. Benchmarking introduced on Estate's Home Farm, and then incorporated into new tenancy agreements when they come up for renewal.
Monitoring of progress? Tracking of new benchmarking studies, with subsequent evaluation on a five or ten yearly basis.

↳ *Develop collaborative, landscape-scale strategic wildlife enhancement partnerships with tenants, surrounding landowners and environmental bodies*

Why? Landscape-scale partnership working where groups of organisations with a shared vision work across ownership boundaries to deliver habitat or species specific projects has been demonstrated to be effective in building shared ownership and enhancement of wildlife groups.
How? Creation of farmer-led, professionally advised habitat and species recovery projects.
Monitoring of progress? Annual tracking of partnerships formed and environment improvements against baseline levels.

↳ *Monitor and improve the extent, connectivity and quality of hedgerows*

Why? Hedgerows represent one of the Estate's strongest wildlife assets supporting biodiversity, providing connectivity through the countryside and providing resilience to climate change.
How? Through improving understanding of existing hedgerow condition, improved management of existing hedgerows and creation of new hedgerows. Work undertaken in-house, by tenants and external parties.
Monitoring of progress? Tracking of status reports for farms, hedgerow management/ creation undertaken.

↳ *Strengthen collaboration with citizen science and wildlife interest groups*

Why? To improve external engagement, strengthen business capacity to capture baseline data on wildlife, and improve species and habitat-specific enhancement programmes.
How? Through building stronger links at community level with wildlife enthusiasts and organisations with wildlife interests.
Monitoring of progress? Tracking of relationships built, surveys/monitoring undertaken and species-habitat-recovery programmes undertaken.

↳ *Strengthen public engagement with wildlife management in the countryside*

Why? To improve business understanding of local society's values, and society's understanding of the challenges of integrated land management.
How? Through resourcing an annual programme of countryside learning and engagement at primary, secondary, tertiary and community levels.
Monitoring of progress? Tracking of engagement activities and educational partnerships built.

KEY OPPORTUNITIES

- Building strong collaborations and strategic land management partnership models
- Creation of landscape-scale ecological networks
- Significant land holdings create rare opportunities of scale
- Creation and testing of transferable models of landscape-scale wildlife planning
- Demonstrating synergies between wildlife enhancement, environmental protection and business productivity and sustainability
- Harnessing power of habitat and wildlife enhancement as a business engagement tool

KEY CHALLENGES

- Funding cost of data collection and delivery of wildlife enhancement
- Qualifying and quantifying Estate Natural Capital
- Developing innovative business evaluation protocols and decision-making processes that reflect true value of Natural Capital
- Adapting/transforming internal business behaviour
- Rapidly changing funding and policy mechanisms
- Responding to climate change, invasive species and disease
- Embedding flexibility in approach to respond to exponential change in society's requirements and demands

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[Left] A dead oak tree – a casualty of prolonged and frequent flooding in the Otter Valley, East Devon. Such trees provide valuable roosts for bats and nesting sites for birds in the holes and cavities.

[Overleaf] A roe deer in an ancient sunken lane (hollow way).