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Bwrdd Iechyd Prifysgol Caerdydd a'r Fro
Cardiff and Vale University Health Board

Recall of the wild:

Reconnecting with and restoring nature for biodiversity and health

Annual Report of the Director of Public Health - 2022
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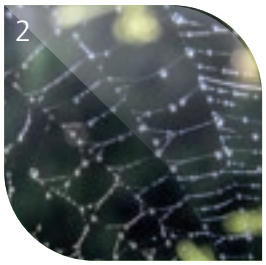
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The 'biodiversity stripes'[1] provide a stark visual representation of the change in biodiversity over time from 1970-2018. Each coloured band represents a year, with the highest level of biodiversity coloured bright green and lower levels moving through yellow to grey, depending on the level of decline. Greater declines are indicated with darker greys. As the stripes show, our world is fading from green to grey.

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Foreword

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We are in a nature emergency – since 1970, there has been a 69% decline in biodiversity globally, with 1 in 6 species in Wales now facing extinction. Given this picture, how can we, as senior leaders and active participants in society, and as anchor organisations, make a positive contribution to support nature to recover and thrive for the benefit of future generations and their wellbeing?

I grew up in the countryside in the rural Borders of Scotland. Little did I know at the time that forty years down the line, many of the birds that I would hear or see as a child, like the cuckoo and the curlew, would be a rare experience today. Little did I know that most children may never see in their lives more than a couple of species of butterfly, or know what a hare looked like other than in story books or on their mobile phones. That wildflower meadows would be scarce, and that many people may never set foot in or appreciate nature for all the benefit it provides.

This is an all too familiar story for people and local communities living across Cardiff and the Vale of Glamorgan, Wales and the rest of the world in the present day. Without action to reverse and restore our biodiversity loss, there is a real danger that future generations, forty years from now, will not experience and enjoy much of the nature that we have left.

This significant decline in biodiversity isn't just bad for the species and habitats affected, it also has clear detrimental impacts on our physical and mental health. As you will see in this report, there is strong evidence that nature offers multiple health benefits, from improving our mental wellbeing to promoting physical activity; mitigating climate change, and providing sources of medicines for disease treatment.

We are losing both the abundance of nature and our connection with nature, which throughout our history on this planet have been key to our development and survival. The very thing that has supported our growth and evolution is being extinguished by our actions, with climate change, land-use changes and overexploitation amongst the causes of biodiversity loss. There is an urgent need for us to reconnect with and restore nature for increased biodiversity and the many associated health benefits this brings.

There is work going on in Cardiff and the Vale of Glamorgan, and Wales, to try and reverse this biodiversity loss, details and case studies of which are featured throughout this report. But is it enough?

We can reconnect with nature by regularly spending time outdoors in green spaces and the natural world, appreciating the changing seasons, and valuing its beauty. We can restore nature by gaining an understanding of the health benefits, protecting the natural areas we still have, and creating improved natural spaces in which species can thrive.

None of us can do this alone. It is the responsibility of government, organisations and all of us to take action and return our greying world to a green one. The nature emergency is not a future problem, it is happening right now, and has been for many decades. Nature needs us, but for our health and very survival, we also need nature.

"Deep in the forest a call was sounding, and as often as he heard this call, mysteriously thrilling and luring, he felt compelled to turn his back upon the fire and the beaten earth around it, and to plunge into the forest, and on and on, he knew not where or why; nor did he wonder where or why, the call sounding imperiously, deep in the forest."

The Call of the Wild, Jack London

Chapter 1: The nature emergency

What is biodiversity?

Biodiversity is defined as 'the number and types of plants and animals that exist in a particular area'[2], or the 'diversity of living organisms, whether at the genetic, species or ecosystem level'[3]. It is a term that can be used to describe the huge variety of life on Earth, referring to every living thing, including animals, plants, bacteria and fungi[4], along with different habitats[5]. It can be used to describe the number of species in any specific region or location, from a country park to a garden, or a small grass area on a street.

If an area contains lots of different species, it would be deemed as having high biodiversity or being very biodiverse. At the other end of the scale, an area without much living in it, or having lots of only a few species, would be deemed as having low biodiversity, or not being very biodiverse. So even places that we may think of as being 'green', like fields in the countryside, may not actually be very biodiverse if they contain only cattle and pasture grass, with limited other species. Research has found that humans can be good at intuitively identifying how biodiverse an area is, with perceived and actual biodiversity across different habitats relating well in studies[6,7,8,9].

A biodiverse Wales?

Wales has a diverse landscape, with varied ecosystems across mountain ranges, grasslands, woodland, coastal areas and waterways supporting rich and diverse wildlife[10]. It has 21 Special Protection Areas (SPAs) for rare and vulnerable birds and 95 Special Areas of Conservation (SACs) for other rare species and threatened natural habitats. The combined areas of SPAs and SACs is 8.5% of Welsh land area[10]. Along with these, Wales also has 1078 designated Sites of Special Scientific Interest (SSSIs), 139 Marine Protection Areas (MPAs) and 76 National Nature Reserves (NNRs)[10]. Definitions of protected sites are provided in *Appendix 3*.

Today, the total number of species in Wales is likely to exceed 50,000[11].

Native terrestrial species include[10]:

11 species of amphibians and reptiles
(collectively known as herpetofauna)

49 species of free-ranging mammals

220 regularly occurring bird species

Over 20,000 species of invertebrates, including:

550 spider species

around 3000 beetle species

around 1800 butterfly species

around 4000 fly species

This may sound like Wales is rich in biodiversity, but these numbers represent only a portion of the biodiversity Wales has had in the past. Details of the current nature emergency are covered later in this chapter (see *The nature emergency*).

A biodiverse Cardiff and Vale?

The landscape varies greatly across Cardiff and the Vale of Glamorgan, with diverse habitats supporting a variety of plant and animal species. This can be seen in ***Figure 1***, with habitats ranging from the rolling rural patchwork of farmland and woodland in the Vale of Glamorgan, to the urban areas of the city of Cardiff, the inter-tidal ranges of the Severn estuary, and the rugged heritage coastline in the West of the Vale of Glamorgan[13,14]. Many of these areas have unique aspects and are vital for the survival of thousands of species.

Figure 1: Land-use in Cardiff and Vale of Glamorgan[15]

Coastally, the tidal range of the Severn estuary is the second highest in the world[13], and there are reefs in the Vale, created by honeycomb worms and providing habitats for seaweeds and mussels[14]. Dunraven Bay is home to Shore Dock, a rare plant, whilst East Aberthaw is nationally valued for its limestone cliffs, saltmarsh, shingle pits and relict sand dune habitats[16].

In terms of woodland, the largest continuous area of woodland in Cardiff is a 618-acre (around 375 football pitches) section from Castell Coch to the bluebell-blanketed Coed-y-Wenallt[13]. Along its northeast corner Cardiff has the only 'green belt' in Wales, which protects land and restricts building[17].

Over half of Cardiff's woodland is classified as ancient, defined as having continuous tree cover since 1600 AD[13]. An area of 284 acres of beech woods in Cardiff is the most westerly naturally occurring beech wood in the UK, with beech trees themselves supporting 200 lichen species and around 100 species of invertebrates[13]. The three major rivers (the Rhymney, Taff and Ely) provide wet woodland habitats, which is favoured by willow trees, second only to oak trees in the number of species they can support[13]. Oak trees are also common in Cardiff, which can support over 400 species of invertebrate[13], whilst the Vale holds 90% of all known 'true service' trees in the UK[14]. Perhaps surprisingly, there are even fragments of temperate rainforest scattered throughout Cardiff and the Vale, giving indications of the historic environments of the region[18].

Tree canopy cover in urban areas is below the average for Wales (16.4%), at only 15.3% cover in Cardiff and 12.3% in the Vale, and has been decreasing[19]. Over two thirds of this urban tree

cover is in the form of amenity trees, which are individual or small groups of trees along streets, verges and gardens[20,21]. Around a quarter of the urban trees are found in gardens, and almost half of the tree canopy is found in open public spaces. Transport routes, including verges and pavements, account for roughly 18% of our urban areas, but contain only 11-12% of overall tree cover.

Figure 2 illustrates the different land uses in our urban areas, along with the proportion of these areas that have tree canopy cover. As we will see in *Chapter 2*, trees and their cover can be hugely beneficial to both our health and biodiversity, so these low and decreasing figures raise concern and present an opportunity to find ways to intervene to improve both our health and biodiversity.

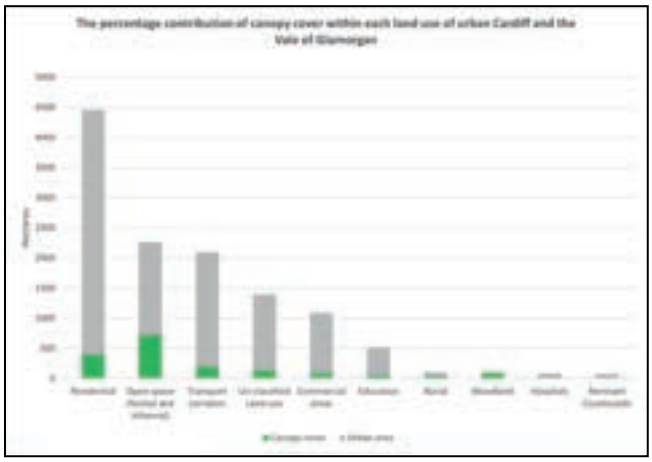

Figure 2: Land-use and tree cover in urban areas of Cardiff and Vale of Glamorgan[18]

Parklands amongst the urban areas provide a variety of habitats and access to green space, including Porthkerry in Barry which covers 220 acres[14], and Bute Park in the centre of Cardiff which covers 442 acres[13]. Even smaller areas of green space contain hidden treasures, with Coryton roundabout, located between the M4 and A470, containing five species of orchid[13].

If observing Cardiff and Vale of Glamorgan from above over the last few centuries, you would witness a changing landscape. As human-made spaces were established and grew, the use of the land drastically changed. Woodland gave way to agriculture, industry and residential areas. Ironically, this was fuelled largely by the demand for ancient, decayed plants and forests in the form of coal, the export of which led to the growth of our coastal urban areas of Cardiff and Barry. As coal and other industries stopped, these industrial areas changed again, becoming commercial and residential developments in Cardiff Bay and Barry Waterfront, or nature areas like the water-filled gravel-work quarries of Cosmeston Lakes[17]. These human-made lakes are now home to Wales' only population of Starry Stonewort[13], and are one of the richest sites in South Wales for dragonfly and damselfly breeding[17], demonstrating that man-made nature areas can boost biodiversity. Incidentally, all lakes and reservoirs in Cardiff are human-made[13].

Urban areas have expanded across formerly open countryside over the last century, with farmland decreasing to about a quarter of the Cardiff area[13]. Conversely, the Vale of Glamorgan is dominated by farmland[14], as is most of Wales with 88% of land used for agriculture[22]. The majority of species-rich grassland have been lost in the 20th century due to the use of fertilisers, ploughing and re-seeding, leading to improved grass growth which outcompetes the native grassland species and destroys much of the soil fungi[13]. This is the case across the whole UK, where 95% of natural species and flower-rich lowland grasslands have been lost since 1940[13].

Clues to the past natural landscapes of our urban suburbs and villages can be found in some of our urban place names: Cyncoed is derived from Cefn Coed, meaning 'wooded ridge' (which it was until a century ago); Tremorfa translates to 'town on the marsh'; Pendeulwyn (Pendoylan, near Cowbridge) means 'the head of two groves'; and Heath gains its name from being built on what was an area of densely wooded common land until the 18th century.

In terms of diversity, recordings at the **South East Wales Biodiversity records Centre (SEWBReC)** include over

14,000

different species for **Cardiff and the Vale of Glamorgan.**

The Vale of Glamorgan is one of the most important areas for butterflies in Wales[23], including being the last site in Wales to find the high brown fritillary butterfly[24].

The varied and important habitats and species found in Cardiff and the Vale of Glamorgan are reflected in the number of designated protected areas and sites across the region, including three Special Areas of Conservation (SACs), one Special Protection Area (SPA), one Ramsar Site, 41 Sites of Special Scientific Interest (SSSIs), nine Local Nature Reserves (LNRs) and over 500 Sites of Importance for Nature Conservation (SINCs)[25]. The locations of these are highlighted in ***Figure 3***.

Figure 3: Location of designated protected areas in Cardiff and the Vale of Glamorgan[25]

The nature emergency

While we may think that the nature statistics described here represent high biodiversity, in fact this is just a fraction of the biodiversity we used to have. However, we fail to grasp the scale of this due to 'shifting baseline syndrome', whereby each generation accepts current levels of nature as the norm, rather than being aware of what we have lost[26,27].

The biodiversity around today is the result of 4.5 billion years of evolution[28]. Throughout the history of life on Earth biodiversity has varied during different periods, with phases of thriving biodiversity separated by five mass extinction events[29]. These mass extinction events are defined as times when the Earth loses more than 75% of species in a geologically short interval[30]. Evidence suggests that a sixth mass extinction event is now underway[29]. However, the difference between this one and the previous five is that it is being caused by humans[29].

Despite Wales having a biodiverse past, and the potential for a more biodiverse future, along with the rest of the world its present is becoming less

and less biodiverse. So much so that on 30 June 2021 the Senedd declared a nature emergency for Wales, acknowledging the significant loss of biodiversity caused by humans[31]. This was followed by declarations of nature emergencies by Vale of Glamorgan Council on 30 July 2021[32] and Cardiff Council on 25 November 2021[33].

The nature emergency isn't a future problem, it is happening right now, and has been for many decades. But despite this, awareness and coverage of biodiversity loss has been limited in comparison to the climate crisis, to which it also contributes[34].

Globally

In 2019, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) released a landmark report on their global assessment of biodiversity, which identified the status and trends of the natural world[35]. They concluded that biodiversity and ecosystem functions are deteriorating worldwide, at rates unprecedented in human history, with an accelerating rate of species extinction.

Between 1970 and 2018, the population of birds, mammals, amphibians, reptiles and fish dropped by an average of 69% globall[36]. This has been illustrated by the 'biodiversity stripes'[1] (see ***Figure 4***), which provide a stark visual representation of the change in biodiversity over time. Each coloured band represents a year, with the highest level of biodiversity coloured bright green and lower levels moving through yellow to grey, depending on the level of decline. Greater declines are indicated with darker greys. As the stripes show, our world is fading from green to grey.

In terms of biomass, humanity has overseen the loss of:

83% of all wild mammals[37]

80% of marine mammals[37]

15% of fish, and half of plants globally[37]

Around one million animal and plant species are now threatened with extinction, many within decades[35]. One in five plant species are at risk[38]. The average abundance of native species in most major land-based habitats has fallen by at least 20%, mostly since 1900[35]. The average loss rate of vertebrate species over the last century is up to 100 times higher than pre-human extinction rates[39].

Figure 4: The biodiversity stripes[1]

"Nature and its vital contributions to people, which together embody biodiversity and ecosystem functions and services, are deteriorating worldwide"

IPBES Global Assessment Report on Biodiversity and Ecosystem Services (2019)[35]

Yet humans contribute a very small proportion to the total biomass of all life on Earth. Plants comprise 82% of all living matter, with bacteria accounting for 13%, all other creatures combined making up just 5%, and the human contribution being just 0.01%[37]. The overwhelming majority of life is land-based, with just 1% found in the oceans. Despite this, our 0.01% of life has transformed the rest of life on Earth, particularly due to agriculture.

Of all bird life on the planet,

70% is farmed poultry[37].

Considering mammals on Earth,

just 4% are now wild animals, 36% are humans, and a staggering 60% is livestock[37].

That means that of all mammals on Earth,

96% are livestock and humans, and just 4% are wild animals[37].

Our livestock account for 1.6 times the amount of life mass that we do.

Considering these numbers and the loss of animal and plant life, it is clear to see why our biodiverse world is fading from green to grey.

Wales

In Wales, the current trends are similarly bleak to the global situation. The State of Nature report Wales[40] presented an overview of the nation's wildlife situation, highlighting the widespread loss and degradation of habitats across Wales prior to 1970, and concluding that, on average, **Wales' wildlife has declined since 1970.**

1 in 6 species that have been assessed are at risk of extinction[41]

18% of 3,897 species studied in Wales are threatened with extinction[41]

An average of 20% decline in species' abundance since 1994[41]

Megafauna lost to Wales include wolves, brown bears, elks, beavers and lynx. These would all have been common in Wales in previous centuries[11].

The abundance of 33 butterfly species has fallen by 52% since 1976[40]

1 in 3 mammal species threatened with extinction[42]

Hedgehog populations are estimated to have declined by 60% since 1995[40]

Welsh dormouse populations have declined by 79% between 1993 and 2014[40]

1995-2018: Swifts down 72%, greenfinch down 71%, chaffinch down 38%[43]

Loss of more than 90% of semi-natural grassland habitat[40]

Only 15% woodland cover, with only 48% of this considered native[40]

Tree canopy cover in urban areas is only 15.4% in Cardiff and 12.3% in the Vale[19]

Why is biodiversity decreasing?

It is clear from the scientific evidence that biodiversity is being lost on a global, country and local level, but why is this happening? Understanding the threats to biodiversity is essential if we are to restore nature and the health of the planet, upon which our own health depends.

The five most significant drivers of biodiversity loss are human land-use, climate change, pollution, invasive non-native species and species overexploitation[35].

Human land-use:

The main driver of biodiversity loss is the change in land-use by humans, leading to destruction of habitat and modification of the environment[44,45]. Human activity has altered over 70% of all ice-free land globally[46]. Since the industrial revolution, human activity has increasingly destroyed pristine native habitats, such as forests, wetlands, grasslands and other important ecosystems, primarily to make way for food production[47]. In the UK, 69% of the land area is managed for agriculture[48], whilst in Wales the figure is almost 90%[16], with most of that intensified for food production[49,50]. Where and how food is produced to feed ever-growing populations of humans, livestock and pets is one of the greatest human-induced threats to nature.

Other common changes in land use worldwide include logging, transportation, energy production, mining and residential or commercial development[35].

Pollution:

Pollution can cause habitats to become unsuitable for a species to survive in, either directly by causing harm to a species or indirectly by impacting on the food supply or reproductive ability[54]. Some forms of pollution can have a sudden impact (such as an oil spill), whereas others can have a more gradual effect (such as microplastics)[54].

In Wales, 62.7% of the SSSIs either partly or entirely exceed the ammonia critical level for their qualifying habitat or species features[55]. Intensive agriculture produces most of the ammonia pollution, which causes impacts on nitrogen-sensitive ecosystems in surrounding areas[28]. Pesticides are another form of pollution, although people may not think of them in this way as they are often marketed as 'garden essentials' to help 'protect and enjoy garden moments' by garden centres[56], with the global market for them expected to grow by 5% a year through to 2028[57].

Invasive non-native species:

The term 'invasive non-native species' refers to a species introduced, intentionally or unintentionally, outside its native range by humans, which causes damage to the environment and native species[58]. The introduction of non-native species to an area can have detrimental, even devastating impacts on native species. New diseases can be spread, competition for resources, food and space can arise, or native species can become prey for invasive species[35].

In the UK, as of 2021, there were approximately 2,000 non-native species established, with 10 to 12 new species becoming established every year[59]. Invasive species that are widely spread in Wales include the grey squirrel, muntjac deer, Japanese knotweed and giant hogweed[60,61]. The American mink, which escaped from fur farms, had a devastating impact on water vole populations in Cardiff[10].

Species overexploitation:

This can occur either directly, when a particular species is targeted for food, trade or sport, or indirectly, when a species is killed as an unintended consequence, such as bycatch in fishing trawler nets[35]. Since the early 1990s, no country has met the basic needs of its population without overconsuming natural resources[62].

Climate change:

Climate change is playing an increasingly large role in the decline of biodiversity, altering marine, terrestrial, and freshwater ecosystems around the world and locally[51]. It has caused the loss of local species, increased number of diseases and their spread, and driven mass mortality of plants and animals, resulting in the first climate-driven extinctions[28]. The risk of species extinction increases with every degree of warming[52].

Climate change impacts the health of ecosystems and alters habitats, leading to shifts in the distribution of plants, animals, humans and viruses, creating the opportunity for diseases to spread between species, including to humans from animals[28]. This has already been observed in Wales, with species such as migratory birds moving northwards and uphill as the climate warms[53].

There is growing evidence that climate change is driving widespread and rapid changes in the abundance, distribution and ecology of the UK's wildlife, causing changes to species communities which are projected to continue for decades or even centuries to come[40].

Cardiff and the Vale of Glamorgan will have warmer, drier summers and wetter, milder winters in the coming years as a result of climate change, with a rise in sea levels and increased extreme weather events[13]. Wildfires are a risk in hotter dry summers, with 10 wildfires recorded in the Vale in 2018-2020[23]. All of these changes will impact local wildlife and natural habitats, putting a strain on vulnerable species.

Chapter Key Points

- Biodiversity is a term that can be used to describe the huge variety of life on Earth, referring to every living thing, including animals, plants, bacteria and fungi, along with different habitats.
- We are in a global Nature Emergency, with evidence of a human-caused sixth mass extinction event underway[29]. Despite Cardiff and Vale of Glamorgan having a biodiverse past, and the potential for a more biodiverse future, along with the rest of the world it is currently becoming less and less biodiverse.
- The main threats to biodiversity loss arise from human activity: land-use, climate change, pollution, over-exploitation, and non-native invasive species[35].

'But the humans weren't content with that' Badger went on bitterly. 'They began to fell our trees. They continued to do so, at regular destructive intervals, until what was once a large wood had been cut back to the present sad remnant, not much larger than a copse'.

'What do you think will happen Badger?' asked one of the rabbits timidly.

'Happen?' Badger echoed. 'Why, the same thing that has been happening. They will cut down more trees, and build more houses, and shops, probably a school, and offices and roads, and ghastly concrete posts and signs everywhere, faster and faster and faster still, until eventually...' He broke off with a despairing shake of his head.

'Until eventually we are destroyed with the wood'. Tawny Owl finished the sentence with determined pessimism.

From The Animals of Farthing Wood
by Colin Dann (1979)

Chapter 2: Nature and health

Why is biodiversity important?

In Cardiff and the Vale we are facing a number of health challenges, including an obesity crisis, an increasingly physically inactive population, growing mental health challenges, and a climate emergency[63]. Nature can help with all of these health challenges, as well as improving our physical and mental wellbeing[64]. All goods and systems that support human health and wellbeing can be traced back to nature[65], making us fundamentally dependent on the natural world[66]. However, as will be covered in *Chapter 3*, our modern lifestyles and growing urban areas can lead to human contact with nature becoming less frequent[67], meaning the opportunity for health benefits can be missed and lost.

Biodiversity provides the building blocks of ecosystems and healthy natural environments, providing a range of benefits described as ecosystem services[5]. These ecosystem services contribute to making human life both possible and worth living[68]. They can be placed under the categories of supporting, provisioning, cultural and regulating, examples of which are shown in ***Figure 5***.

Figure 5: Ecosystem services provided by nature, taken from from Welsh Parliament Senedd Research[5]

It has been said that species are to ecosystems what rivets are to a plane's wing[69]; losing one might not be a problem, but each loss adds to the likelihood of a disaster. Biodiverse nature is our most important life-supporting safety net[63], and unless the historic and current declines in nature are reversed, regressions in human safety, food and livelihood security, and physical and mental health will continue[10].

The *Future Generations Report 2020* sets out a vision for a resilient Wales in 2050, with everyone in Wales having access to green space that is nature-rich to 'increase wellbeing, improve mental wellbeing, reduce exposure to environmental hazards and air pollution, improve air quality and bring people together in community activities'[63].

How nature improves our health

Nature can help improve our heath in many ways:

Physical activity:

Being physically active has many benefits to our health[70], but in Cardiff and Vale of Glamorgan only 58% of people meet the national guideline levels, with over a quarter (29%) of our population classed as physically inactive[71]. Natural and green spaces create opportunities for physical activity. Research suggests that being physically active in green environments, as opposed to artificial environments such as gyms, can be more supportive of human health[64,72,73]. Being active in natural outdoor environments has been associated with increased energy and attention, reduced fatigue and negative emotions, and an increased intent to do it again[64,72]. Walks in a forest, more so than in an urban area, can increase physiological health-protective factors against cardiac problems, diabetes, obesity, cancer and viral infections, amongst others[74,75,76].

Social interaction:

Humans are social creatures, with human contact and social networks being positive for our health and wellbeing. Social isolation and loneliness is a widespread problem in our society, with two thirds of people in Wales reporting that they are lonely some or all of the time[77]. Public green spaces have been associated with social interaction[78] and improved social networking, which can also lead to reduced violence, aggression and crime[79,80]. Research has also found that having nature nearby can buffer the effect of low social connectedness, offering socially isolated individuals a way of feeling connected[81].

Microbiome:

The human microbiome is the collection of microbes that live on or inside the human body[82], the diversity of which can have impacts on our health[83]. We live in a biodiverse environment but are also biodiverse environments ourselves: the ratio of bacterial to human cells in and on our bodies is estimated at 1.3 to 1[84]. However, urbanisation has been linked to a decrease in microbiome biodiversity[85]. Being in nature increases exposure to a variety of micro-organisms which may be important for our microbiomes, immune system development and inflammatory response regulation, including bacteria, helminths and protozoa[86,87].

Plants can give off phytoncides (antimicrobial organic compounds) which boost immune functioning, reduce blood pressure and alter autonomic activity[88,89,90], whilst microbes within our bodies facilitate processes such as immune system regulation, food breakdown and nutrient uptake[87]. Biodiversity is therefore important for both the environment inside us and the external environment around us!

Climate change adaptation:

Due to climate change the global climate is warming, bringing projected increases in the frequency and severity of extreme heat and flooding event[91,92,93]. Increased ambient temperatures and adverse health outcomes have an established link, with associations found between increased temperatures and heat waves and mortality[94]. Maximum temperature records were broken in Wales in the summer of 2022, with temperatures reaching 37.1C for the first time[95]. Between June and August 2022 3,271 excess deaths occurred in England and Wales due to heat events.[96] Green spaces can have a cooling influence on surface radiating temperature (SRT), cooling an urban area by 2°C, which is beneficial to health[97,98]. Increasing city tree coverage to 30% could reduce heat-related city deaths by up to 40%[99]. Trees and vegetation can also help prevent flooding in our urban areas by slowing and absorbing surface water run-off[98], with interception by leaves and stems reducing the amount of rainfall reaching the ground by as much as 45%[100]. Cardiff faces the highest climate induced flood risk in the UK, with 15% of properties at risk of flooding by 2050[101]. Nature-based solutions could be vital in mitigating this risk.

Clean air:

Cardiff has the highest particulate matter and nitrogen dioxide pollution levels in Wales[102], with levels consistently above World Health Organisation (WHO) recommendations. Green spaces can help mitigate against air pollution, which has negative impacts on climate change and our health[103,104,] including heart attacks and respiratory problems[105]. It is estimated that average life expectancy of UK residents is reduced by 7-8 months due to air pollution[106]. Emerging evidence also suggests that increasing particulate matter is linked with increasing antibiotic resistance[107], which is a major threat to human health[108]. Recognising the risk to health, the WHO recently reduced recommended upper limits for particulate matter ($PM_{2.5}$) from 10 to 5mcg/m^3 annual mean exposure[109].

Land and ocean environments, particularly ecosystems of forest and peatlands, currently absorb half of the greenhouse gases humans produce, acting as natural carbon sinks as a cost-effective nature-based solution to climate change[10,28], whilst also producing oxygen and filtering the air[87]. Trees can cut air pollution by 50%[98]. Improving nature's ability to absorb emissions, through conservation and restoration, could achieve around one-third of the greenhouse gas emission reduction needed in the next decade[35].

Relaxing and calming:

Stress is the body's reaction to feeling threatened or under pressure, causing adrenaline to be released so we can react quickly a situation. Too much stress can affect our mood, body and relationships, potentially leading to ill

health, exhaustion and 'burnout'[110]. A 2018 survey found that 74% of people in the UK had felt so stressed in the last year that they felt overwhelmed or unable to cope[111], whilst in Wales 32% of people have low wellbeing[112]. In the UK, stress, depression and anxiety accounted for 17million days off work in 2021/22[113].

Being in and around nature, or even just seeing and hearing the sights and sounds of nature, can have important physiological impacts which boost our health[114]. If experienced regularly, these could account for long-term health and wellbeing effects[114]. Research suggests that spending 2 hours a week in nature is associated with high levels of wellbeing[115].

Relaxing physiological responses to nature include reductions in heart rate, diastolic blood pressure, reduced cholesterol, and reduced salivary cortisol, the stress hormone[67]. Even images of nature and window views have been found to reduce sympathetic nervous activity and increase parasympathetic activity which is usually associated with periods of relaxation[116,117].

Pharmaceutical opportunities:

The natural world has provided us with the ingredients and inspirations for many of our drugs and treatments that we use for multiple diseases and ailments[87]. Around 60,000 species are used for their medicinal, nutritional and aromatic purposes[65], with around a third of modern pharmaceuticals being directly derived from compounds found in the natural world[118]. For example, aspirin is an extract of willow bark and has been used for centuries as a natural remedy; and quinine is a natural anti-malarial from the Andean 'fever' tree[92]. At Cardiff University, the Pharmabees project involves creating a bee-friendly city to assist their research exploring how the pollination of certain plants could lead to the development of new drugs to treat antibiotic-resistant 'superbugs'[119]. There is a significant role for discovery of new compounds from natural ecosystem biodiversity in future healthcare.

Food provision:

A healthy, balanced diet is important for our health, and all of our food ultimately comes from nature. Biodiversity of agricultural systems, including crop and livestock production and forestry, contributes to the provision of diverse healthy diets and food security. Nutritious dietary diversity plays an important role in our gut microbiome and general health, maintaining a healthy weight and non-communicable disease prevention. Animal pollinators increase production of three quarters of our agricultural crop varieties[120]. Fertile soil and pollinators are essential for diverse food production, but accelerating declines in soil quality and pollinator numbers are impacting the nutritional value and security of food[87,121].

The Nature Friendly Farming Network (NFFN), which has networks across the UK, is a group of farmers who have come together to champion a way of farming which is sustainable and good for nature. One such technique is regenerative farming, which is a way of farming that aims to improve soil health. This has the benefits of producing more food and nutrition, increasing biodiversity, and storing more carbon[122]. An example of where this is being doing in Cardiff and Vale of Glamorgan is at Slade Farm.

As a result of these positive health impacts, research has shown significant health outcomes associated with nature and biodiversity, including:

- Reduced all-cause mortality[67,123,124]
  Providing a basic level of access to green spaces could prevent an estimated 40,000+ deaths each year in cities across Europe[125].
- Improved birth outcomes[126,127]
- Reduced incidences of type 2 diabetes[67,128]
  Exposure to green space has been significantly associated with less cases of type 2 diabetes[129]
- Increased reporting of good health[67,124]
- Sleep improvement[130,131,132]
- Boosts immune function[133]
- Promotes healing and restoration[134,135,136]
  Post-operative surgical patients given a room with views of nature have been found to recover quicker, with shorter hospital stays and less analgesics taken, compared to those without nature views[134]
- Restore attention[137]
- Reduced stress[136,138,139]
  Just 15 minutes walking in a forest area can reduce stress hormone levels by 16%[140]
- Reduced mental health problems[141,142,143,144]
- Improved wellbeing and positivity[145,146,147]
- Reduced loneliness[148.149]

Health inequities

Health inequities (systematic unfair differences in the health status of different population groups[150]) are a key challenge in Cardiff and Vale of Glamorgan, with people in the most disadvantaged areas dying on average 9 years younger than people in our least disadvantaged areas[151]. Socioeconomic health inequities are a prominent feature, and environmental factors are one of the many causes[152]. Exposure to environmental health risks is often disproportionately high amongst those in disadvantaged areas with low socioeconomic status, whilst access to natural, biodiverse, health-promoting green areas can be low[87]. Air pollution is highest in the most disadvantaged areas[153], which can be improved by increased green space.

The greener a neighbourhood is, the greater the nature-health benefits are[154,155,156], with income-related health inequities lower in greener neighbourhoods[157]. A number of studies have reported stronger associations between green space exposure and birth outcomes, morbidity, and self-reported health for those from the most disadvantaged areas and low socioeconomic status groups[158,159,160].

However, reduced green space availability and ease of access has been found in low-income neighbourhoods[161,162], with residents of more disadvantaged areas less likely to use the greenspaces that do exist[163]. Conversely, residents with higher socioeconomic status have higher quality parks and frequency of use[164]. On average, those from the most disadvantaged areas have to travel 48% farther to visit open access green land than those from the least disadvantaged areas, whilst residents from the most ethnically diverse neighbourhoods have to travel 73% farther than residents of the most White-dominated neighbourhoods[165].

Individuals who lack access to green space are at higher risk of developing poor wellbeing than those that do have access[166].


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Provision and accessibility of green space, and creating opportunities for interactions with nature, may currently be an overlooked resource for decreasing health inequities. Research has found that as little as a 10% increase in green space exposure in urban settings can reduce health problems and improve wellbeing[167]. We need to develop interventions to help people access and use green space, particularly in those areas that stand to gain the greatest benefit, as a tool to help reduce health inequities[67].


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Chapter Key Points

- Nature can help with a variety of health challenges, as well as improving our physical and mental wellbeing.
- Benefits to health from nature are achieved through pathways including climate change mitigation, cleaner air, immune system boosting, food provision, relaxing effects, encouragement of social interaction and physical activity, and pharmaceutical opportunities.
- We do not all have equitable access to nature and green spaces, with those in the most disadvantaged areas having the least access but potential for the highest gains.

It is clear that there are a multitude of health benefits we can gain from being around nature and having biodiverse green spaces accessible to us all. Our relationship with nature is important for our health, but how connected are our current lives with nature, and how we can improve this relationship? *Chapter 3* will explore this.

Chapter 3: Reconnecting with nature

Nature connectedness

Nature connectedness is a term that refers to our connection with nature and whether we feel a part of it, being about our relationship with nature rather than simply time spent in nature[168]. Being connected with nature creates a sense of belonging to the wider natural worl[169], and has been identified as a basic psychological need[170,171]. A person's nature connectedness can change over time and in response to different experiences[172], being comprised of cognitive[173], affective[174], experiential[175], learnt[176], and personality factors[177].

Benefits of strong nature connectedness

- **A greater sense of wellbeing**[178,179,180,181,182]
  People with high nature connectedness, compared to those with low nature connectedness, are:
  - 1.7 times more likely to report that their lives are worthwhile than those with low nature connectedness[172]
  - 1.9 times more likely to report good general health[172]
- **Stronger pro-nature conservation behaviours**[183,184,185,186]
  People with high nature connectedness, compared to those with low nature connectedness, are:
  - 2 times more likely to report pro-environmental household behaviours[172]
  - 1.8 times more likely to report pro-environmental conservation behaviours[172]

Are we disconnected?

Throughout human existence we have had a strong connection with nature, with around 10,000 generations existing as hunter-gatherers for over 90% of our history[187]. Less than 0.01% of our history has been spent in modern urban surroundings, with the gap between this setting, and the natural setting to which we are best physiologically adapted, contributing to the 'stress state' of modern people[188]. We used to live as part of nature, but over the course of the agricultural, industrial and technological revolutions we have become distanced from nature[168]. Now, western societies may even view humanity as set apart from or above nature[189,190].

Currently more than 55% of people across the world live in cities, with a projected rise to 68% by 2050[191]. As of 2017, in Europe the proportion of people living in urban areas was 75%, and in the UK 83%[192]. As can be seen in ***Figure 6***, the gap between the proportions of those living in urban vs rural environments in the UK has been widening since 2000, and is projected to widen further through to 2050. More and more of us are moving away from nature, from green to grey areas. The resultant reduced nature contact[193] is a key risk factor for health problems, mental health issues, anxiety and depression[194,195]. Even culturally, references to nature in fiction, songs, and movie plots have been steadily declining since the 1950s[196].

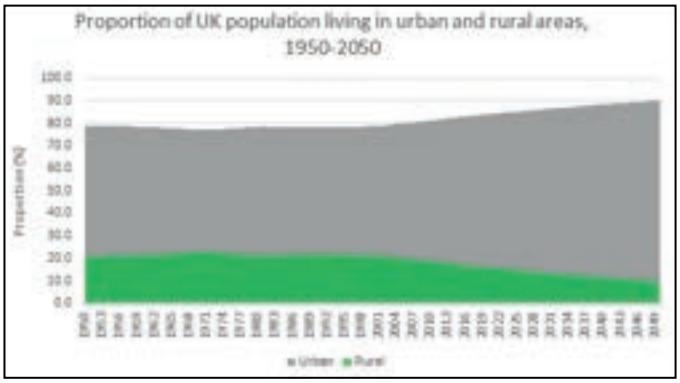

Figure 6: Proportion of UK population living in urban and rural areas, 1950-2050. Data source: Copyright © 2018 by United Nations, made available under a Creative Commons license CC BY 3.0 IGO: http://creativecommons.org/licenses/by/3.0/igo/ Available at: United Nations World Urbanisation Prospects 2018. Note: proportions are estimates to 2018, followed by projections.

In the UK we have a particularly distant relationship with nature compared to other European countries, scoring bottom for nature connectedness of 14 countries included in a recent study[197].

Only **59%** of people in England feel they are a part of nature[198],

with **93%** of our time spent either indoors or in a vehicle, and urban UK residents typically spending less than **five minutes** each day in green space[199].

One UK survey found that **80%** of people rarely or never watched wildlife, smelled wildflowers or photographed nature,

whilst **62%** rarely or never listened to birdsong or took a moment to notice butterflies or bees[200].

Nature connectedness can be quantified using the Nature Connection Index (NCI), which uses six questions to produce a weighted score from 0-100[201,202]. Research has found the average NCI score for the UK population to be 61, with women (64) scoring significantly higher than men (58) and a sharp dip in scores during teenage years[202]. This teenage dip has also been found in other research in the UK and in studies in other countries, including China and Canada[203,204]. The Canadian study also found that 25% fewer mental health symptoms were experienced by those teens with a closer nature connection[204]. Although nature remains a favourite place for teenagers to spend time, few take part in nature-based activities[205].

Childhood is an important time to develop a relationship with nature, but UK research has found only 18% of children have a strong connection with nature, whilst 46% had a low connection[206]. This presents a missed opportunity to create positive relationships that will have multiple benefits throughout life for both children and the environment[168].

Since the start of the COVID-19 pandemic and lockdowns in Spring 2020, people in the UK have reported visiting and noticing nature more, with 42% of adults visiting nature more and 30% noticing nature more[207]. This increase in noticing nature has been associated with a greater sense of having a worthwhile life and more pro-nature conservation behaviours[182].

The extent to which we are connected with nature varies across populations, often due to differing combinations of opportunity to interact with nature and desire to do so[207,208,209]. Those living nearer nature, or with a stronger desire to experience nature, are more likely to interact with it more often[210,211]. But simply visiting and accessing nature doesn't necessarily lead to nature connectedness or improved wellbeing; what is also important is actually 'tuning in' and noticing nature: 'creating moments, not just minutes'[212]. Our relationship with nature is not as connected as it could be, leading to missed opportunities for the health and wellbeing benefits this can offer. There is now global recognition that solving the planetary emergencies of both nature loss and climate change requires a reconnection with the natural world and restoration of the human-nature relationship[213,214].

How can we reconnect?

To achieve reconnection with nature we need to: ensure there is **nature nearby**, **spend time with nature**, and **notice nature**.

Things that can help us to do this include activities such as 'forest bathing' (immersing ourselves in woodland and taking it all in), and nature prescribing through health and social care settings (*see below*).

For organisations, it might be worthwhile to set up a 'nature group' of interested employees to help co-ordinate some of these actions and promote nature within the organisation, or ensure that biodiversity is included under existing green groups that an organisation supports.

Partneriaeth Bioamrywiaeth Cymru
Wales Biodiversity Partnership

Partneriaeth Natur Fro
Vale Nature Partnership

Partneriaeth Natur Leol Caerdydd
Cardiff Local Nature Partnership

Keep up to date with nature activities in Cardiff and the Vale, including biodiversity-related news and events, how to help biodiversity, and national and local actions and objectives:

The Wales Biodiversity Partnership (WBP) brings together key stakeholders from the public, private and voluntary sector to promote and monitor biodiversity and ecosystem action in Wales. Their website provides useful resources and links.

Locally, we have the Cardiff Local Nature Partnership and the Vale of Glamorgan Local Nature Partnership, who host regular meetings and events for getting involved with nature in local areas.

Nature nearby

To spend time with and notice nature it should be nearby as often as possible, having nature as a normal part of our everyday lives around us, rather than just something we need to find or go to. The more wildlife and natural spaces a country has, the greater the sense of close connection to nature and the likelihood people will engage with it, but the UK is one of the most nature-depleted countries in the world[168]. If there is less nature around, we spend less time with nature and experience it less, leading to us getting used to not having it around, and a more distant relationship becoming the norm. This makes us less concerned about nature, which feeds into reductions in nature and a self-reinforcing spiral.

We need to increase the quantity, quality and proximity of natural green spaces and wildlife in our daily environments: at home, in our local communities, in our work and educational settings. This will require taking actions to restore nature, which is covered in detail in the next chapter *(see Chapter 4)*.

One of the physical environment indicators in the Welsh Index of Multiple Deprivation (WIMD) is the proportion of households within 300m of an accessible, natural green space[215]. The latest data (2017) found that in Cardiff this was 76% of households and in the Vale of Glamorgan it was 85%, with a Wales average of 77%[215]. Out of the 22 Welsh Local Authorities, the Vale of Glamorgan ranks 5th and Cardiff 14th. A more detailed breakdown by local area is shown in ***Figure 7***, with an interactive map available here. It is important to note that although large areas of Cardiff and Vale of Glamorgan may be viewed as 'green' areas, such as the rural Vale of Glamorgan, this does not always mean they are accessible (such as private land) or natural (such as agricultural fields).

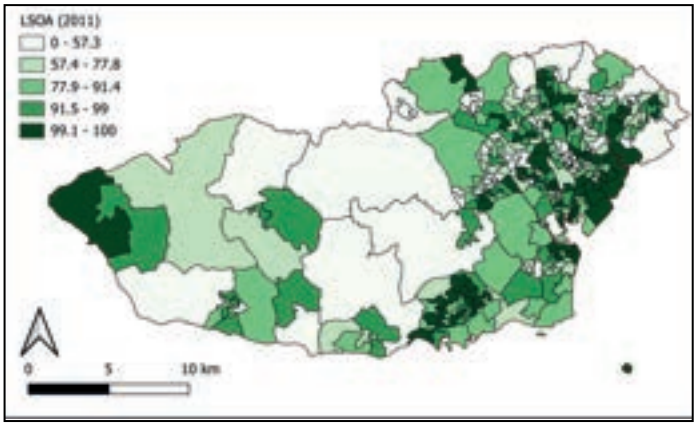

Figure 7: Percentage of households in proximity to accessible natural green space (2017). Adapted from OS data from InfoBaseCymru on the Physical environment indicators of WIMD, using QGIS[215,216].

Spend time with nature

Having nature nearby is one thing, but the full benefits of nature connectedness will only be achieved by spending time with it. As encouraged in Natural Resources Wales' *A Natural Progression*, step one is 'being in the natural environment, enjoying it and feeling comfortable in it'[217]. To facilitate this, we need to ensure that natural spaces are accessible for all, and understand the barriers to accessing these spaces.

Using insights from behavioural science, we are more likely to spend time with nature if it is 'normal, easy, attractive, and routine', details of which are provided in the table below[218]:

Spend time with nature in Cardiff and Vale of Glamorgan

Behavioural science principle[219]	**Ideas for organisations** **NB.** these will be more relevant to some organisations than others, depending on the nature of the organisation and its work	**Ideas for individuals**
Normal: we are more likely to do things that we see being done by people with whom we identify	Promote spending time with nature with case studies of employees or service users/clients. Showcase examples of creating natural spaces on estates that an organisation owns or manages. Weave ideas into organisational wellbeing communications to employees.	Join others who spend time with nature. Follow local nature groups on social media.
Easy: we are more likely to do things if they are simple, within our capabilities and require little by way of resources, time or effort	Identify barriers to having nearby nature, such as proximity of green space, location of access points, transport routes, area safety and potential entry and travel costs. Restore nature on estates and in communities so there is more of it (see Chapter 4). Create nature walking route maps starting from estates.	Discover what and where natural spaces are around your home and workplace and how to access them, e.g. using map services, local nature groups or exploring. Create natural spaces in and around homes so it is close. Learn new nature skills by attending local workshops and events. e.g. those promoted by the Local Nature Partnerships in Cardiff and the Vale of Glamorgan.

		Try using apps such as Merlin birdsong identifier, to understand and engage in the nature around you
Attractive: we are more likely to do things if we think they will be enjoyable, serve a purpose or avoid something bad happening	Promote the health benefits of spending time with nature, including its effect as a natural mood-lifter. Raise awareness of nearby nature and the functions it fulfils.	Gain an understanding of the health benefits of nature. Find a nature space that interests you the most: different habitats, different wildlife, instils different emotions.
Routine: we are more likely to do things if they are part of our routine so we don't have to think about them	Encourage and facilitate time outdoors for employees, such as outdoor break and lunch areas, walking meetings, regular involvement in nature volunteer schemes with partner organisations, including suggestions for any employees who work from home. Ensure employees can see nature around estates and from buildings, where possible.	Incorporate nature contact into your daily life: choose a commute that features natural settings, factor a regular walk through nature into the day, spend time outside each day.

Notice nature

Spending time in nature is an important aspect of reconnecting with nature, but we can maximise the wellbeing and environmental action benefits of a strong relationship by ensuring we actually notice nature when it is around us. For example, you may walk through a natural space on your way to work each day, but spend that whole time on your phone, listening to a podcast or thinking about the day ahead, without ever noticing the sights, smells and sounds of the trees, plants and wildlife around you. Actually noticing nature will bring about greater wellbeing benefits[168].

Noticing nature can be achieved by engaging with nature through simple activities - smelling wildflowers, appreciating street trees, flowering plants, or listening to birdsong - taking the time to really notice the nature around us and pay attention to our senses[168]. Learning techniques in mindfulness can help, which has been found to increase levels of nature connectedness and wellbeing during nature walks[220].

Other research has found that being prompted to notice the good things in urban nature can significantly improve mental health in both the general population and for people with mental health difficulties[181], and that noting what emotions were evoked can significantly increase the positive effect, feeling of elevation and a general sense of connectedness[221].

Guidance for nature connectedness has been summarised under five pathways[168,176]:

Senses - noticing and engaging with nature through simple things such as stopping to listen to birdsong, watching trees in the wind, or smelling flowers[181].

Emotion - engaging emotionally with nature by noticing the good things, experiencing the joy and calm they can bring, and sharing feelings about nature with others.

Beauty - taking time to appreciate beauty in nature and engaging with it through music, art or words.

Meaning - exploring how nature brings meaning to life through its appearance in culture, or celebrating the signs and cycles of nature.

Compassion - caring for nature by taking actions that are good for nature, such as restoring nature.

Forest bathing

Forest bathing, or 'shinrin-yoku', is the practice of slowing down and immersing yourself in a forest atmosphere[222]. First developed in Japan in the 1980s[223], spending time in a forest setting each week has been found to have positive effects on physical and mental health, including[224,225,226,227,228,229,230,231,232]:

- reducing anxiety, stress and depression
- boosting immunity
- treating chronic diseases
- regulating mood
- regulating blood pressure
- reducing blood glucose

The National Trust have produced a beginner's guide to forest bathing, available here: Forest bathing | Mindfulness | National Trust. Put simply, shinrin-yoku is about spending time in woodland and taking the time to notice your surroundings (the sights, smells, sounds and feels) to immerse yourself in the environment.


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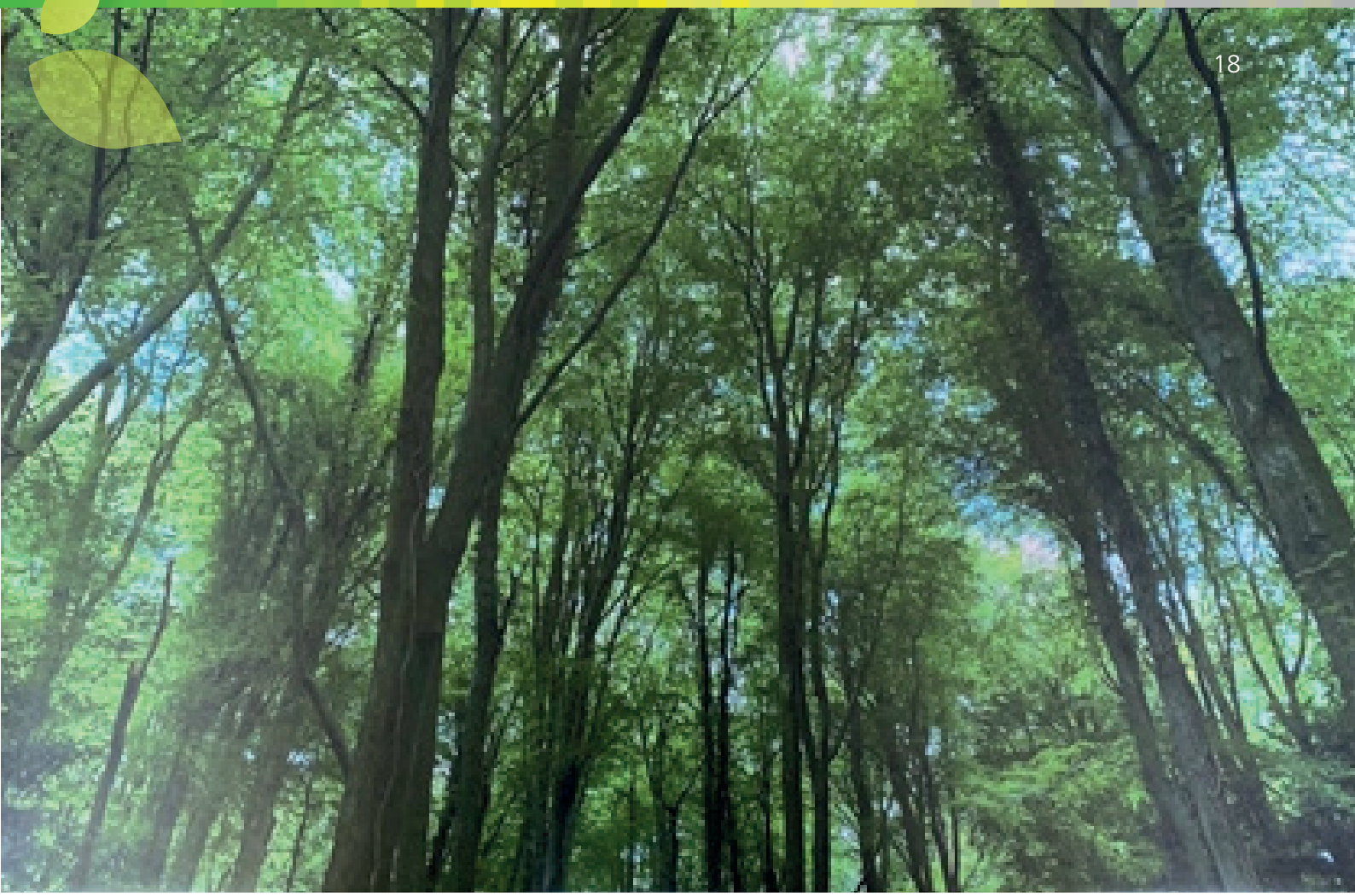

Nature prescribing

Improving the availability of green spaces is not necessarily sufficient for ensuring that everyone is able to access and benefit from them[233]. Nature prescriptions typically involve a health or social care professional recommending a person to spend a certain amount of time a week in a natural setting[233], emerging as a potential solution to empowering and enabling people to spend more time in nature[234].

The Royal Society for the Protection of Birds (RSPB) describes a nature prescription as "*a free to use, non-medical approach based on accessible, self-led activities that people can do anywhere, on their own or with others; and that aim to create lasting connections with nature. From birds to bees to buds*"[235].

A recent systematic review of nature prescribing outcomes has found a range of nature-based interventions to be effective across all age groups and a variety of health conditions, with a meta-analysis showing benefits to blood pressure, physical activity rates, and depression and anxiety[234]. It also found that the positive effects were stronger when the activities were instigated by a health or social professional with an existing connection to the individual.

Nature Prescriptions is a scheme commenced in Scotland in 2017 with the RSPB, whilst Green Social Prescribing was introduced in England in 2021, including activities such as nature walks, community garden projects, conservation volunteering, green gyms and outdoor arts and cultural activities. In the first two years of the England scheme, over 8500 people were referred to a green social prescribing activity, with interim evaluation findings showing positive improvements in mental health and wellbeing and strong engagement in communities with high levels of social inequalities[236]. The final evaluation report is due in late 2023.

In Wales, examples include Green social prescribing in the Cynon Valley, the Bridgend Association of Voluntary Organisations' (BAVO) Community Navigator Service, and the Grow Cardiff scheme. Cardiff and Vale University Health Board also has the Our Health Meadow project at University Hospital Llandough (*see case studies*).

Case Study:
Our Health Meadow, University Hospital Llandough

Our Health Meadow is a seven-acre area with meadow and woodland located at University Hospital Llandough (UHL). It is the first of its kind in the UK, offering a unique opportunity to deliver outdoor-based healthcare and rehabilitation for patients, volunteers, community groups and improve staff wellbeing, as well as providing space for nature to thrive and boost biodiversity on the Health Board estate. The goal is to establish an ecological community health park, which aims to benefit wildlife, plants and people through positive human environment interaction.

The project is run by Cardiff and Vale Health Charity, on behalf of Cardiff and Vale University Health Board, with Down to Earth, a Social Enterprise specialising in sustainability and improving mental health and wellbeing for participants.

Launched in 2015, every element of the site has been co-created with participants.

Since commencement, hundreds of patients and participants have benefited, taking part in woodcarving, path building, tree planting and maintenance, and currently building two roundhouses with green roofs and a seating area. Once fully completed – estimated for 2026 - the space can be used by anyone within the hospital as a place to rest, reflect and enjoy some tranquillity away from the wards, including patients, their visitors, and staff. It can also be used by local communities.

Users so far have reported improved social connection, wellbeing and perception of physical self and function after attending the site for rehabilitation sessions.

"It's so relaxing to be in nature – it seems a million miles away from the clinical environment in the unit"

– Employee member feedback

"After each session I felt more innate with nature"

– Patient user feedback

In 2022, Our Health Meadow received a Building with Nature Full Award, the first of its kind in Wales, for putting nature at the heart of development in a way that's good for people and for wildlife.

The next phase of Our Health Meadow is to construct a Nature Haven, which will provide an ecologically built fluid space and an arts sculpture trail.

Case Study: Natur am Byth

The Natur am Byth partnership is Wales' flagship Green Recovery project, uniting nine environmental charities with Natural Resources Wales to deliver the country's largest natural heritage and outreach programme to save species from extinction and reconnect people to nature. This has been developed following learning from similar schemes in England and Scotland.

The 10 core partners are: Natural Resources Wales (lead), Amphibian and Reptile Conservation, Bat Conservation Trust, Buglife, Bumblebee Conservation Trust, Butterfly Conservation, Plantlife, Marine Conservation Society, RSPB and Vincent Wildlife Trust.

The partnership received £4.1m from the National Lottery Heritage Fund in 2023, and has also received a commitment from Welsh Government for funding.

Species facing the greatest threat have been identified using the Environment (Wales) Act 2016 Section 7 list in consultation with natural heritage experts, which have then been mapped against landscapes and coastal areas for targeting projects. The delivery 4-year phase of Natur am Byth began in Summer 2023, with two identified areas for programme focus in Cardiff and the Vale of Glamorgan:

- Cardiff and Newport Gwent Levels: Led by Bumblebee Conservation Trust, this project will target three shrill carder bee population centres in South Wales, including Cardiff/Newport, to train landowners and volunteers to manage and monitor in the long term.
- Vale of Glamorgan: Led by Butterfly Conservation, Natur am Byth will open up areas of woodland to increase optimal habitat for the high brown fritillary butterfly (the UK's most threatened butterfly), and upskill community members to monitor and manage habitat for the long term.

Website: Natural Resources Wales / Natur am byth! Saving Wales' threatened species Twitter: @NaturAmByth

Case Study:
Garden Project at Park Road Houses, Cardiff and Vale University Health Board

This project involves maximising the use of green spaces on a Health Board community rehabilitation site by converting neglected garden areas into accessible, biodiverse natural areas for wildlife and food growing by employees and patients.

Following a grant from Keep Wales Tidy in October 2022, raised beds were constructed for wildflower planting and homes for wildlife were created with bird boxes and bug hotels. There were also 22 trees planted, obtained for free from the Woodland Trust, and a 30m2 area left as 'no-mow' to allow long grass to develop and create further wildlife habitats. Work was completed by Health Board volunteers and patients, getting them involved with nature and learning new skills.

Additional funding was secured in July 2023 to establish a food-growing garden, which will include planters, a greenhouse and wildflower turf. There are plans to host 'seed-to-plate workshops' with patients.

Early results are showing improved job satisfaction, reduction in stress levels and increased nature connectedness.

Keys to success for the project have been fostering partnership working and stakeholder involvement, documenting the project progress for shared learning, and planning evaluations early to demonstrate effectiveness and success.

"The Garden Project has been a true blessing. It not only provided a space for relaxation but also brought us closer as a team."
– Employee feedback

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Case Study:
Heath Park Meadows Health and Wellbeing Route – Plantlife and Magnificent Meadows Cymru

The Meadows Health and Wellbeing Route in Cardiff, Wales is part of Magnificent Meadows Cymru, a programme funded by the Welsh Government that is working to restore over 500 hectares of wildflower meadows and grassland in Wales while connecting communities to these environments for their own health and wellbeing. Developed in partnership between Plantlife and NHS Forest, the project has created two walking 'Green Health Routes' connecting the University Hospital of Wales to the meadows at Heath Park. During all seasons, a walk through the meadows provides an array of colours, smells and sounds. This is a great opportunity for using nature as part of the care of patients while also benefitting the health and wellbeing of health staff.

The route is promoted via signage placed near the hospital and park, providing information on biodiversity and the walking routes. There is also a virtual walk of one of the routes available online, enabling hospital patients who are unable to visit the site to get to know the green space and local area.

Green Health Routes such as this can help people in accessing local green spaces as part of a healthy lifestyle, with projects linking with healthcare practitioners and social prescribing link workers for nature prescribing.

Any organisations interested in developing a Green Health Route can get in touch with NHS Forest.

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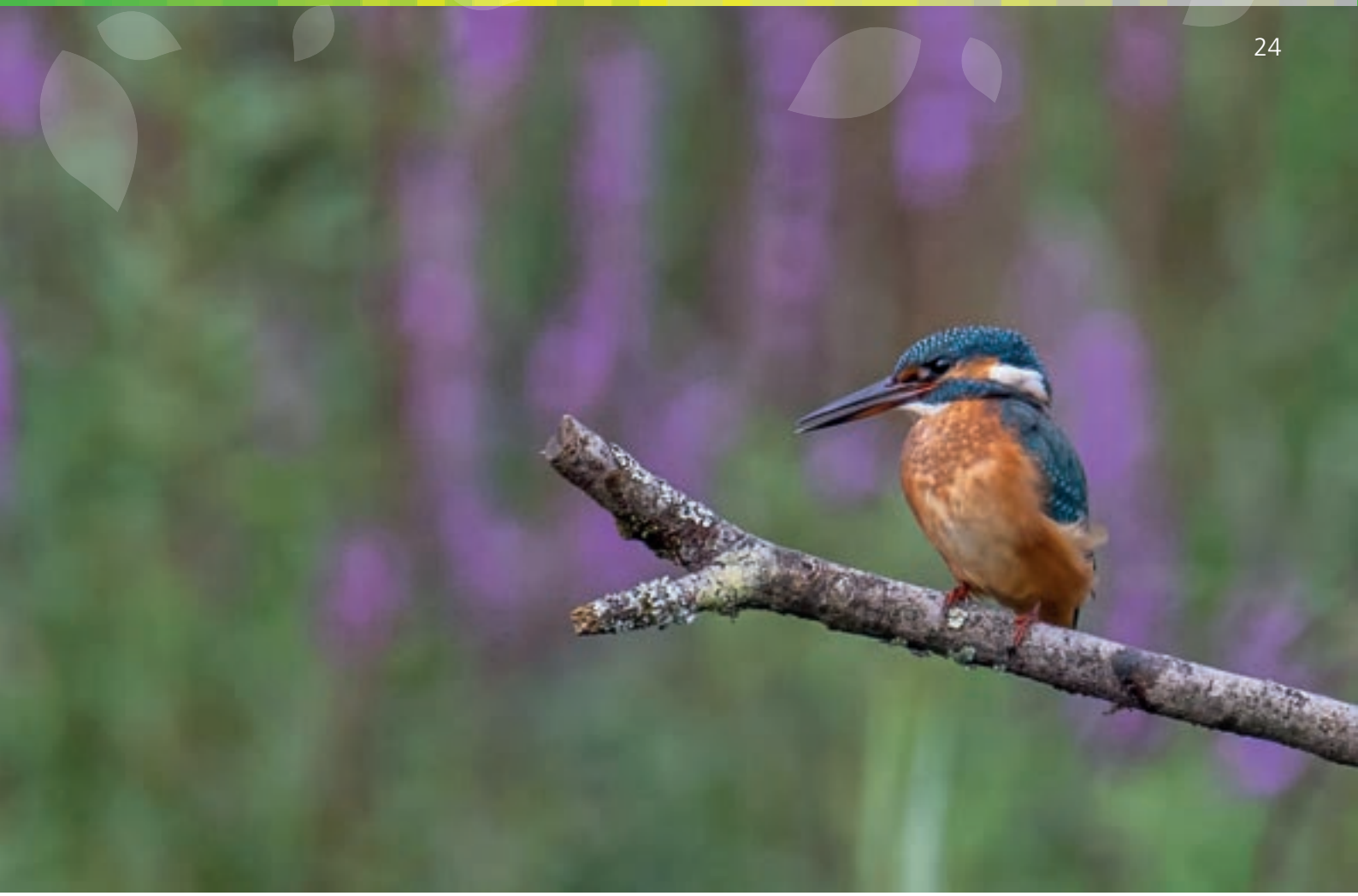


Chapter Key Points

- Nature connectedness is a term that refers to our connection with nature and whether we feel a part of it, with stronger nature connectedness leading to improved wellbeing and stronger pro-nature conservation behaviours.
- We are not as connected to nature as we could be, leading to missed opportunities for the health and wellbeing benefits it can offer.
- To achieve reconnection with nature we need to: ensure there is nearby nature, spend time with nature, and notice nature. There are inequities in opportunities to do this in Wales.
- Things that can help us reconnect include activities such as 'forest bathing' (immersing ourselves in woodland and taking it all in), and nature prescribing through health and social care settings (*see boxes*).
- People can keep up to date with nature activities in Cardiff and the Vale, including national and local actions and objectives, biodiversity-related news and events, and how to help biodiversity via the Wales Biodiversity Partnership (WBP), Cardiff Local Nature Partnership and the Vale of Glamorgan Local Nature Partnership.
- For organisations, it might be worthwhile to set up a 'nature group' of interested employees to help co-ordinate some of these actions and promote nature within the organisation, or ensure that biodiversity is included under existing green groups.

Reconnecting with nature is essential if we are to experience the full benefits to health that nature can offer. However, to reconnect with nature we need to have accessible, biodiverse nature in Cardiff and the Vale of Glamorgan. *Chapter 1* described how depleted our current biodiversity is, but *Chapter 4* will set out how we can seek to reverse this, for current and future generations, by restoring nature.

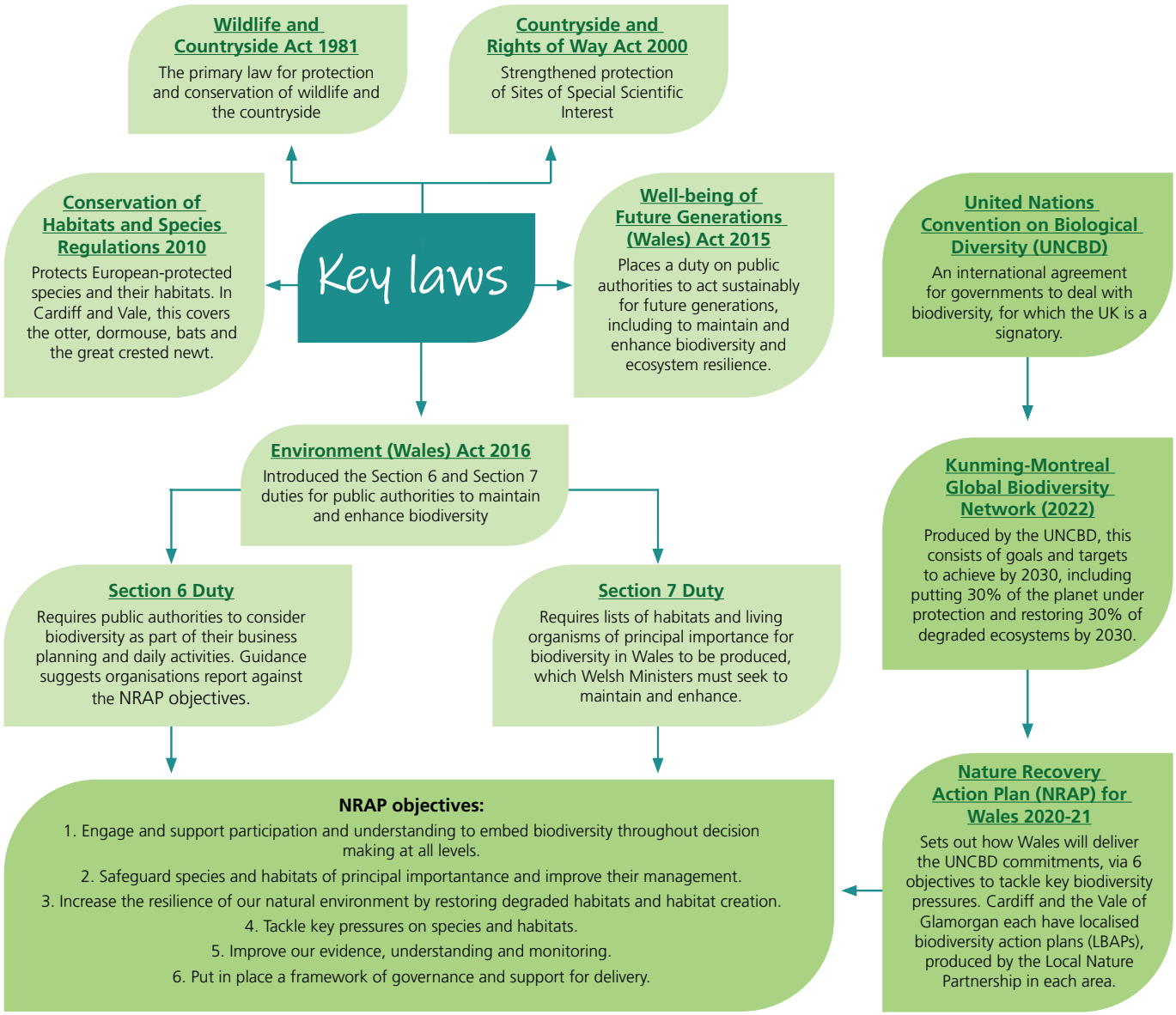
Chapter 4: Restoring Nature

"To restore stability to our planet, therefore, we must restore its biodiversity, the very thing we have removed. It is the only way out of this crisis that we ourselves have created. We must rewild the world!"

– David Attenborough

Actions to restore nature can be taken by anyone, from organisations to individuals, to local communities, to governments, to international partnerships. To help guide and facilitate these, there are a number of agreements, laws and plans at the international, national and local level, along with a multitude of guidelines, resources and specialist groups, to support organisations and individuals with restoring nature (***Figure 8***). However, Wales currently has no statutory targets for biodiversity.

Figure 8: Key biodiversity-related laws and guidelines



The Section 6 Duty of the Environment (Wales) Act 2016[237] requires public authorities to publish a plan setting out what they propose to do to comply with the Section 6 requirements, along with a report every three years on what they have done to comply with the Duty.

Both Cardiff and the Vale of Glamorgan also produce a ten-year Local Development Plan (LDP) to set out their proposals for future development and use of land in their area, featuring consideration of biodiversity. These LDPs, which are currently being refreshed, must follow guidance set out in Planning Policy Wales and the Future Wales National Plan, both of which reference the need to protect and enhance biodiversity. The Vale of Glamorgan also has biodiversity and development supplementary planning guidance, which aims to ensure that new developments maintain, enhance, restore or increase biodiversity in the Vale of Glamorgan.

Understand, Protect, Create

To restore nature we need to:

Understand the status of, value of and threats to biodiversity…

Protect current biodiversity by preventing and mitigating further harm and loss…

Create more biodiverse environments by enhancing degraded areas and creating new habitats.

Actions to achieve this can be taken at multiple levels, including at international, governmental, organisational, community and individual levels. Suggestions for these are given in the sections below.

Organisations need a well-governed, evidence-based, structured plan for biodiversity[238]. However, plans are only as good as their delivery. Organisations need to ensure they have the leadership, resources, skills, expertise and processes in place to do this.

A range of information on techniques for restoring nature can be found online from organisations such as The Wildlife Trusts, the Wales Biodiversity Partnership and our Local Nature Partnerships with detailed guidance.

Understand

Biodiversity may not be a term people are familiar with or understand the importance of, both on an individual and organisational level. In organisations, this has led to nature being consistently undervalued in conventional economic analyses and decision-making[68], leading to damage or overexploitation. As individuals, many of our actions, directly or indirectly, will affect biodiversity, so it is vital that we consider nature impacts and benefits in our daily behaviours.

To restore nature it is important that people understand what the current level of biodiversity is in their local area, its value, threats and pressures to it, and how and where to take action. Conducting surveys is a way to achieve this.

In Wales, the *State of Nature in Wales* report provides an overview of biodiversity in Wales on a national level[41]. Area Statements, providing information on a regional level, are produced by Natural Resources Wales covering seven different areas of Wales[239]. Cardiff and the Vale of Glamorgan form part of the South Central Wales Area Statement, alongside Cwm Taf Morgannwg. The statements outline the key challenges facing each particular locality, what we can all do to meet those challenges, and how we can better manage our natural resources for the benefit of future generations.

At a local level however, often little is known about what is in an area due to a lack of robust, consistent surveys and recordings. What data is available is reliant on sporadic recording by local nature and special interest groups, or by members of the public via the South East Wales Biodiversity Records Centre (SEWBReC)[240].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What can organisations in Cardiff and Vale do to understand biodiversity?[241]

Commission a specialist biodiversity assessment and audit of sites.

Form links with local nature groups and Local Nature Partnership in Cardiff or the Vale of Glamorgan.

Raise awareness of the biodiversity onsite and near estates, with staff and service users. Identify whether any principal habitats and species are found in an organisation's area. Involve staff in nature planning and management.

Staff volunteering days with partner organisations to undertake habitat management and taking part in nature recording.

What can individuals in Cardiff and Vale do to understand biodiversity?

Check out which species have been recorded near your postcode at Aderyn.

Take part in local and national nature surveys, such as the Big Butterfly Count, the Big Garden Birdwatch, or logging sightings on the LERC Wales App.

Attend nature events in your local area to learn about local biodiversity and information on your area from your Local Nature Partnership in Cardiff or the Vale of Glamorgan.

SEWBReC

SOUTH EAST WALES BIODIVERSITY RECORDS CENTRE
CANOLFAN GOFNODION BIOAMRYWIAETH DE DDWYRAIN CYMRU

SEWBReC (South East Wales Biodiversity Records Centre) is an organisation which gathers wildlife sightings (' records') from various sources, including public submissions, into a central database. They are one of four Local Environmental Record Centres in Wales (LERC Wales) that work together to promote recording and provide data to Welsh Government and other organisations to help assess biodiversity impacts.

Sending in your wildlife records helps to protect the nature around us, and is also a fun, easy and rewarding activity. Records must include four essential elements to be helpful: What species was seen; When it was seen; Where it was seen; and Who saw it.

To get involved you can download the LERC Wales App and fill in the information about your sighting. You can also enter records using a computer online.

If you would like to learn about the species that have already been found in your neighbourhood, visit the online sightings database Aderyn and add your postcode for a list of existing records, including Wales-wide distribution mapts for different species.

You can learn more about SEWBReC's work and how to get started with wildlife recording on their website: www.sewbrec.org.uk.
Twitter: @sewbrec

Protect

Biodiversity is in decline, with what remains urgently requiring protection to prevent and mitigate further harm and loss. The sad reality is that what nature really needs protecting from is us, humans, as we are responsible for all of the main threats to biodiversity (see *Chapter 1*)[35]. We have altered the land to suit our needs, caused a changing climate, polluted the environment, over-exploited nature and introduced invasive species, all of which has led to habitat and species degradation and destruction. Section 7 of the Environment (Wales) Act 2016 provides a list of the habitats and species of principle importance for the maintenance and enhancement of biodiversity in Wales[242].

The Kunming-Montreal Global Biodiversity Framework (2022) calls, amongst other things, for putting 30% of the world's land under protection by 2030 to prevent further biodiversity loss[243]. Organisations should strive for the same target; ensuring portions of their estate are identified for the protection of nature from development. In Wales, 21% of the land area is protected as Sites of Special Scientific Interest and Special Areas of Conservation, but only an estimated 8% of these areas have been assessed as being in favourable condition[10, 244]. It is vital to anticipate, prevent and mitigate the causes of biodiversity loss by following legislation and relevant policy, and employing innovative nature-based solutions. By doing so, the health and wellbeing of employees and local populations can be improved, and there are the potential for cost savings too.

As individuals, we all have a moral obligation to protect species and habitats for future generations; but more than that, doing so enhances the places and spaces we live in, improving our well-being. A number of behaviours to protect nature are also climate-friendly behaviours, with both direct and indirect impacts on biodiversity.

Examples of living organisms and habitats identified as being of principal importance to biodiversity in Wales, under Section 7 of the Environment (Wales) Act 2016[242]

Living organisms	Habitats
Water vole	Hedgerows
Otter	Lowland meadows
Hedgehog	Wet woodland
Dormouse	Traditional orchards
Bats	Heathland
Skylark	Ponds
Herring gull	Coastal sand dunes
Common starling	Lakes
Slow-worm	Swamps
Adder	Reedbeds
Bumblebee	Upland oak woodland
Stag beetle	Lowland fens
Juniper	Blanket bogs
Cornflower	Rivers


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What can organisations in Cardiff and Vale do to protect biodiversity?

Councils and building developers should ensure compliance with Local Development Plans, considering biodiversity impacts in land developments.

Review procurement policies to ensure local and sustainable sources.

Practising wildlife-friendly land management, such as designated protected areas and pesticide-free policies.

Encourage practices which reduce waste, pollution and energy use.
Encourage active travel and public transport use for commuting to work sites.

What can individuals in Cardiff and Vale do to protect biodiversity?

Reduce energy consumption at home: find tips here.

Reduce waste by reusing, repairing and recycling items. Find local repair cafes here

Reduce mains water use in your home and garden, such as by installing a water butt, which can then be used to water plants rather than a hosepipe too. Find tips here.

Go pesticide-free in the garden; find advice from a guide by the *Pesticide Action Network UK* here.

Keep it real - avoid replacing real nature with artificial materials, such as artificial lawns and plants.

If possible, use active travel or pubic transport for journeys and commuting.

Create

Protecting the nature we currently have is necessary but not enough - in order to restore nature we also need to increase the number and size of our natural spaces, creating more habitats for more species. Diverse habitats support diverse species, leading to greater resilience against pressures including climate change. This can be in the form of enhancing degraded environments and creating new areas.

As well as advocating for the protection of existing land, the Kunming-Montreal Global Biodiversity Framework (2022) calls for restoring 30 per cent of degraded ecosystems by 2030[243], which would be a valuable target for organisations to emulate in their policies and plans.

Large-scale restoration of nature - 'rewilding' - can lead to large increases in biodiversity and environmental benefits, such as those seen from rewilding at the Knepp Estate in Sussex, which has seen numerous rare species return to the area and improvements in soil quality, carbon capture, water storage and habitat creation[245]. The results from projects such as this provide hope that it is possible to reverse nature loss within the next generation. Information on rewilding can be found on the Rewilding Britain website.

An easy way to restore nature is by simply leaving nature to be natural. Mowing grass less frequently or not at all in some seasons, cutting back hedges and plants less often, and leaving areas to be wild will allow an abundance of habitats to naturally develop, which will quickly attract a variety of

wildlife. It will also save time and money for both organisations and individuals. Examples of this include the recent grass mowing schemes from Cardiff Council ('It's for them') and Vale of Glamorgan Council ('Making space for nature'), which create of a mix of short and long grass habitats and boost local biodiversity. Locations of these identified 'one-cut' areas can be seen in ***Figure 9 and Figure 10***.

Figure 9: Identified 'one-cut' grass areas in the Vale of Glamorgan, source: Frequently Asked Questions (valeofglamorgan.gov.uk)

Figure 10: Identified 'one-cut' grass areas in Cardiff, source: Cardiff - My Cardiff

Welsh Government has set a target of planting 43,000 hectares of woodland by 2030, and a total of 180,000 hectares by 2050, which requires around 6,000 hectares of planting each year[246].

However, only 6,790 hectares of new planting occurred between the 2010/11 and 2022/23 planting seasons[247]. The National Forest for Wales, from Welsh Government, is creating areas of new woodland and restoring and maintaining ancient woodlands to form a connected network of woodlands throughout Wales. Locally, schemes such as Coed Caerdydd and Canopi Caerdydd are increasing tree cover across Cardiff.

When planting trees to create green space, it is important to ensure it is the right tree for the right place. This will help the area to thrive, offer more support to local wildlife, and provide the most benefits to the area. Details on sources of free resources and grants for planting trees and other plants in Cardiff and the Vale of Glamorgan are provided in *Appendix 2*, as well as on the Natural Resources Wales page here.

Pollinators, such as bees, bugs, butterflies and moths need the nectar and pollen of flowers to survive[248]. They are best suited to native plants, which they have evolved with, thriving on wild patches and mini meadows. Sunny sheltered spots are best, with plants grouped together so that the pollinators can detect their colour and scent easier[249]. Recommended plant lists can be found online; ideally they should be flat for easy access by wildlife, and flower throughout the season[9].

All animals need water to drink to survive, but it is also used by amphibians such as newts, frogs and toads for breeding grounds and shelter, by birds for washing, and as a source of nutrients for butterflies and moths. Anything from a pond to a small bowl of water will attract wildlife.

"Rewilding holds out hope of a richer living planet that can once more fill our lives with wonder and enchantment"

– George Monbiot

What can organisations in Cardiff and Vale do to create biodiversity?

Create natural-nature policies: no-mow summer, reduced hedge cutting, leaving wild areas. Community engagement with employees and visitors should be involved to explain the reasons and benefits of doing this.

Set targets for the proportion of estates / public land to be natural areas.

Create habitat areas on estates, such as nest boxes, bee banks, ponds and water areas, or green roof installations.

Plant trees and bushes for nesting, shelter and food sources. See *Appendix 2* for free tree sources.

Plant for pollinators: find advice here.
Install Sustainable drainage systems (SuDS).

What can individuals in Cardiff and Vale do to create biodiversity?

Let lawns grow longer and be more diverse than just grass. Find ideas here.

Leave hedges to grow at certain times of year (particularly nesting season).

Let an area of the garden grow wild.

Install things like nest boxes, bat boxes, log piles, bug and bee hotels, bushes and trees for nesting, or a water source of any size.

Plant for pollinators: find advice here.

Get involved with your Local Nature Partnership in Cardiff or the Vale of Glamorgan.

Plant a tree from a free tree scheme: find details in *Appendix 2*.

Case Study: Coed Caerdydd

Coed Caerdydd is a 10-year programme to increase the number of trees in Cardiff, supporting the city's One Planet climate change strategy. It involves multiple organisations, including Cardiff Council, The Woodland Trust, Natural Resources Wales, Welsh Government, Buglife, RSPB, Wildlife Trusts and South and West Wales, Cardiff Public Services Board and local community groups. By working with communities and partner organisations to plant new trees and care for existing woodlands, the aim is to increase coverage across the city from 18.9% to 25%.

Between 2021 and 2023 over 50,000 new trees have been planted across Cardiff, involving over 2,500 people in volunteer opportunities (including tree planting and caring for trees in the nursery). Ten tree skills training sessions have been held, and over 3,000 trees have been donated to households and community groups.

Recommendations for others from the scheme are that partnership working is very important to ensure the planting of the "right trees in the right places", and the need to be flexible in approaches to climate change adaptation (e.g. experimenting with non-local but native species like the Wayfaring tree, which is more drought resilient).

For more information:
Website - www.outdoorcardiff.com/biodiversity/coed-caerdydd/ Social Media - @coedcaerdydd
Email - coedcaerdyddproject@cardiff.gov.uk

Case Study:
Porthkerry park golf course rewilding

A range of partners have been involved in this rewilding project, including the Porthkerry Wildlife Group, Vale of Glamorgan Council, the Amphibian and Reptile Conservation Trust, Vale of Glamorgan Local Nature Partnership and lots of community volunteers.

Porthkerry park, in Barry, is a 220 acre area near the coast with a range of dynamic ecosystems, some left wild and many sensitively managed. It previously included a 3.5 hectare 12-hole golf course, which was closed in 2019 due to flooding and maintenance challenges. With the help of partnership working with community groups, schools and volunteers, the area has now been rewilded. It features multiple ponds, wildlife corridors linking the ponds, wildflower areas and woodlands, which have already attracted amphibians, reptiles, mammals, birds and insects. Some species, like grass snakes, have returned to the area for the first time in years.

The work has enhanced the resilience of the site's ecosystems, boosted biodiversity, and provided education and learning for visitors. It is a prime example of boosting diversity in green spaces. Recommendations for others from the project are to allow time to plan rewilding areas, visit other areas that have already rewilded to learn from them, involve local networks, and take advice from experts: start small, but think big!

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ARUP

Case Study: Greener Grangetown

Completed in 2018, Greener Grangetown is a retrofit sustainable drainage system (SuDS) project designed to better manage rainwater and make the area a cleaner, greener place to live. Delivered in partnership with Natural Resources Wales, Cardiff Council and Dwr Cymru (DCWW), the project site covers 12 hectares, including 12 terraced streets and over 500 properties.

After learning lessons from the Dwr Cymru (Welsh Water) 'Rainscape' work in Llanelli, the project maximises the removal of surface water within an area that can drain by gravity to the river.

The project has resulted in the diversion of more than 42,000m^3 of rainwater from the city's sewers each year through the installation of over 100 rain gardens, thousands of new plants and over 100 new semi-mature trees both within and outside the SuDS features. Both amenity and biodiversity have been significantly enhanced in an inner city community, with a strong emphasis on community involvement both before, during and after the project was completed. Other sustainability improvements were made as part of the redevelopment, including improvements to walking and cycling networks in the area.

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Case Study:
Boosting Nature - The Innovate Trust, with Cardiff and Vale of Glamorgan local authorities

The Boosting Nature project provides environmental volunteering opportunities for people with learning disabilities to improve biodiversity in Cardiff and the Vale of Glamorgan, whilst also making accessible the environmental volunteering opportunities outside the Innovate Trust through a Volunteering Buddies scheme.

In weekly groups, adults with learning disabilities and non-disabled community volunteers work alongside the Cardiff Council Park Ranger Team and the Vale Countryside Team to carry out seasonal conservation and biodiversity initiatives within parks and green spaces such as planting, sustainable meadow management tasks, coppicing, removal of invasive species and hedgerow management.

These sessions have improved biodiversity in the local area and have also contributed to personal development and long-term social benefits; encouraging social connection with peers and community members, and contributing to reducing poverty and inequality by facilitating acquisition of skills that are transferable to other areas of life.

The Innovate Trust recommends strong partnerships as a key to the success of such projects, along with a person-centred approach to project planning and delivery to ensure that the voices of individuals are heard and shape the project.

'It makes me very happy to get the work done. I beat the work. It makes me feel proud' – Service user

'We like taking care of wildlife, especially the water voles and the Bittern' – Service user
Website: https://innovate-trust.org.uk/services/boosting-nature/
Contact: boostingnature@innovate-trust.org.uk
Social Media: @BoostingNature


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Case Study:
Restore the Thaw Landscape Project

A large, increasing number of partners are involved in this project, including Vale of Glamorgan Council, Vale Local Nature Partnership and multiple third sector organisations. Beginning in July 2023, it will deliver a range of biodiversity improvements along the River Thaw, its tributaries and surrounding landscapes and engage a wide diversity of audiences in a range of nature recovery projects. The project area contains a network of protected sites including 7 Sites of Special Scientific Interest (SSSI) and 120 Sites of Importance for Nature Conservation (SINC). In addition to enhancements for wildlife and resilience, areas of low nature value in between the sites will be improved by creating new wildlife corridors, links and connections.

Nature benefits will include the planting of 31,000 trees, invasive non-native species removal, hedgerow planting, 10 hectares of lowland meadow and calcareous grassland enhancement, new nature corridors for wildlife, creation of five new ponds and enhancement of 10 existing locations, wildlife surveys, and improved water quality of the river. If you'd like to get involved with volunteering on the project, or to learn more, contact the team on the email address provided below.

Contact: thaw@valeofglamorgan.gov.uk Social Media: @Thawproject

Chapter Key Points

- There are a number of agreements, laws and plans at the international, national and local level, along with a multitude of guidelines, resources and specialist groups, to support organisations and individuals with restoring nature. Section 6 of the Environment (Wales) Act 2016 is of particular importance to public organisations in Cardiff and the Vale of Glamorgan, placing a duty on them to maintain and enhance biodiversity and report progress against doing so.

- To restore nature we need to: understand the status of, value of and threats to biodiversity; protect current biodiversity by preventing and mitigating further harm and loss; create more biodiverse environments by enhancing degraded areas and creating new habitats. Actions to achieve this can be taken at multiple levels, including at international, governmental, organisational, community and individual levels.

- Organisations need a well-governed, evidence-based, structured plan for biodiversity. However, actions need to go beyond just producing a plan; they also need to be delivered. Organisations need to ensure they have the leadership, resources, skills, expertise and processes in place to do this.

- Individuals can take actions to create spaces for nature at home, protect local green areas, and understand their local biodiversity through information and resources available from Local Nature Partnerships.

Recommendations

Recommendations for people living in Cardiff and Vale of Glamorgan:

1. Have **nature as nearby as possible** throughout the day, either within view or within walking distance.
2. **Familiarise yourself** with what green spaces are near to the places you spend the most time, so that you can plan to spend time there in your day.
3. **Spend time in nature** regularly, such as during commutes and school-runs, break times, walking work meetings, and recreational time. Plan a specific time to go there, such as lunch; being active in nature will give multiple benefits, so plan to walk, run or do some other form of exercise while there, such as a parkrun event or with a local walking group.
4. **Notice nature** when it is near, taking a moment to take in the sights, sounds, smells or feel of it.
5. **Find out more** about the nature where you live and work – contact your Local Nature Partnership in Cardiff or the Vale of Glamorgan for details of workshops, surveys and other activities.
6. Take **nature-friendly actions** at home, such as reduced mowing, going pesticide-free and retaining real (and native where possible) plants, flowers and lawns, rather than replacing with artificial alternatives.
7. **Create** more biodiverse habitats by enhancing degraded areas and leaving space for nature. Activities such as tree planting, sowing wildflower areas (with local seed), and creating a water area, all help give nature a home. See *Appendix 2* for available resources and grants.
8. **Get involved** with local nature groups or community groups who manage a local green area.

Recommendations for organisations and public bodies:

For public bodies, implementing the Section 6 Duty of the Environment (Wales) Act 2016, where applicable, will support many of these actions.

1. **Welsh Government** should formalise biodiversity targets for Wales for the maintenance and enhancement of biodiversity, confirming the commitment to have 30% of Wales as protected natural spaces.
2. **Welsh Government** and **local authorities** should encourage schools to include nature, biodiversity and the benefits of the natural environment as part of their curriculum, so that future generations grow with an awareness and respect for the natural environment. Schools should feature learning about nature and biodiversity, both through classroom learning and spending time in nature.
3. Members of the **Public Service Boards** in Cardiff and the Vale of Glamorgan should work together in each area to further develop our joint priorities for the maintenance and enhancement of biodiversity, and consider developing local targets for biodiversity in line with Welsh Government aspiration.
4. **Organisations** and **public bodies** should conduct ecological surveys of their estates to identify species which are present and the quality of habitats; identify the threats to this biodiversity; and take action to promote this biodiversity and the benefits to health it can bring. Local Nature Partnerships can provide advice.
5. **Organisations** and **public bodies** should ensure nature-friendly policies for estate land management, such as reduced mowing and going pesticide-free.
6. **Organisations** and **public bodies** should promote local nature walking routes near to work sites and seek to establish routes and access if this is not currently in place.
7. **Organisations** and **public bodies** should encourage and facilitate employees spending time with nature during breaks in work, by highlighting the health benefits and providing guidance on noticing nature.
8. **Organisations** and **public bodies** should create more biodiverse habitats by enhancing degraded areas and creating new spaces through rewilding approaches and leaving space for natural nature, such as tree planting, wildflower meadow creation, water installations and giving nature a home. See Appendix 2 for available resources and grants.
9. **Public bodies**, depending on their size, should have an identified biodiversity lead and/or group, which could be part of or linked to pre-existing green groups due to the overlap between the climate and nature emergencies.
10. For **local authority planners**, the impact of development on biodiversity should be given due consideration in planning policy and consequently in the assessment of planning applications. Developers and construction companies should include consideration of all developments on the impact on biodiversity within planning applications.
11. **Organisations** and **public bodies** should ensure that employee well-being plans recognise the benefits of nature to employee health and well-being, including providing opportunities for employees to participate in voluntary environmental activities that enable employees to learn about and contribute positively to the natural environment.
12. **Cardiff and Vale University Health Board** and primary care clusters should seek to establish nature prescribing schemes, as part of social prescribing development work, in collaboration with third sector and partnership organisations.
13. **Cardiff and Vale University Health Board** should ensure that access to and views of nature are incorporated into plans for the development of new sites, including future clinical sites such as the potential 'UHW2'.

Appendices

Appendix 1: Delivery Against Recommendations of the Previous Director of Public Health Report

Annual Report of the Director of Public Health 2021 'Delivering Better Outcomes for People Through a Value-based Approach' update on progress

Last year's report highlighted how a Value-based approach can help ensure that every penny of public spending goes towards achieving outcomes that matter to local people, and the importance of shifting spending upstream to help people stay happy and well. It provided practical recommendations on how this could be applied across the public sector. Last year's report and supporting animation for 'Delivering Better Outcomes for People Through a Value-based Approach' can be accessed. The report made six recommendations, an update on each is provided here.

Recommendation 1: Any organisations that wish to adopt a Value-based approach should undertake an assessment of their organisational readiness. This could be led by a small group with a report back to the leadership team, which should enhance discussions about where to focus energies going forward.

As one of the public sector organisations locally, Cardiff and Vale University Health Board (UHB) has undertaken an assessment of its organisational readiness and has reviewed this regularly. This was undertaken by a small group who reported back to the three Executive Leads responsible for Value in the organisation. This has enhanced the discussions on direction of travel.

A 'Value in Healthcare Steering Group' has also been established and meets regularly to guide and support the work being carried out across the organisation. There are a number of projects being supported through this mechanism including the PROMs infrastructure improvements, frailty pathway development, and improved lymphoedema service locally.

Recommendation 2: A range of learning and development opportunities on both the theory and practical application of a Value-based approach is needed both within organisations and partnerships.

The Wales Value in Health Centre have produced a range of learning and development materials, including the 'Value Base Health Cast' which aims to create a safe space for early thinking, making connections, sharing ideas between people working on value from across Wales. The monthly webcasts seek to share what others have learnt from the pursuit of Value Based Health Care and share the challenges and barriers as well as the successes. This provides a monthly forum offering lively discussion on the topic of value. The sessions provide practical advice and insights on implementing Value Based Health Care whatever the organisational setting.

Cardiff and Vale UHB has sourced access to training resources available that can support teams to develop their skills. In addition to this, training on particular aspects of Value has been provided to specific groups of staff working on Value projects within the organisation. There is more that could be done to embed value as a guiding principle across the organisation and with further partners that would support practical delivery.

Recommendation 3: Where pertinent public sector organisations should consider systematically and sequentially shifting funding upstream towards prevention to improve the health and well-being of the local population and ultimately stem the demand for public sector services downstream.

A good example of targeting action upstream is our partnership work in Cardiff and Vale of Glamorgan around the emotional and mental health of children and young people. Following the introduction of Welsh Government statutory guidance in 2021 - `Framework on embedding a whole-school approach

to emotional and mental well-being' - partners are supporting our schools to embed a whole school approach to emotional and mental wellbeing, which recognises that every aspect of school life can impact on health and wellbeing. Schools are required to complete a Self-Evaluation Tool with support from the Cardiff and Vale Implementation Lead, Healthy Schools' team, Health and Education colleagues, and to produce and implement an action plan to address any challenges or gaps in provision. This forms a continuous process of reflection and improvement enabling schools to embed ways of working that protect and promote the emotional and mental wellbeing of the whole school community

All of our primary and secondary schools, including special schools, are engaged in the whole school approach – some of our schools were early pathfinders and are now sharing their experiences and learning with others.

A short film has been produced which highlights the Whole School Approach with support from the Cardiff and Vale Regional Partnership Board , featuring staff and pupils from Ysgol Plasmawr and Ysgol Nant Caerau – link below: https://youtu.be/OmVJldLPtdI

Recommendation 4: For Cardiff and Vale UHB to consider the use of Programme Budgeting and Marginal Analysis as a tool to help shift funding from low value interventions to high value interventions and move funding upstream towards prevention

The UHB Public Health Team has started scoping the requirements of implementing Programme Budgeting Marginal Analysis for the organisation. The concept has been socialised with a variety of staff across the organisation to test the appetite for this work. Whether or not we have the level of financial detail needed and the time commitment to complete this detailed task is being considered as part of the scoping review.

Recommendation 5: Across the public sector, changes to data collection and infrastructure are needed to allow decisions to be driven by the data. This data must be focussed on the outcomes that matter to local people and must be timely to support service improvement.

Cardiff and Vale Regional Partnership Board have developed the innovative Regional Information Sharing System (RISS). This contains key data from the Welsh Ambulance Service Trust, Cardiff Council, Vale of Glamorgan Council, Third Sector Organisations and Cardiff and Vale University Health Board. This data has been brought together and anonymised to shine a light on people's experiences across our organisations. The image below shows the type of data available to the partners.

Recommendation 6: To review the types of indicators used in monitoring the success of public sector services, with a view to increasing those that are focused on outcomes and balance this with quality and cost indicators. Using a data driven approach will support decision making at every level, i.e. operational, strategic and partnership. Cardiff and Vale University Health Board has expanded the use of Patient Reported Outcome Measures (PROMs). PROMs assess outcomes such as improvements in health and well-being after a procedure e.g. a knee operation. They use questionnaires which are completed by patients to share information on how they are feeling and functioning before, during and after care. Further expansion of PROMS is planned. In addition, a new system to collect experience measures which ask about the patient's experience, including how well information was explained to them, whether they had opportunities to ask questions, and whether staff were polite has been introduced across the Health Board. This will increase the amount and quality of feedback that the Health Board can base service improvements upon. Furthermore, more real time data is being utilised across the organisation to monitor quality on the wards.

Appendix 2: Grants and free resources (such as trees and garden packages) for creating habitats and tree cover:

Local Places for Nature - Keep Wales Tidy: Run by Keep Wales Tidy and funded by the Welsh Government as part of the 'Local Places for Nature' programme. Consists of pre-paid packages ranging from small gardening projects to orchards and large-scale makeovers. Each one includes lots of native plants, tools, resources and other materials. Deliveries and assistance with installations is provided. Apply online.

Coed Caerdydd: Led by Cardiff Council, you can nominate sites and also apply for free trees for your household here.

Woodland Trust MOREwoods: If you want to plant 500+ trees on at least half a hectare, such as on farms, the MOREwoods scheme can provide site visits, design advice, tree selection support, supply the agreed trees and cover up to 75% of costs. Apply here. (See also MOREhedges, a similar scheme that supplies hedging).

Welsh Government Small Grants – Woodland Creation: This scheme provides financial support for small areas of tree planting on land between 0.1 and 2 hectares. Farmers and other landowners can apply. Trees must be planted on land which is agriculturally improved or of low environmental value. Apply here.

The Tree Council grants programme: The Branching Out Fund is for communities looking to plant trees, supporting applications ranging from £250 up to £2,500. Apply here.

Welsh Government Woodland Investment Grant: For landowners and managers including not-for-profit organisations. Can be used to create woodlands for local communities to use. It must have the potential to be part of the National Forest for Wales programme in the future. Apply here.

NHS Forest: Currently England only but hoping to offer trees beyond England in the future. Provides free tree bundles to NHS sites. Apply online.

Appendix 3: Protected site definitions

Sites of Special Scientific Interest (SSSIs): highly protected areas for the safeguarding of the range, quality, and variety of habitats, species and geological features.

Special Protection Areas (SPAs): part of the Natura 2000 sites identified in Europe as the most important sites for wildlife. SPAs are designated because of rare or migratory birds and their habitats. Protected by European law.

Special Areas of Conservation (SACs): part of the Natura 2000 sites identified in Europe as the most important sites for wildlife. SACs are designated for a wide range of habitats and species other than birds. Protected by European law.

Marine Protection Areas (MPAs): areas of sea, seabed or shore protected under laws.

National Nature Reserves (NNRs): set up to conserve and allow people to study their wildlife, habitats or geological features of special interest. Most nature reserves are open to everyone to explore, learn and enjoy.

Sites of Importance for Nature Conservation (SINCs): areas of land recognised for their importance for wildlife, which fall outside the legal protection of the SSSIs system.

Ramsar site: wetlands of international importance, designated under the Ramsar Convention – an intergovernmental treaty that aims to stop the loss of wetlands. Wetland sites can be areas of marsh, fen, peatland or water. They can be natural or artificial and either permanent or temporary, with water that is static or flowing, fresh, brackish or salt. They can also include shallow sea areas.

Heritage Coasts: stretches of outstanding, unspoilt coastline, usually cared for by local authorities which account for nearly half of Wales' coastline.

Appendix 4: Photo credits

1. High brown fritillary butterfly (cover), credit: Frank Sengpiel
2. Spiders web (cover), credit: Maxine Levett
3. Fox (cover), credit: David Williams
4. Water vole (cover), credit: Mel Stewart
5. Adder (cover), credit: Alex Edwards
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