



The return
of nature to a
British farm

WILDING

'Inspirational'
Daily Mail

'Hugely important'
Guardian

ISABELLA TREE



PICADOR

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WILDING

The return of nature to a British farm

For Charlie

and our children,

Nancy and Ned

What would the world be, once bereft

Of wet and wildness? Let them be left,

O let them be left, wildness and wet;

Long live the weeds and the wilderness yet.

Gerard Manley Hopkins, 'Inversnaid', 1881

'You may expel Nature with a pitchfork but she will always return'

Horace, *Epistles I*, 20 BC (quoted by Jeeves to Wooster in

The Love that Purifies by P. G. Wodehouse, 1929)

The cowman who clears his range of wolves has not learned to think like a mountain.

Hence we have dustbowls and rivers washing the future into the sea.

Aldo Leopold, *A Sand County Almanac*, 1949

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Timeline

12th century

William de Braose (1144–1211), lord of the Rape of Bramber, builds the motte and bailey keep, now known as Old Knepp Castle.

1206–15

King John visits Knepp on several occasions to hunt fallow deer and wild boar.

1573–1752

Knepp estate owned by the Caryll family, Sussex ironmasters.

1787

Sir Charles Raymond buys the Knepp estate and gives it to his daughter Sophia and son-in-law, William Burrell.

1809–12

Sir Charles Merrik Burrell commissions John Nash to design Knepp Castle with a park in the style of Humphry Repton.

1939–45

Knepp Castle, requisitioned by the War Office, becomes HQ of the Canadian Infantry and Armoured Divisions during the Second World War.

1941–43

Widespread clearance of scrub and ploughing of permanent pasture at Knepp, including the Repton park, as part of the Second World War's 'Dig for Victory' campaign.

1947

Clement Atlee's government passes the Agriculture Act guaranteeing fixed market prices for farm produce in the UK in perpetuity.

1973

The UK joins the EEC and converts to farming subsidies under the Common Agricultural Policy (CAP).

1987

The author's husband, Charlie Burrell, inherits Knepp Estate from his grandparents. The farm is already losing money.

1987–99

Intensification of the farm, including amalgamating dairies, improving infrastructure, and diversifying into ice-cream, yoghurt and sheep's milk, fails to deliver profits.

2000

Sale of dairy herds and farm machinery; arable put out to contract.

2001

Restoration of the Repton park, with funding from Countryside Stewardship.

2002

February – Introduction of fallow deer from Petworth House to the restored Repton park.

December – Charlie sends the Department for Environment, Food and Rural Affairs (DEFRA) a 'letter of intent to establish a biodiverse wilderness area in the Low Weald of Sussex'.

2003

First visit by scientists from English Nature to consider rewilding at Knepp.

June – Introduction of twenty Old English longhorns to the Repton park.

June – CAP reform, based on decoupled aid, allows farmers to take land out of production while still receiving subsidies, thus allowing Knepp to come out of conventional farming.

2003–6

The Southern Block of the Knepp Estate is left fallow, beginning with the worst fields and leaving the most productive fields to last.

2003

August – Neighbouring farmers and landowners invited to ‘A Wild Wood Day’ at Knepp, in an attempt to encourage them to support and/or join the rewilding project.

November – Introduction of six Exmoor ponies to the Repton park.

2004

Countryside Stewardship funds extension of the park restoration to the ‘Middle’ and ‘Northern Blocks’; boundary fences around the Middle and Northern Blocks erected.

July – Twenty-three old English longhorns introduced into the Northern Block.

December – Introduction of two Tamworth sows and eight piglets to the Middle Block.

2005

July – Duncan, an Exmoor colt, introduced to the Middle Block.

2006

January – ‘An Holistic Management Plan for a naturalistic grazing project on the Knepp Castle Estate’ drawn up for Natural England.

May – Inaugural meeting of Knepp Wildland Advisory Board.

2007

Summer – First turtle doves recorded at Knepp.

2008

The 1.5 mile River Adur restoration project at Knepp gets the go-ahead from the Environment Agency after eight years of consultations and feasibility studies.

February – Natural England scientists advise that Knepp is unlikely to receive backing for the foreseeable future.

June – Andrew Wood, founder of the Higher Level Stewardship agri-environment scheme, visits Knepp.

2009

Knepp receives notice of Higher Level Stewardship (HLS) funding for the whole estate (to start on 1 January 2010), so now the Southern Block, too, can be ring-fenced for free-roaming animals.

March – A 9 mile perimeter fence is built around the Southern

Block.

March – First ravens nest at Knepp.

May – A mass migration of 11 million painted lady butterflies from Africa descends on Britain; at Knepp, tens of thousands are attracted by an outbreak of creeping thistle.

May – 53 longhorn cattle introduced into the Southern Block.

August – 23 Exmoor ponies introduced into the Southern Block.

September – 20 Tamworth pigs introduced into the Southern Block.

Scrapes created along 3 kilometres of River Adur tributary floodplains.

Five-year monitoring survey reveals astonishing wildlife successes, including breeding skylarks, woodlarks, jack snipe, ravens, redwings, fieldfares and lesser redpolls; thirteen out of the UK's seventeen bat species, and sixty invertebrate species of conservation importance including the rare purple emperor butterfly.

2010

February – Forty-two fallow deer introduced into the Southern Block.

July – Beaver Advisory Committee for England set up, with Charlie as Chair.

Sir John Lawton's review *Making Space for Nature* submitted to government, with recommendations for 'more, bigger, better and joined up' areas of nature in Britain.

2012

A survey by Imperial College London identifies thirty-four nightingale territories at Knepp (from none in 2002), making it one of the most significant sites in the UK for this critically endangered bird.

2013

April – Red deer introduced to the Middle and Southern Blocks.

State of Nature report charting the continued cataclysmic decline of British species.

400 species identified in three transects at Knepp over one recording weekend, including thirteen birds on the International Union for Conservation of Nature (IUCN) Red List and nineteen on the Amber List; and several extremely rare butterflies and plants.

Studies by Imperial College identify nineteen species of earthworm at Knepp, indicating a marked improvement in soil structure and function compared with neighbouring farms.

2014

‘Knepp Wildland’ campsite and safari business opens.

Summer – Eleven male turtle doves recorded; first sightings of short-eared and long-eared owls.

Knepp now has all five UK species of owl.

2015

Charlie becomes Chair of Rewilding Britain.

March – Official release of beavers into the River Otter in Devon – the first reintroduction of an extinct mammal in England.

2015

July – Knepp is now the site of the UK’s largest breeding population of purple emperor butterflies.

Knepp receives People. Environment.

Achievement. (PEA) Award for Nature.

Knepp receives 2015 Innovative and Novel Project Award at the UK River Prize for the River Adur restoration project.

2015

July – The United Nations Food and Agriculture Organisation warns that the world’s agricultural land has only sixty harvests left, so depleted are its soils.

2015/2016

Dave Goulson of Sussex University records sixty-two species of bee and thirty species of wasp at Knepp, including seven bee and four wasp species of national conservation importance.

2016

December – Thirty-four white storks from Poland are introduced into a holding pen in the Southern Block as part of a joint project with Cotswold Wildlife Park, the Durrell Foundation, the Roy Denis Foundation and two other landowners in the south-east to reintroduce white storks to Britain after an absence of hundreds of years.

2017

Summer – Sixteen male turtle doves recorded; peregrine falcons nest in a Scots pine; a red-backed shrike sets up a territory at Knepp for several weeks.

Knepp receives the Anders Wall Environment Award for contribution to creating a ‘positive rural environment’ in the European Union.

2018

January – Knepp Estate is singled out in DEFRA’s 25 Year Environment Plan as an outstanding example of ‘landscape-scale

restoration in recovering nature’.

2018

Summer – Twenty male turtle doves recorded.

September – Soil research by Cranfield University finds that, under rewilding at Knepp, soil carbon, organic matter and microbial biomass have more than doubled, and fungal biomarkers (mycorrhizae) have more than tripled.

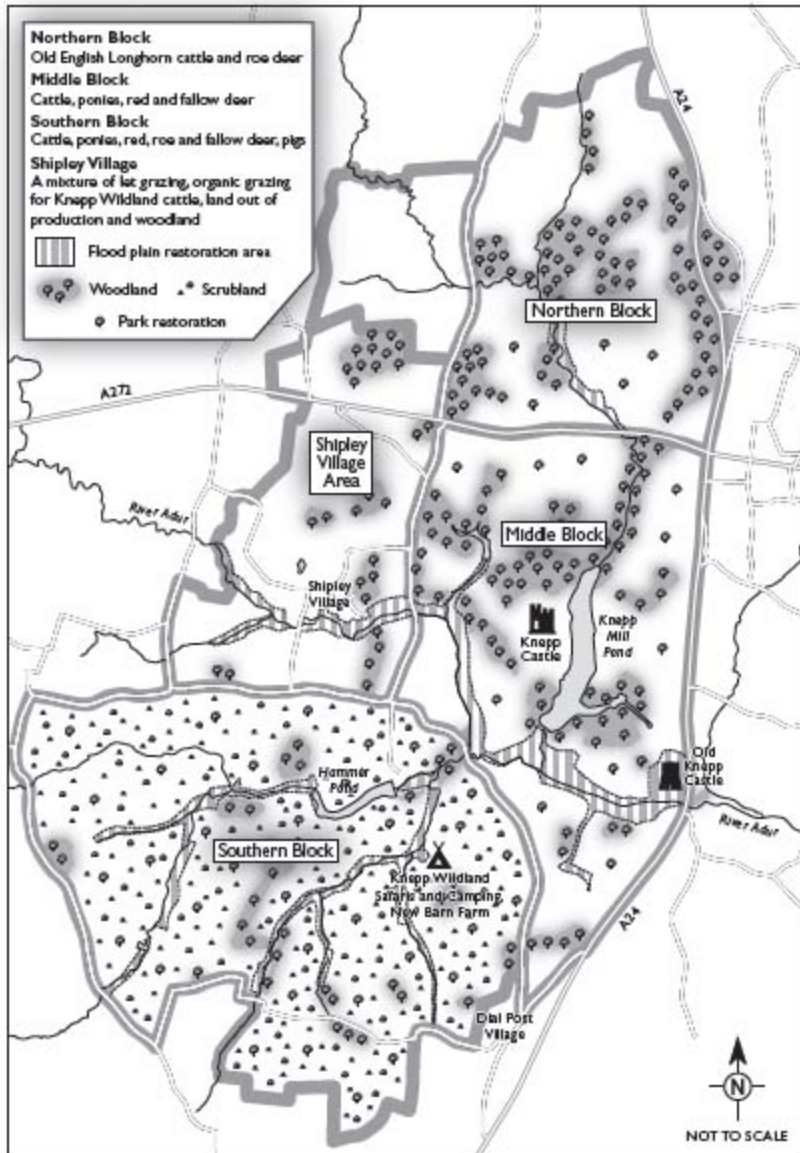
Land managers owning, in total, a million acres visit Knepp to investigate the possibilities of rewilding.

2019

May – UN report warns that one million species are at risk of extinction in the next few years, with serious consequences for human beings as well as the rest of life on Earth.

May – A pair of white storks nest in the top of an oak tree in the Southern Block; quite possibly the first free-flying white storks to nest successfully in Britain since they were persecuted to extinction after the English Civil War.

June – We submit our application to DEFRA for a licence to release beavers at Knepp (decision is pending).



Introduction

‘Flowers appear on the earth; the time of the singing of birds is come, and the voice of the

Turtle is heard in our land.’

Song of Solomon 2:12

It’s a still June day on Knepp Castle Estate in West Sussex. We can call it

summer now. This is a moment we've been waiting for, not sure if we dare expect it. But there it is – from the thicket that was once a hedgerow, that unmistakable purring: soothing, inviting, softly melancholic. We tread quietly past an eruption of saplings of oak and alder, billowing with skirts of blackthorn, hawthorn, dog rose and bramble. The thrill of recognition is tinged with relief and, though neither of us tempts fate by expressing it, a hint of triumph. Our turtle doves have returned.

For my husband Charlie, their gentle burbling takes him back to the African bush, to his infancy running around on his parents' farm. This is where the doves have come from – their tiny flight muscles pumping 3,000 miles from deep in West Africa, from Mali, Niger and Senegal, across the epic landscapes of the Sahara Desert, the Atlas Mountains and the Gulf of Cadiz; over the Mediterranean, up the Iberian Peninsula, through France and across the English Channel. They mostly fly under the cover of darkness, covering between 300 and 450 miles every night at a maximum speed of 40 miles an hour, usually making landfall in England around May or early June. Like their fellow African migrant, the nightingale, they are famously timid. It is their call that tells us they are here. Like the cuckoo and the nightingale – who generally arrive here first – they have come to breed, to raise their young far from the predators and competitors of Africa

and to take advantage of the long daylight feeding hours of the European summer.

For most people our age, born in the 1960s, who have grown up in the English countryside, turtle doves are the sound of summer. Their companionable crooning is lodged for ever, somewhere deep in my subconscious. But this nostalgia, I realize, is lost to generations younger than ours. In the 1960s there were an estimated 250,000 turtle doves in Britain. Today there are fewer than 5,000. At the present rate of decline, by 2050 there could be fewer than 50 pairs, and from there it would be a hair's breadth to extinction as a breeding species in Britain. Now, at Christmas, when we sing of the gifts my true love gave to me, few carollers have ever heard a turtle dove, let alone seen one. The significance of its name, derived from the lovely Latin *turtur* (nothing to do with the reptile; all to do with its seductive purring), is lost to us. The symbolism of 'turtles', their pair-bonding an allegory of marital tenderness and devotion, their mournful *turr-turr* -ing the song of love lost, the stuff of Chaucer, Shakespeare and Spenser, is vanishing into the kingdom of phoenixes and unicorns.

As its territory shrinks to the south-east corner of England, Sussex is one of the turtle's final redoubts. Even so, numbers for our county are reckoned to be at best 200 pairs. Trouble on the migration route is undoubtedly partly

responsible: periodic droughts, changes in land use, the loss of roosting sites, increasing desertification and hunting in Africa – and the stupendous challenge of crossing the firing squads of the hunters of the Mediterranean. In Malta alone the slaughter claims 100,000 turtle doves every season. Around 800,000 a year are killed in Spain.

Yet these impacts, considerable though they are, are not enough to explain the almost complete collapse of the population in Britain. In France, where hunters still shoot the birds on their return passage to Africa after the breeding season, numbers have decreased 40 per cent since 1989 – a significant loss, but nothing compared with ours, where, in recent times at least, we have opted not to shoot them. Across Europe, turtle-dove numbers have declined by a third over the past sixteen years to fewer than 6 million pairs – leading, in 2015, to a change in the bird's status on the International Union for Conservation of Nature (IUCN) Red List of Endangered Species from 'Least Concern' to 'Vulnerable', the start of a worrying downward slide.

But compared to the angle of European decline, the trajectory of the UK numbers is an almost vertical dive. The turtle dove's predicament in Britain is rooted in the almost complete transformation of our countryside – something that has come about in just fifty years. Changes in land use and,

in particular, intensive farming have altered the landscape beyond anything our great-grandparents would recognize. These changes have taken place at all scales in the landscape, from the size of fields that now cover entire valleys and hills to the almost total disappearance of native flowers and grasses from farmland. Chemical fertilizers and weedkillers have eradicated common plants like fumitory and scarlet pimpernel, on whose tiny, energy-rich seeds the turtle doves feed; while the wholesale clearance of wasteland and scrub, the ploughing of wildflower meadows, and the draining and pollution of natural water courses and standing ponds has wiped out their habitat.

The same agricultural revolution has taken place on the Continent, but in Europe, it seems, there is enough wild land left – and in large enough areas – to slow the decline in turtle-dove numbers. But in lowland England what tiny fragments of nature remain, whether left by accident or by design, are like oases in a desert, disconnected from natural processes – the interactions and dynamism that drive the natural world. We lost more ancient woods – tens of thousands of them – in the forty years after the Second World War than in the previous four hundred. Between the beginning of the war and the 1990s we lost 75,000 miles of hedgerows. Up to 90 per cent of wetland has disappeared in England alone since the Industrial Revolution. 80 per

cent of Britain's lowland heathland has been lost since 1800; a quarter of the acreage in the last fifty years. 97 per cent of our wildflower meadows have been lost since the war. This is a story of unremitting unification and simplification, reducing the landscape to a large-scale patchwork of ryegrass, oilseed rape and cereals, with scattered, undermanaged woods and remnant hedgerows the only remaining refuge for many species of wildflowers, insects and songbirds.

Underfunded and unprioritized, conservation measures have failed to hold ground against agricultural intensification and development. Ironically, England, which boasts one of the greatest traditions of recording its wildlife and has the largest membership of wildlife-protection organizations in Europe, has among the smallest amount of land nationally protected as nature reserves. Compared to 2.75 million hectares in France, England has only 94,400 hectares (364 square miles, less than 1 per cent of its land area) conserved for nature. Even Estonia manages over 258,000 hectares. Our tiny SSSIs (Sites of Special Scientific Interest), SACs (Special Areas of Conservation) and SPAs (Special Protection Areas designated under European legislation) are eroded, neglected and sometimes completely forgotten about. In many cases, their role is overruled by bigger priorities such as roads and building projects. All of England's ten National Parks

contain large areas intensively grazed by sheep or managed as grouse moors. Unlike the American National Park model, sacrosanct areas of wilderness where nature is primary, ours are regarded primarily as ‘cultural’ landscapes for human recreation.

The transformation of our countryside has impacted not just on turtle doves but on birds in general. In 1966, according to the RSPB, there were 40 million more birds in the UK than there are today. Our skies have emptied. In 1970 we had 20 million pairs of what are known as ‘farmland birds’, such as quails, lapwings, grey partridges, corn buntings, linnets, yellowhammers, skylarks, tree sparrows and turtle doves – most of them songbirds that depend on insects for their chicks and copses or hedgerows for their nests. By 1990 we had lost half of them. By 2010 that number had halved again. It is hard to countenance figures of this magnitude. Reframing the statistics, putting them in another context, is helpful. Over those forty years, for example, our country has gained another 5 million people. So for every extra person living in the UK we have lost three pairs of what are now considered ‘priority’ farmland birds.

But what does this mean for us as a nation? Do we need to worry about the loss of these birds, lovely as they are? Certainly Charlie and I would be desperately sad if we or our children were never to hear a nightingale or a

turtle dove on English soil again. But their loss represents something far more important than that. Familiar, conspicuous in our skies and in our landscape, birds are, in a very real sense, our canaries in the mine – casualties connected to far greater and less visible losses. Preceding them, and following in their wake, are all the other species – including the less glamorous forms of life like insects, plants, fungi, lichens, bacteria – that share their fate. As the American biologist E. O. Wilson explained just thirty years ago, life's diversity is dependent on a complex web of natural resources and inter-species relationships. In general, the more species living in an ecosystem, the higher its productivity and resilience. Such is the wonder of life. The greater the biodiversity, the greater the mass of living things an ecosystem can sustain. Reduce biodiversity, and biomass may decline exponentially; and the more vulnerable individual species collapse. In *The Song of the Dodo* (1996), David Quammen describes an ecosystem as being like a Persian carpet. Cut it into tiny squares, and you get not tiny carpets, but a lot of useless scraps of material fraying at the edges.

Population crashes and extinctions are the signs of an ecosystem unravelling.

The ground-breaking 2013 *State of Nature* report, compiled by scientists from twenty-five British wildlife organizations, reveals a bleak story for

wildlife in the UK over the previous fifty years. The numbers of Britain's most endangered species have more than halved since the 1970s, with one in ten species overall threatened with extinction within our shores. The abundance of all wildlife has fallen dramatically. Insects and other invertebrates have been particularly badly hit, more than halving since 1970. Moths have declined 88 per cent, ground beetles 72 per cent and butterflies 76 per cent. Bees and other pollinating insects are in crisis. Our flora is also failing. Seed-bearing 'weed' species – upon which turtle doves and countless other birds depend – declined by 1 per cent every year during the twentieth century since the records began in the 1940s. According to the 2012 *Our Vanishing Flora* report, one plant species becomes extinct every other year in sixteen counties of the UK. And these are just the species that can be identified and monitored. Countless other insects, water plants, lichens, mosses and fungi are not even on the radar.

In 2016 a new *State of Nature* report, compiled by scientists from fifty conservation organizations, found some grounds for optimism. The numbers of certain species such as bats, including the greater horseshoe bat, have increased in recent years thanks to legal protection; the creation of new reed-beds has enabled the bittern to recover from just 11 booming males in 1997 to 156 in 2015. Some locally extinct species like the short-

haired bumblebee and the large blue butterfly have been successfully reintroduced. Red kites have spread following successful introductions, and otters are making a comeback in many rivers. But the report offers a sober reminder of the longer historical context. ‘Although these recoveries are certainly worth celebrating,’ it says, ‘we should remember that they have only brought species back to a fraction of their former level.’

Across the board, substantial losses continue. Between 2002 and 2013, more than half our species declined in numbers. This is not something we can assign conveniently to failures in the 1970s. In recent years, some of our best loved ‘common’ species like hedgehogs, water voles and dormice have become scarce. The government’s own assessment, published in August 2016, found that a hundred and fifty of two hundred so-called ‘priority’ species are still falling in number across the country and we are in imminent danger of losing 10–15 per cent of our species overall.

It is tempting to assume that such declines are no different to the rest of the world. But they are different. Using the ‘biodiversity intactness index’ – a new system that measures the condition of a country’s biodiversity – the updated 2016 *State of Nature* report discovered that the UK has lost significantly more biodiversity over the long term than the world average. Ranked twenty-ninth lowest out of 218 countries, we are among the most

nature-depleted countries in the world.

Against this background of almost inconceivable loss the turtle doves' appearance at Knepp seems little short of a miracle. Our patch – 3,500 acres of former intensive arable and dairy farmland, just forty-four miles from central London – is bucking the trend. The turtle doves are here now because we have turned our land over to a pioneering rewilding experiment, the first of its kind in Britain. Their arrival has taken us and all those involved in the project completely by surprise.

We began to hear turtle doves, only ever recorded here in ones and twos, just a year or two after the project began – three in 2005, four in 2008, seven in 2013 and by 2014 we reckoned we had eleven singing males. In the summer of 2017 we counted sixteen. Occasionally, over the last couple of years, we've chanced upon a pair out in the open, sitting on telephone wires or on a dusty track, their pink breasts touched by the glow of evening, the tiny patch of zebra stripes on their necks a hint of Africa – a reminder that, just a few weeks earlier, these birds would have been flying over elephants. Their colonization of Knepp is one of the few reversals in the otherwise inexorable trend to national extinction; possibly the only optimistic sign for turtle doves on British soil.

But it's not just turtle doves that have found us. Other endangered British

birds – migrants like nightingales, cuckoos, spotted flycatchers, fieldfares and hobbies, and residents like woodlarks, skylarks, lapwings, house sparrows, lesser spotted woodpeckers, yellowhammers and woodcock – have been recorded here in good numbers since the project began or are now breeding at Knepp. So too are ravens, red kites and sparrowhawks, lording it at the top of the food chain. Every season new species arrive. In 2015 the big excitement was long-eared owls and in 2016 we had our first pair of breeding peregrine falcons. Populations of common birds are rocketing, too, and occasional visitors like osprey, green sandpipers and little egrets are also on the rise.

And it's not just birds. Other rare creatures, solemnly declared 'UK Biodiversity Action Plan species' by the civil servants, are also back – Bechstein's and barbastelle bats, dormice, slow-worms, grass snakes and butterflies: purple emperor, brown hairstreak and white-letter hairstreak. The speed at which these events have happened has astonished observers, not least ourselves, particularly given the dire condition of our land before we made our first tentative steps into what we now call 'rewilding', back in 2001.

The key to Knepp's success, conservationists are beginning to realize, is its focus on 'self-willed ecological processes'. Rewilding is restoration by

letting go, allowing nature to take the driving seat. In contrast, conventional conservation in Britain tends to be about targets and control, doing everything humanly possible to preserve the status quo, sometimes to maintain the overall look of a landscape or, more often, to micro-manage a particular habitat for the perceived benefit of several chosen species, or just a single, favoured one. In our nature-depleted world this strategy has played a crucial role. Without it, rare species and habitats would have simply disappeared off the face of the earth. Such nature reserves are our Noah's Arks – our natural seed banks and repositories of species. But they are also increasingly vulnerable. Biodiversity continues to decline in these costly and micro-managed oases, sometimes even threatening the very species these areas are designed to protect. Something drastic needs to happen, and happen soon, if we are to halt this decline, and perhaps even reverse it. Knepp presents an alternative approach – a dynamic system that is self-sustaining and productive, as well as far cheaper to run. Such an approach can work in conjunction with conventional measures. It can be rolled out on land that on paper, at least, is of no conservation importance. It can add buffers to existing protected areas, as well as bridges and stepping stones between them, increasing the opportunities for species to migrate, adapt and survive in the face of climate change, habitat degradation and pollution.

Allowing natural processes to happen, and having no predetermined targets to meet, no species or numbers to dictate the plan, is a challenge to conventional thinking. It particularly unsettles scientists who like to test hypotheses, run computer models, tick boxes and fix goals. Rewilding – giving nature the space and opportunity to express itself – is largely a leap of faith. It involves surrendering all preconceptions, and simply sitting back and observing what happens. Rewilding Knepp is full of surprises, and the unexpected outcomes are changing what we thought we knew about some of our native species' behaviour and habitats – indeed it is changing the science of ecology. And it is also teaching us something about ourselves, and the hubris that has led us to our current predicament.

When we began rewilding the estate seventeen years ago we had no idea about the science or the controversies surrounding conservation. Charlie and I embarked on the project out of an amateurish love for wildlife and because we would have lost an impossible amount of money if we had continued to farm. We had no idea how influential and multi-faceted the project would become, attracting policy makers, farmers, landowners, conservation bodies and other land-management NGOs, both British and foreign. We had no idea Knepp would end up a focal point for today's most pressing problems: climate change, soil restoration, food quality and

security, crop pollination, carbon sequestration, water resources and purification, flood mitigation, animal welfare and human health.

But what is happening here also seems to touch a deeper chord, something more visceral. In 2013 George Monbiot published a plea for a wilder Britain in his inspirational book *Feral*. The public response was extraordinary. He seemed to have attuned to a craving that people were feeling but hadn't yet voiced: the idea that we are missing something – some more fulfilling connection with nature in all its awe-inspiring, unfettered complexity; that we are living in a desert compared to our gloriously wild past.

Inspired by this public outpouring and desire for change, the charity Rewilding Britain was launched in 2015, with my husband Charlie as one of its trustees and then its chair. Its goals are ambitious. By 2030 it aims to have returned natural ecological processes and key species to 300,000 hectares of core land (1,158 square miles, equivalent to the size of Britain's golf courses, or roughly equivalent to a large county) and three marine areas, crucial for the restoration of our fisheries and marine wildlife. Over the next hundred years it hopes this will have extended to at least 1 million hectares, or 4.5 per cent of Great Britain's land and 30 per cent of our territorial waters, with at least one large rewilded area connecting both land

and sea, descending from mountaintops to coastal waters. Its overall aim is not to rewild everywhere – prime agricultural land will naturally always be needed for food production and much land will still, of course, be required for housing and industry – but to restore parts of the British Isles to wild nature and to allow lost creatures, like the lynx and beaver, the burbot, eagle owl and Dalmatian pelican, and, in our remotest places, elk and wolf, to live here once more.

Knepp is but a small step on that road to a wilder, richer country. But it shows that rewilding can work, that it has multiple benefits for the land; that it can generate economic activity and employment; and that it can benefit both nature and us – and that all of this can happen astonishingly quickly. Perhaps most exciting of all, if it can happen here, on our depleted patch of land in the over-developed, densely populated south-east of England, it can happen anywhere – if only we have the will to give it a try.

1

Meeting a Remarkable Man under a Remarkable

Tree

A single 400-year-old-oak . . . [is] a whole ecosystem of such creatures for which ten

thousand 200-year-old oaks are no use at all.

Oliver Rackham, *Woodlands* , 2006

Ted Green came to a standstill under the canopy of the old oak. He caressed the rippled bark with a weather-worn hand. 'You're a sight for sore eyes,' he said. As if in response a stirring shuffled through the foliage above our heads and a smattering of acorns thudded to the ground. Handing Charlie one end of a 'Diameter at Breast Height' measure, Ted extended the tape around the trunk and with a cry of delight read off 7m. Its girth made it about 550 years old. Most likely, it had started life during the Wars of the Roses, nearly three centuries before my husband's family, the Burrells, had arrived at Knepp. It would have germinated when 'Knap' was a thousand-acre deer park owned by the Dukes of Norfolk, its acorns fodder – or 'pannage' – for wild boar and fallow deer. As a fine young tree only a hundred years old, it would have welcomed the arrival of the Carylls, Catholic ironmasters, owners of Knepp for over a hundred and seventy years. In the mid-seventeenth century it would have witnessed the Civil War, the assault on Knepp by Parliamentary troops and counter-assaults by Royalists. It had lived and breathed what we can only absorb from history books.

Looming over the approach to the nineteenth-century castle it has been known for as long as anyone can remember as the Knepp Oak. It would have been 350 years old when Charlie's ancestor Sir Charles Merrik

Burrell, the 3rd baronet, commissioned the up-and-coming architect John Nash to build him a mansion house right next to it.

The Burrells have been associated with Sussex since the fifteenth century, first as farmers and vicars of Cuckfield, then as ironmasters in the seventeenth century. Knepp came into the Burrell family when William Burrell, a lawyer and Sussex historian, married an heiress, his second cousin, Sophia Raymond. Her father, Sir Charles Raymond, had bought Knepp in 1787, shortly after the Caryll dynasty had dissolved. Sir Charles gave the estate, then 1,600 acres, to his daughter, and the Raymond baronetcy to his son-in-law.

It was their son, Sir Charles Merrik Burrell (3rd Bt), who put down roots at Knepp. The new castle, designed by Nash in his new 'picturesque' Gothic style, would have crenellations and turrets and studded oak doors and stand on an 'elevated and beautiful' spot only 100 yards or so away from the great oak, overlooking the old 80 acre mill pond – then the largest body of water south of the River Thames.

Like all the Burrells who have lived here since, our fortunes have seemed somehow wedded to the fate of this tree. Horses and carriages, ponies and traps, steam ploughs, men heading off to two world wars, the first Bentley, Charlie's grandfather's Series One Land Rover, the first combine harvester

would all have passed beneath its branches. It had witnessed marriage processions, funeral cortèges, bizarre twists of family fate. When our son was born in the autumn of 1996 – a prolific year for oak mast – we grew one of its acorns on in a jar and planted the sapling out for the future, a stone's throw from the original. We wondered how much longer the old tree could survive. Sometime in the early twentieth century it had begun to split down the middle and during the Second World War the Canadian army stationed at the castle had strapped it together with tank chains. By the late 1990s it seemed that its gigantic outstretched limbs were once again threatening to tear it apart. We were told of a man who would know what to do.

Ted stood back, assessing the bifurcating structure above us. His brow furrowed as he studied the chainsawed amputation of a lower limb. As it grows old a tree sometimes lowers its branches towards the ground, for stability, Ted explained, like an old man using a walking stick. To the modern eye this self-buttressing tendency is considered a weakness and the walking stick – the lowering branch – is generally removed. 'We have a fixed image of how a tree should look,' Ted said, 'like a child's drawing with a straight trunk and a pom-pom on top. We don't want to see anything else. We deny the tree its ability to grow old, to gain character, to be itself.'

It's like taking away my bus pass and giving me a facelift so I always look fifty.'

One of our longest-lived trees, the oak – so the saying goes – grows for 300 years, rests for another 300 years and spends the last 300 gracefully declining. But that mid-life period of 'standing still' is deceptive, Ted said. The tree may have reached its optimum mass but it is always shifting, balancing its weight, responding to its environment and the growth of vegetation around it – only at a pace that humans can barely register. Top-heavy and unable to find equilibrium, the Knepp Oak was struggling to hold itself together – an allegory, perhaps, of Knepp in the twentieth century.

Ted, at least, was optimistic about the tree. 'A bit of a haircut should do it – a little at a time over the next few years. If we can reduce the crown by 10 per cent – just a metre or two – that'll be enough to reduce the wind effect by around 70 per cent and prevent it wrenching itself down the middle. See, it's already beginning to drop this branch over here. In time, if you let that reach the ground, it'll have a lot more support.'

He looked thoughtfully up into the crown. 'This old soul could see another four centuries.'

For the past decade Ted Green, then in his sixties, had been custodian of the royal oaks in Windsor Great Park. One of the most distinguished tree

experts in the country, and recently awarded the Royal Forestry Society's prestigious gold medal, he had, like the tree he was currently admiring, started out life on the other side of the fence. His father, captured in the war, had been killed when a US submarine torpedoed an unmarked Japanese ship carrying prisoners of war. The loss had devastated Ted, an only child, living with his mother on the borders of Silwood, Sunninghill and Windsor Great Parks in Berkshire. He turned feral, running wild in the woods and meadows. When Ted and his mother were evicted from their home they took over a hut from an abandoned military camp at Silwood. Ivy and honeysuckle wound around the inside walls and his mother slept in bed under an oilskin when it rained. A dab hand with a slingshot, Ted took to poaching rabbits and pheasants off the Crown Estates.

'I was a problem kid,' he said in his soft Berkshire burr. 'Running about on my own – that's how I made sense of the world. Nature taught me things: observation and patience. That's what saved me.'

Ted had arrived in academia sideways, thanks to a scientist he had met bird-watching. Posted as technician in plant pathology at Imperial College's new field station in Silwood Park, he was eventually given an honorary lectureship – only the second ever in the history of the college. His students, invariably, adored him. In the 1980s, after thirty-four years supporting

research and teaching botany and biology, he left to become conservation consultant to the Crown Estates at Windsor. His life, it seemed, had come full circle.

As we wandered back along the drive towards the house Ted paused.

‘Now those old trees,’ he said, ‘they’re the ones we should be worrying about.’ He was gazing out at the scattered oaks, once features of the nineteenth-century deer park, now stranded like lighthouses in a choppy sea of agriculture and currently presiding over a ley of shiny Italian ryegrass. It wasn’t an exact science, identifying sickness in a tree, Ted said, more a matter of intuition, like sensing when a close friend is unwell. A healthy oak has the bloom of giant broccoli, with a dense, rounded crown, bursting with life. These trees, planted two centuries ago or more, sentinels of Humphry Repton’s park setting for Nash’s castellated mansion, were growing thin and stag-headed, losing their leafy abundance. Half the age of the Knepp Oak, they looked crumpled by comparison, like war-weary veterans. ‘It’s ploughing that’s doing them in,’ said Ted, ‘and everything that comes with it.’

Like most of their landowning neighbours, the Burrells had responded with patriotic ardour to the government’s cry to ‘Dig for Victory’ in the Second World War. Isolated, and with German U-boats torpedoing supply

lines across the Atlantic, Britain's 50 million inhabitants faced starvation. As chairman of the West Sussex 'War Ag' (War Agricultural Executive Committee), Charlie's great-grandfather Sir Merrik Burrell, then sixty-two, had been charged with impelling the county, most of which was under permanent pasture and made up of subsistence farms with small fields, horse-drawn machinery and little electricity between them, into intensive dairy and arable production. Sometimes, Sir Merrik admitted to the Royal Agricultural Society (of which he had recently been President), he had to 'lean quite hard' on farmers who were reluctant to put their pastures to the plough.

He had led by example, ploughing up those parts of his estate that for decades had been considered either sacrosanct or too costly and problematic to farm. Two huge tractors yoked with chains were sent into hundreds of hectares of scrub, ripping up gorse, hawthorn, sallow and dog rose, and levelling anthills. Easier to plough were the old water meadows, known locally as 'laggs', and the 350-acre Repton park around the house.

Timber was required for the war effort too, with carrot- and-stick incentives from the government – £60 for felling and grubbing out a mature oak, and a quota that every landowner was required to fulfil. Sir Merrik felled the old trees along the ancient droving road of Greenstreet and the

great oaks of Big Cockshalls, and clear-felled Jockey Copse. He spared – at least – the oaks in the park around the castle, though to his dismay he was forced to surrender the elm boards he was carefully seasoning for the family's coffins.

The war utterly transformed West Sussex, like everywhere in Britain. On Knepp's horizon, tides of wheat rolled over the chalk grasslands of the South Downs – traditional grazing lands since the Bronze Age, meadows of cowslips and orchids considered out of bounds even during the First World War, when they supplied hay for military transport. Around the nearby villages of Dial Post, Shipley and West Grinstead, woods were felled and thousands of acres ditched and drained. At Knepp and on neighbouring farms, farmers too old to go to war were supported by an army of Land Girls, a national task force of 80,000 female volunteers and conscripts under the command of Charlie's great-grandmother Trudie Denman, a pioneering feminist. The Land Girls laboured up to a hundred hours a week, mounting headlights onto tractors so they could plough day and night. During the war they more than doubled the acreage producing fodder for livestock and more than tripled the acreage of fields under cereal. 'Dig for Victory' achieved what many had considered impossible. In the years just before the war, Britain imported nearly three-quarters of its food.

Increased grain production abroad – particularly in Russia and America – and cheap transport by steamship had pushed food prices to rock bottom. Naturally enough, the acreage of arable land in Britain had fallen to an all-time low – an effect of what we would today refer to as ‘globalization’. By the end of the war, arable land in Britain, now subsidized by the government, had doubled to 20 million acres – from the smallest to the largest area ever in just five years. An extra 10,000 square miles had been ‘brought under the plough’, doubling Britain’s output of wheat.

Whether or not Sir Merrik ever dreamed the park would one day be restored to its original state, he must have given up hope by the time he died in 1957. After the war, Britain verged on bankruptcy. With little to export and little foreign currency to pay for imports, with much of Continental Europe starving, with dependants in her protectorates to feed, and her allies no longer coming to her aid, there was less food in Britain than during the war itself. Food rationing continued until 1954, a full nine years after VE-Day. And the result was a sea change in the nation’s mentality. That memory of privation, stretching well into the 1950s, etched itself into the country’s subconscious. Feeding ourselves became as much a matter of honour as it was of security. Never again, the government declared, would Britain allow herself to be threatened with starvation. Supported by

subsidies, the country would remain in peak production. Fallow land came to be considered wasted land. As Charlie's aunt Penelope Greenwood, now in her eighties, describes it, 'We were all brought up to believe we would go to heaven if we made two blades of grass grow where one had grown before.' Knepp's park – indeed every conceivable inch of the estate – would remain dedicated to intensive agriculture.

Ted marched off across the ryegrass, clods of clay sticking to his walking boots, making a beeline for one of the old park oaks. We joined him on the tiny coracle of turf left unploughed directly around its trunk. 'This is the problem,' he said, leaning against the tree and staring at the tussocky ground beneath our feet. 'We never think of what's going on below ground. The tree we see is just the tip of the iceberg.'

An oak's roots spread way beyond the drip-line of the leaves, he told us, to a distance of up to two and a half times the radius of the crown. At Windsor recently, he had found roots from one of the veteran oaks extending a full fifty yards from the trunk. With oxygen available in soil only relatively close to the surface, the majority of a tree's roots are found in the top twelve inches and are therefore vulnerable to ploughing and compaction. Our dairy cows, weighing half a ton each, congregating en masse in the shade on a summer's day – a pastoral idyll, so we had thought

– were doing the roots no favours, and the repeated ploughing and the traffic of heavy combines, power harrows and seed drills directly under the oaks and further into the field were constantly assailing their roots.

And the roots are just the beginning. A tree's life-support system extends further still, into a dark and invisible universe that microbiologists and mycologists are only just beginning to fathom: that of the mycorrhizae – fine, hair-like filaments of fungus that attach themselves to the roots and create a deep, intricate and vast underground network.

Mycorrhizae, from the Greek *mikas-riza* (literally 'fungus-root'), relate symbiotically to plants. The fine fungal filaments extend from the roots of plants to supply their hosts with water and essential nutrients. The plants, in return, provide the mycorrhizal fungi with carbohydrates they need for growth. At a hundredth of a millimetre in diameter – ten times finer than the finest root – these filaments, or 'hyphae', are invisible to the naked eye. A single filament may extend hundreds or thousands of times the length of one tree root. Mycorrhizal partnerships can be highly specific, Ted told us, associating only with an individual plant or species. They can also be generalist and promiscuous, creating vast community structures, known as common mycelial networks. These networks can be indefinitely huge, spanning – some believe – entire continents.

One of the most crucial processes of life on earth, mycorrhizae arose 500 million years ago, when primitive plants emerged from the oceans to experiment with terrestrial life. To colonize land, plants had to find a way of acquiring mineral nutrients, in particular scarce minerals like phosphate – an essential nutrient readily available in water but occurring in extremely low concentrations in soil. On its own, a plant's ability to extend its roots to explore for nutrients is limited. Partnerships with mycorrhizae expand that capability exponentially. 90–95 per cent of terrestrial plants in all ecosystems on every continent have mycorrhizal relationships. A single bluebell, for example, may be colonized by eleven or more species of mycorrhizal fungi, most of which have not yet been scientifically described. Without them, a bluebell, with its short, thick roots, growing in soils where phosphate is typically available at less than 1 part per 10 million, would die. The same is true for trees. One study in North America discovered over a hundred species of mycorrhizal fungi associated with a single tree. Using an arsenal of biochemicals unique to fungi, mycorrhizae can even mine rock, extracting minerals and bringing them into the plant food cycle.

Another key function of mycorrhizae is to act as an early warning system. Chemical signals transmitted by mycorrhizae from a plant under attack stimulate a defensive response in other plants in the vicinity,

prompting them to raise levels of protective enzymes. By acting as a communications network – even between plants of different species – mycorrhizae alert plants and trees to the threat of pathogens, and to predation by insects and herbivores. They can even stimulate the release of chemicals from the tissues of a tree to attract predators for the particular pest assailing it. And they can alert trees to provide intensive care for ailing individuals or vulnerable offspring, supplying them with a boost of nutrients as though plugging them into an intravenous drip. As Canadian forest ecologist Suzanne Simard discovered in the late 1990s, and Peter Wohlleben describes in his remarkable book *The Hidden Life of Trees – what they feel, how they communicate* (2015), this underworld system of molecular signalling reveals a world where trees are responsive and sociable creatures, much more like us than we ever imagined.

The delicate mycorrhizae are, inevitably, destroyed by the churning blades of ploughs. They are also highly susceptible to agricultural chemicals, whether in fertilizers or pesticides. At low concentrations, phosphate is a nutrient that mycorrhizae convey to support life. When added to the land in large quantities as artificial fertilizer it becomes a pollutant, overwhelming natural biological systems and depressing the mycorrhizae's spore germination and viability. Nitrates, insecticides,

herbicides and, of course, fungicides reduce mycorrhizal colonization of roots and inhibit the elongation of the hyphae, the fungal filaments. Even livestock dung, which is routinely loaded with anti-worming agents (ivermectins) and, often, antibiotics, can leach into the soil and destroy mycorrhizae.

‘So what we’re seeing with these trees,’ Ted explained, ‘is most likely an effect of what’s been happening to the soil. These trees have been cut off from their allies. They’re stranded out there on their own.’

In the early twentieth century, a Prussian chemist, Fritz Haber, pioneered modern chemical fertilizers, by inventing a technique to draw nitrogen from the air and transform it into the plant-available nitrates that stimulate plant growth. A process that can take place only under intense heat and pressure, the manufacture of artificial nitrates requires huge inputs of fuel – generally, in today’s world, gas. It can also generate the raw materials for explosives and before Haber’s process became widely used in agriculture, it revolutionized the development of munitions in the Second World War.

After the war, switching manufacture from munitions to agricultural fertilizers was obvious and easy for industrialists. Tanks converted to tractors; poison gas to pesticides and herbicides. In the United States, where, far from the action in Europe, ten large-scale bomb-making factories

remained unscathed after the war, nitrate production sky-rocketed, making the States the undisputed champion of artificial fertilizer, with a vested interest in driving up arable production in Britain and Europe.

Not everyone in Britain was sure that arable was the best way to continue after the war. A group of influential scientists led by Professor Sir George Stapledon, director of the grassland research station at Drayton, Stratford-upon-Avon, had recommended a return to food production based on grass – the country's richest and most reliable resource. The dash for arable crops in the early years of the war had been severely damaging to soil fertility and, in the closing years, the War Agricultural Executive Committee had urged farmers to rotate their arable crops with leguminous nitrogen-fixating crops, such as clover, sainfoin and lucerne, and short-term pastures for livestock to allow the soil to recover. In Stapledon's view, this rotational system not only maintained soil fertility, it kept farmers self-sufficient by avoiding the need for chemical fertilizers and imported animal feeds. With low overheads farmers had no need to borrow money and build up debt. In periods of agricultural recession, mixed farming gave farmers greater resilience and stability. It was, he advised, the ultimate tool of food security. Other celebrated farmers, like George Henderson, author of the bestselling *The Farming Ladder* (1944), also campaigned for a return to the

traditional mixed-farming system. His farm in the Cotswolds had successfully weathered the agricultural depression of the 1930s and at the outset of the war had the highest outputs per acre in Britain. The Ministry of Agriculture had used it as a showcase farm, bussing people to the Cotswolds to learn from it. Maintaining the natural fertility of the soil, Henderson was convinced, was the key. ‘If all of Britain was farmed this way,’ he wrote, ‘our country could easily feed a population of a hundred million people.’

Henderson was adamantly against continuing farm subsidies after the war. They would be disastrous for the country in the long run, he warned, removing all incentive, instinct and self-reliance for farmers, creating a culture of dependency and giving bureaucrats control over what farmers did with their land. However the National Farmers’ Union disagreed and lobbied hard to retain subsidies. In 1947 Clement Atlee’s government passed the Agriculture Act – drawn up by Professor John Raeburn, the agricultural economist behind the Dig for Victory campaign – guaranteeing fixed market prices for farm produce in perpetuity.

By the time Charlie’s grandparents were running the Knepp estate, subsidies were already beginning to affect the choices farmers made. By the late 1960s the rising trend was for large, specialized farms, the majority of

which focused solely on arable, with grass eliminated from the rotation altogether. Without the fertility-building benefits of grass, clover and livestock, chemical fertilizers and sprays were needed to grow decent crops, and it was the generous subsidies provided by the government that made these additional costs affordable for farmers. The idea of being able to fertilize the soil artificially seemed nothing short of a miracle and, together with improvements in technical efficiency, bigger and better machinery and the development of new varieties of crops, the era of industrialized agriculture – misleadingly named the ‘Green Revolution’ – was firing on all cylinders.

Trees had no place in this new scheme of things. Free-standing trees in the middle of fields were now an aggravation, disrupting the trajectory of farm machinery and taking up precious yards of viable land. Many farmers, if they did not remove them altogether lopped off the lower branches so they could plough right up to the trunk, as we did. Trees, particularly old trees, began to be seen as a potential source of disease and pests – a threat to crops. In an effort to maximize efficiencies and to accommodate bigger machines with broader turning requirements, fields were enlarged. Between 1946 and 1963, hedgerows were ripped out at the rate of 3,000 miles a year. By 1972, according to a report by the Countryside Commission, the rate of

destruction had increased to 10,000 miles a year. Included in these hedgerows were thousands upon thousands of trees that, down the centuries, had been allowed to grow out and above the hedgerow for fodder, fuelwood, timber and shelter, the vast majority of them oaks.

To Ted, the loss of ancient open-grown oaks from Britain is an unacknowledged catastrophe. Britain's ancient Druids worshipped in groves of oaks, and our first kings adorned themselves with coronets of oak leaves. No tree, to his mind, is more closely entwined with our culture. A symbol of strength and survival, couples would marry under its branches, carry acorns in their pockets for good luck, decorate Yule logs of oak with mistletoe and holly at Christmas. Conspicuous in the landscape, oaks magnetized key moments in history. King John held political 'parleys' under landmark trees such as the King John Oak at Woodend Park in Devon and the Parliament Oak in Nottinghamshire's Sherwood Forest, both still surviving after nearly a thousand years. In 1558 Queen Elizabeth I learnt of her succession to the throne as she sat under a great oak in the park at Hatfield House. 'Her' tree became a place of pilgrimage; its hollow bole, propped and fenced, was celebrated in Edwardian postcards. When, eventually, the old tree died, the present Queen Elizabeth planted a young oak to replace it. In 1651, after losing the Battle of Worcester, King Charles

He hid from his Roundhead pursuers in an oak at Boscobel House before escaping into exile – a feat immortalized in pubs up and down the country. There can be few Britons who have not downed a pint in a Royal Oak. The day of the king's entry into London after his exile – 29 May 1660 – became a national holiday, still celebrated in some parts of the country as Oak Apple Day.

To the commoner the oak was both sustenance and livelihood: providing acorns for feeding pigs and making bread; bark for tanning leather; pollarded branches as tree fodder for livestock in winter and fuel for domestic fires; sawdust for smoking meat and fish; oak galls for making ink; and wood for charcoal and hence for smelting iron – especially here in the Weald where iron foundries abounded until the end of the sixteenth century. But the English oak, one of the hardest and most durable woods in the world, was most prized for its timber – as boards for flooring, support beams for houses and barns and most important of all, for an island nation, for ship-building.

‘See that limb there,’ said Ted, extending his arm to mirror an upwardly arching branch, ‘split in two that makes a matching pair of timbers for the hull of a ship. And the genius of it was, you didn’t have to kill the tree to do it. You could just take the limbs that suited what you needed them for.’ The

oak's very name in Latin, *Quercus robur* , resonates strength and until the middle of the nineteenth century shipbuilders relied almost entirely on oak, 'the wooden walls of Old England' carrying sailors around the globe, fuelling the expansion of the British Empire. The tree is saluted in the naming of eight HMS *Royal Oak* warships down the centuries, in the 'Hearts of Oak' march of the Royal Navy and even in a verse of 'Rule, Britannia'.

But beyond its historic associations, it is for biodiversity in the present day that Ted most bemoans its loss. 'You never see crowns like these in woods,' he said looking across at five or six trees, spaced generously apart, standing between us and the lake. 'Oaks need light and space.' Spreading horizontal limbs in all directions to make the most of the sun, an open-grown English oak has six times the leaf cover of woodland trees. 'That's 360 degrees of niches and cover for wildlife,' he said. It supports more life forms than any other native tree, including over 300 species and subspecies of lichens and a staggering number of invertebrate species, providing food for birds including treecreepers, nuthatches, pied flycatchers, great and lesser spotted woodpeckers and several species of tits which nest in the tree's holes and crevices, or in the spreading branches. Bats roost in old woodpecker holes, under loose bark and in the tiniest of cracks. Its acorns –

millions over a lifetime – feed badgers and deer in the run-up to winter, as well as jays, rooks, wood pigeons, pheasants, ducks, squirrels and mice, which, in turn, attract birds of prey such as owls, kestrels, buzzards and sparrowhawks, which may also nest in oaks. The soft leaves – 700,000 produced by a mature oak every year – break down easily in autumn, forming a rich leaf mould on the ground – habitat for scores of fungi including many colourful milkcaps, boletes, brittlegills and truffles. But it is when it begins to retract and hollow with age that the oak really comes into its own as an ecosystem. As the heartwood rots down, the slow release of nutrients gives the trunk a new lease of life. The droppings of bats and birds roosting inside the hollow tree provide additional fertilizer. Bat guano, indeed, contains levels of phosphate and nitrogen as high as the guano of seabirds. Fallen branches supply yet more nutrients to the roots. Key to this recycling process are yet more fungi, this time visible and above ground – such as the edible and appropriately named chicken-of-the-woods and beefsteak fungus. Fungi, often maligned as the harbingers of death for trees, are more often decomposers of deadwood than they are parasites, explained Ted. Rather than causing a tree to die, they rid it of the useless burden of dead tissues, breaking them down and creating another reservoir of plant nutrients accessible to the roots. In the process they