Gwent Public Well-being Assessment Environmental Well-being

Contents

Introduction	7
Environmental well-being	7
Key messages from the assessment of environmental well-being	8
An overview of the natural environment in Gwent	8
Section A: Stocks of natural capital are safeguarded and enhanced	10
Biodiversity and species	10
What are the well-being strengths?	12
What are the issues impacting well-being?	13
Invasive Non-Native Species (INNS)	15
What are the gaps in understanding?	16
What are people telling us?	16
Future trends and challenges	17
Climate change	17
Land use and soils	18
Soils	18
Landscape types and land use	18
Urban	19
What are the well-being strengths?	19
Soils	19
Land use	20
Urban	20
What are the issues impacting well-being?	21
Contaminated land	21
What are the gaps in understanding?	22
Future trends and challenges	23
Brexit	23
Population, cultural and behavioural changes	23
Climate change	23
Decision making	24
Air quality	24

Ammonia	24
Particulate matter (PM)	26
What are the well-being strengths?	28
What are the issues impacting well-being?	28
Nitrogen dioxide (NO ₂)	28
Particulate matter (PM)	29
What are the gaps in understanding?	29
Future trends and challenges	29
Climate change	29
Section B: Ecosystems are resilient to expected and unforeseen change	30
Woodland	31
What are the well-being strengths?	32
Opportunities to improve ecosystem resilience through the creation of nature networks	33
What are the issues impacting well-being?	34
Threats	35
Pollution	36
Habitat loss and degradation	36
What are the gaps in understanding?	37
What are people telling us?	37
Future trends and challenges	37
Climate Change	37
Semi-natural grassland	38
What are the well-being strengths?	39
Opportunities to improve ecosystem resilience through the creation of nature networks	40
What are the issues impacting well-being?	41
Threats	42
What are the gaps in understanding?	43
Future trends and challenges	43
Climate Change	43
Mountains, moorland and heathland (MMH)	44
What are the well-being strengths?	45
Opportunities to improve ecosystem resilience through the creation of nature networks	45
What are the issues impacting well-being?	47
What are the gaps in understanding?	48
Future trends and challenges	48
Climate Change	48

Freshwater	49
What are the well-being strengths?	50
What are the issues impacting well-being?	51
Pollution	54
Habitat loss and degradation	55
Invasive Non-Native Species (INNS)	55
What are the gaps in understanding?	56
Future trends and challenges	56
Climate Change	56
Coastal margins and marine	57
What are the well-being strengths?	58
What are the issues impacting well-being?	59
Habitat loss	60
Pollution	60
Unsustainable practices	60
Invasive Non-Native Species (INNS)	60
What are the gaps in understanding?	61
What are people telling us?	61
Future trends and challenges	61
Climate Change	61
Section C: Wales has healthy places for people, protected from environmental risks	64
Carbon sequestration	64
What are the well-being strengths?	64
Nature based solutions	64
Spatial opportunities for carbon sequestration in Gwent	64
What are the issues impacting well-being?	66
Competing land use pressures	66
What are the gaps in understanding?	67
Future trends and challenges	67
Hazard regulation	68
Flood	69
What are the well-being strengths?	71
Community Flood Plans (CFPs)	71
Natural Resources Wales (NRW) Flood Warning Service	71
Natural flood management (NFM)	71
What are the issues impacting well-being?	71

What are the gaps in understanding?	72
What are people telling us?	72
Future trends and challenges	73
Climate change	73
Fire	74
What are the well-being strengths?	76
What are the issues impacting well-being?	76
What are the gaps in understanding?	77
Future trends and challenges	77
Climate change	77
COVID-19	77
Public health	77
Housing	78
Recreation, access and tourism	78
What are the well-being strengths?	78
Access and recreation	78
Tourism	78
What are the issues impacting well-being?	79
Inequalities	79
COVID-19	80
Anti-social behaviour (ASB)	80
Negative impacts on biodiversity	80
Collaboration	81
Brexit	81
What are the gaps in understanding?	81
Greenspace	81
Anti-social behaviour (ASB)	81
Climate change	81
What are people telling us?	82
Greatest barriers to use of woodlands across Gwent	82
Future trends and challenges	83
COVID-19	83
Climate change	83
Food and agriculture	84
What are the well-being strengths?	85
What are the issues impacting well-being?	85

Unsustainable practices	85
Agricultural pollution	86
Loss of farmland biodiversity	86
Climate change	88
What are the gaps in understanding?	89
What are people telling us?	90
Future trends and challenges	90
Economic and market changes	90
COVID-19	90
Brexit	91
Climate change	91
Timber	94
What are the well-being strengths?	94
What are the issues impacting well-being?	95
What are the gaps in understanding?	95
Future trends and challenges	95
Sector changes	95
Climate change	95
Water supply	96
What are the well-being strengths?	98
What are the issues impacting well-being?	98
Drought	98
River management	98
Future trends and challenges	98
Climate change	98
Section D: A regenerative economy with sustainable levels of production and consumption.	100
Net zero, zero waste and One Planet Wales	100
Greenhouse gas (GHG) emissions	100
Waste and ecological footprint	101
Waste generation	101
Household waste generation	102
Waste recycling	102
Ecological footprint	104
What are the well-being strengths?	105
Net zero	105
Zero waste and One Planet Wales	106

What are the issues impacting well-being?	106
Net zero	106
Zero waste	107
Waste crime	108
What are the gaps in understanding?	108
Net zero	108
What are people telling us?	109
Net zero	109
Best Practice local involvement	110
Future Trends and challenges	111
Policy and practice at the regional level	112
COVID-19	113
Brexit	113
Market forces	114
Technological advancement	114
What are people telling us?	115
Endnotes	118

Introduction

Environmental well-being

'Environmental well-being' refers to the well-being of people and communities, and how environmental factors affect that well-being, both positively and negatively. This section assesses environmental well-being in Gwent and in doing so identifies how and where Gwent's natural habitats can be safeguarded and enhanced to provide us with a range of vital well-being benefits to people and communities. It will also explore the extent to which natural resources can help protect our communities from several current and longer-term environmental risks.

The Environmental well-being section does this by taking a closer look at the extent to which the sustainable management of natural resources is being achieved, by combining local, regional, and national evidence to better understand the performance of our natural environment against the following measures:

Section A: Stocks of natural resources are safeguarded and enhanced	Section B: Ecosystems are resilient to expected and unforeseen change	Section C: Wales has healthy places for people protected from environmental risks	Section D: A regenerative economy achieving sustainable levels of production and consumption
	CLIMA	TE RISK	
Pollu Invasive non-nati Unsustainal Habitat de	ution ive species (INNS) ole practices egradation	 Carbon sequestration Flood Fire 	Net zeroZero wasteOne Planet Wales
 Biodiversity and species Land use and soils Air quality 	 Woodland Semi-natural grasslands Mountains, moorland and heathland (MMH) Freshwater Coastal margins and marine 	 Recreation, access and tourism Food and agriculture Timber Water supply 	

Fig. I1 Four measures of environmental well-being

These measures work together and are cyclical; we cannot work towards healthy places for people without resilient ecosystems, and cannot make our ecosystems resilient without safeguarding stocks of natural resources. The regenerative economy safeguards and restores those stocks and is the route to transformational change.

In 2020, Natural Resources Wales (NRW) published the second <u>State of Natural Resources Report</u> (<u>SoNaRR</u>). SoNaRR2020 builds on a number of Welsh, UK and global assessments of the status and trends of natural resources. It looks at the risks those trends pose to our ecosystems and to the long-term social, cultural and economic well-being of Wales¹. The measures used in this section to assess environmental well-being are informed by the aims of SoNaRR.

Key messages from the assessment of environmental well-being

- The evidence presented in this section indicates that we fall short of achieving the four measures which contribute towards the sustainable management of natural resources in Gwent. This section demonstrates that we are using stocks of our natural resources at a rate which is unsustainable and that our ecosystems are under increasing pressure and threat from the impacts of climate change, land use change, invasive non-native species (INNS), pollution and over-use. This jeopardises the ability of our natural environment to provide a number of vital well-being benefits now and in the future
- Climate risk is an increasing concern which is predicated to have a significant impact on the habitats, people and places of Gwent. This section assesses the risk to the environment from future climate predictions, but more work will need to be done to make sure we take an integrated look at climate risk across cultural, economic and social well-being
- The failure of current practices to achieve a model of sustainable natural resource management is putting the well-being of future generations at risk in Gwent
- Brexit is a key risk which has the capacity to have a significant future impact on land management in Gwent and while future trade deals and policy creation is a national issue, more can be done to reduce the impact of future changes at the local level
- More work needs to be done to address the drivers of unsustainable management which exist outside of the environmental well-being sphere. As a result of this analysis, it is recommended that a closer and more integrated look at key challenges is taken, where transformation and systemic change would have significant well-being benefits 'in the round' (i.e. as pertaining to all four pillars of well-being, not just environmental well-being). Transformation in the food, energy and transport sectors has the greatest potential to improve well-being in Gwent.

An overview of the natural environment in Gwent

Gwent holds a wealth of both natural and cultural heritage, from the historic castles along the English border to the east, to the cradle of the industrial revolution, the <u>Blaenavon World Heritage</u> <u>Site (WHS)</u>, in the west. Gwent is home to 591,100 people². As well as boasting several sites of national and international significance, Gwent is made up of a number of <u>distinctive landscape areas</u>, all of which contribute to our iconic natural environment.

The distinctive Gwent Levels form an extensive, low-lying, coastal reclaimed landscape along the Severn Estuary. This is an area of international historical and archaeological importance; a reclaimed agricultural landscape where parcels of fertile grazing and arable land are framed by a network of drainage ditches known as reens. These distinctive habitats pattern the landscape and provide a rich, biodiverse habitat for plants, mammals and invertebrates. The landscape is protected by a sea wall from the Severn Estuary, with its mud flats and salt marshes, and is bounded by the River Wye.

Further east is the picturesque landscape of the <u>Wye Valley Area of Outstanding Natural Beauty</u> (<u>AONB</u>). The landscape is rural and tranquil in character, except along the major road network of the A40, A48 and M4 corridors. It contains the largest and longest river gorge in Wales, with dramatic limestone cliffs above Chepstow and spectacular scenery of the gorge and meandering River Wye. The landscape reflects a rich archaeological, cultural and industrial heritage and many of its iconic destinations such as <u>Tintern Abbey</u> are popular with visitors to the area. This predominantly wooded and riverine environment is renowned as a refuge of rare species and forms one of the largest remaining areas of ancient semi-natural broadleaved woodland in the country. <u>Wentwood Forest</u>

which may appear to be largely coniferous is part of the largest block of ancient woodland in Wales. Further up the valley, smaller hamlets and villages lead us to the historic market town of Monmouth which is set within an agriculturally crafted landscape. Here, and on the plateau, you find pastures enclosed by hedgerows with some arable areas.

Adjacent to the Wye Valley is the tranquil and sheltered landscape of Central Monmouthshire with its gentle rolling hills and intervening valleys providing notable views towards the uplands. The River Usk flows south from the historic market town of Abergavenny and the Monnow and Trothy flow east into the River Wye. Monmouthshire's undulating lowlands are pasture-rich with hedgerows and arable on the fertile flood plain. Isolated small parcels of woodland with broadleaved and mixed plantations are present on hills and slopes. Biodiverse riparian and freshwater habitats and the open water of <u>Llandegfedd Reservoir</u> feature. Modern intrusion is largely confined to the A40 and A449 corridors; medieval stone churches and parkland are notable with numerous castles that reflect a contested past.

The city of Newport is Gwent's most heavily urbanised area, with its historic core it is the only city in the region. The M4, main roads and railways are prominent in the landscape. The tidal River Usk flows through the city with its iconic transporter bridge and industrial port. Urban green space is located at <u>Gaer Hillfort</u>, Ridgeway and <u>Tredegar Park</u> with some sections of the Rivers Ebbw, Lwyd, Usk lowland river corridors providing tranquil and biodiverse sections. The Roman town of Caerleon lies to the east of the city, and to its north are the nearby towns of Cwmbran and Pontypool which boast industrial heritage.

The west of Gwent is made up of the eastern section of the South Wales Valleys landscape. The extensive wild and wind-swept plateau with intervening deep valleys characterises this landscape which is well known for its extensive industrial coal and ironworking heritage, notably preserved at <u>Blaenavon World Heritage Site (WHS)</u>. The landscape has upland moorland with heather, grass, bracken and stone walls, much of which is common land. Moorland, bog, fridd and rhos pasture are notable. The busy, noisy valleys contrast with the comparatively remote and tranquil uplands. Roads and railways follow valleys and passes with dramatic views of uplands and crags. Extensive conifer blocks are present with broadleaved woods on steep hillsides and hilltops. The Prehistoric Bronze Age and Roman archaeology of the uplands found at <u>Gelligaer Common</u> is notable, as well as the biodiverse beechwoods of <u>Clydach Gorge</u>, <u>Caerphilly</u> and <u>Ruperra Castle</u>s and the <u>Monmouthshire and Brecon Canal</u>.

The north of Gwent also includes a small part of the Brecon Beacons which is big on scenic quality and part of the <u>Brecon Beacons National Park (BBNP</u>). It includes the Vale of Ewyas and surrounding upland in the Black Mountains and the distinctive peaks of the Skirrid and Sugar Loaf framing the Usk Valley at Abergavenny. Exposed upland moorland with extensive views this is a landscape noted for tranquillity, dark skies and a lack of modern development. Conifer and broad-leafed woodland are present. Pastures are often enclosed by thick hedgerows with narrow lanes. Scattered small settlements are located in the valleys with prehistoric archaeology and Medieval sites including Llanthony Priory and historic parkland.

Residents in Gwent appreciate the quality of their local environments and its frequent use. People noted how they frequently go on walks and enjoy the beautiful local scenery within Gwent.³

Section A: Stocks of natural capital are safeguarded and enhanced

Biodiversity and species

Biodiversity is a critical stock of natural resources that is declining, in Wales and globally, at an unprecedented rate. Around 1 million animal and plant species are now threatened with extinction, many within the next few decades (IPBES, 2019)⁴. <u>The State of Natural Resources Report</u> (<u>SoNaRR2020</u>) identifies both winners and losers for different aspects of biodiversity in Wales (across all natural resources registers). The overall trend, however, mirrors the global picture and is one of decline.

Species are declining globally. The same pattern is occurring in Wales and the UK, with evidence of several species being at risk in the future (Welsh Government, 2021)⁵). The <u>State of Nature Report</u> (National Biodiversity Network, 2019)⁶ describes the UK as "among the most nature-depleted countries in the world." The summary for Wales highlights that since 1970, there is less wildlife in fewer places. 73 species of the 3,902 assessed have been lost, numbers of butterflies have fallen by 52% since 1976 and Wales is in the worst 25% of countries for biodiversity loss (of 218 countries assessed globally).





Fig. A1 Change in the distribution of UK pollinators, 1980-2017

In 2017, the UK Government indicator for pollinators declined by 30% compared to its value in 1980, representing long term decline (Fig. A1)⁷.

A quarter of Gwent is protected for biodiversity reasons, with thirteen <u>Special Areas of Conservation</u> (<u>SACs</u>). One of these, the Severn Estuary, is also a <u>Special Protection Area (SPA)</u> and <u>Ramsar site</u>. There are also five <u>National Nature Reserves (NNR</u>), 94 Sites of <u>Special Scientific Interest (SSSIs</u>), 25 <u>Local Nature Reserves (LNRs</u>) and over 1600 <u>Sites of Importance for Nature Conservation (SINCs</u>)⁸. Gwent's resource of protected sites represents some of our most important and cherished areas for biodiversity, habitats and species. Natural Resources Wales (NRW) undertook a <u>Protected Sites</u> <u>Baseline Assessment</u> in 2020, which assessed the quality of the protected sites evidence base to help understand (where possible) the relative 'health' of key species and habitats across freshwater and terrestrial features on protected sites in Wales. The condition of species and habitat at our best sites can provide some indication as to the health of biodiversity across the region, given that they provide some of the best condition examples of biodiversity.

NRW currently has sufficient evidence to determine the condition of around 45% of the features on these sites in Gwent (compared to a national figure of 49%). Of those features, an estimated 29% are 'favourable' and around 71% 'unfavourable'. This information suggests that our habitats and species are under increasing pressure across the region.

The <u>Gwent State of Nature Report (GSoN)</u> was published by the Resilient Greater Gwent (RGG) partnership in 2021. The report interrogates recording data collated by the South East Wales Biodiversity Records Centre (SEWBReC), utilising almost 120,000 records to provide information for over 500 species and create 100 stories of wildlife in Gwent. Each story shows what information we have for that species or species group and what is happening to them over time.

Strong	Moderate	No Significant	Moderate	Strong
Decline (11)	Decline (10)	Change (21)	Increase (6)	Increase (8)

Fig. A2 Long-term trends (1995-2018) for 56 species within Gwent, based on the British Trust for Ornithology (BTO)/Joint Nature Conservation Committee (JNCC)/RSPB Breeding Bird Survey (number of species in brackets)

Lowland Farmland	Upland Farmland	Woodland
Yellowhammer	Grey Wagtail	Willow Warbler
Starling	Curlew	Chaffinch
Rook	Wheatear	Goldcrest
Greenfinch	Buzzard	Green Woodpecker
Jackdaw	Meadow Pipit	Blue Tit
Linnet	Raven	Wren
Whitethroat		Coal Tit
Woodpigeon		Bullfinch
Skylark		Robin
Goldfinch		Garden Warbler
Stock Dove		Redstart
		Jay
		Long-Tailed Tit
		Song Thrush
		Chiffchaff
		Great Tit
		Blackbird
		Nuthatch
		Treecreeper
		Dunnock
		Blackcap
		Great Spotted Woodpecker
		Tree Pipit
		Sparrowhawk

Fig. A3 Gwent State of Nature (GSoN) species used as indicators

Combined indicators were produced for upland and lowland farmland birds and woodland birds. Species used to produce the 108 indicators are shown in Fig. A2⁹ and Fig. A3¹⁰. The lowland and upland farmland bird indicators show declines of 45% and 30%, respectively, over the Breeding Bird Survey (BBS) period, largely in accordance with UK as well as Wales patterns for farmland and upland birds. Although it fell in the last year, the Gwent woodland indicator is broadly stable.

Reliable regional population trends were also available for two mammals (Lesser Horseshoe Bat and Otter), both of which were assessed as having a well-established Gwent population.

What are the well-being strengths?

Biodiversity is essential to all ecosystems; complex interactions generate services and benefits to human health, well-being and resilience. Biodiversity is fundamental in providing economic, social, environmental and cultural well-being. Our economies are embedded within nature, not external to it and investing in ecosystems as assets gives an annual rate of return far greater than most conventional economic assets¹¹.

Environment and Rural Affairs Monitoring & Modelling Programme (ERAMMP)

Year 1 Report 11



Fig. A4 Partial Wales natural capital asset value estimates

The value of the stock of Welsh natural capital in woodland, farmland, and freshwater was estimated to be approximately £30.5 billion in 2014 (Fig. A4¹²). This is a partial value and the true value is expected to be significantly higher than this figure, as only seven of the benefits received from natural capital in Wales are currently measured.

What are the issues impacting well-being?

In order to continue to provide benefits, species and habitats must be healthy and resistant to pressures and threats.



Fig. A5 Global Biodiversity Outlook: Trends in biodiversity

As identified by the Future Trends Report 2021, global biodiversity outlook data indicates that loss overall is continuing, despite substantial ongoing efforts for biodiversity conservation and sustainable use. While current conservation and management actions are having positive impacts, their effects are overwhelmed by the growing pressures on biodiversity, which in turn are related to increased levels of consumption of food, energy and materials and to the development of infrastructure. Consequently, the world is not on track to achieve most of the current globally agreed targets for biodiversity and trends in biodiversity are projected to continue to decline if future trajectories follow business as usual scenarios (Fig. A5¹³).



Wales continues to face biodiversity loss, with 1 in 6 species that have been assessed in Wales at risk of extinction. Of the 3,902 species assessed since rigorous scientific monitoring began in the 1970s in Wales, 73 species have been lost already (Hayhow et al., 2019) (Fig. A6¹⁴).

The most significant drivers of biodiversity decline include land use change, direct exploitation, pollution, climate change and invasive non-native species (INNS) (IPBES, 2019)¹⁵. The actions associated with feeding our population are driving significant environmental damage (Welsh Government, 2021)¹⁶.



Invasive Non-Native Species (INNS)

Fig. A7 Number of invasive non-native species (INNS) established in or along 10% or more of Great Britain's land area or coastline, 1960 to 2019

Over the period 1960 to 2018, INNS have become more prevalent, increasing the pressure on native biodiversity (all natural resources registers). The rate at which new INNS are establishing in the UK has increased dramatically in the last 50 years and this trend is set to continue (Fig. A7¹⁷). Freshwater and marine ecosystems have the highest number of different INNS (already present and yet to arrive in Wales), followed by woodland and semi-natural grassland ecosystems.



Fig. A8 Invasive non-native species (INNS) Occurrences in Gwent (South East Wales)

The picture for Gwent in (2017-18) is similar to that of the national picture although the data indicates that semi natural grassland ecosystems recorded the highest number of INNS occurrences, followed by woodlands and urban (Fig. A8¹⁸).

What are the gaps in understanding?

It is recommended that the following gaps in understanding are given due consideration in the development of the Gwent Well-being Plan:

- The RGG project is currently undertaking a review of 700 Gwent SINCs. This data would be helpful in contributing to the overall picture of resilience once available.
- While there is a range of policies and measures in place aimed at facilitating adaptation and reducing the impacts of climate change on terrestrial habitats such as the <u>Natural Resource</u> <u>Management Framework</u>, <u>National Forest Programme</u> and the <u>National Peatland</u> <u>Restoration Programme</u>, there is a lack of evidence of the effectiveness of these measures to date.
- A range of indicators show ongoing declines in biodiversity, which leave species and habitats more vulnerable to climate change impacts. More empirical evidence is needed.
- There is a need for more co-ordinated socio-economic evidence gathering and information about the benefits that nature and biodiverse spaces provide. This also applies more broadly about information to increase awareness about the need for transformational change to deliver biodiversity recovery across all sectors¹⁹.
- The policy framework in Wales is in place with appropriate conservation objectives, but there is a need for more coherent delivery of widespread landscape-scale adaptation that not only builds ecologically resilient networks, but also ensures wider environmental benefits²⁰.

What are people telling us?

The South East Area Statement sets out a sustainable vision for the management of Gwent's natural resources. This vision has been developed collaboratively and is underpinned by what specialists and wider stakeholders identified they want to see in Gwent.

With regards to biodiversity and species, stakeholders identified the following²¹:

- "Abundant wildlife and biodiversity."
- "Community gardens and corridors for wildlife."
- "Good habitats in the best possible condition contributing to resilience of the wider area."
- "Nature is intrinsically valued."
- "Wildlife and species saved from extinction."

Future trends and challenges

Climate change

Expected climatic changes including changing rainfall leading to periods of water scarcity or flooding at different times, extreme heat and wildfire, could affect the rate and extent of terrestrial species losses or gains across the UK.

The Intergovernmental Panel on Climate Change (IPCC) report (2018) indicates that global warming in excess of 1.5°C above pre-industrial levels will undermine life-support systems for humanity. It is predicted that if the world warms by 2°C, one in twenty of all species will be threatened with extinction²².

The recently published <u>Third Climate Change Risk Assessment Technical Report: Summary for Wales</u> (Netherwood, 2021)²³ has identified a number of specific future climate risks which will impact terrestrial biodiversity. The report finds that the magnitude of risks from climate change to nature, now and in the future, is high due to the number of species adversely affected and likely to be affected. Studies on changing bioclimatic suitability for different species groups show impacts from mean or extreme changes in climate, combined with other drivers acting separately or in combination with climate, such as land use and habitat loss.

The report assessed the following risks to be at the highest level of urgency where more action is needed²⁴ include:

Risk N1. Terrestrial species and habitats: Changing climate conditions. The magnitude of current and future risks from climate change, both now and in the future is considered to be high due to the number of species adversely affected and likely to be affected.

Risk N2. Terrestrial species and habitats: Pests, pathogens and invasive species. Despite strong international and national policy frameworks for managing the risks to terrestrial species and habitats from native pests and pathogens and establishment of INNS, these risks are expected to continue increasing.

Risk N4. Soils: Changing climatic conditions, including seasonal aridity and wetness. Future climate projections, including UKCP18, provide strong evidence that climate risk factors will increase due to heavier rainfall events (erosion and compaction risks) and increased soil moisture deficits in summer (loss of biota and organic matter, etc). The magnitude of this risk will increase from medium to high in Wales in future.

The assessment also highlighted the following risk pertinent to woodlands which will require **further investigation** including:

Opportunity N3. Terrestrial species and habitats: New species colonisations. Climate change, especially increasing temperatures, can provide the opportunity for increases in populations as well as leading to species moving or expanding their ranges northwards or to higher altitudes.

Land use and soils

Soils

Much of the diversity of landscapes and habitats across Gwent is due to the underlying geology and soils. Most of Monmouthshire is underlain by the Old Red Sandstone rocks, with the older Usk Inlier in the centre. Parts of the Old Red Sandstone series, known as the Brownstones formation, form the Black Mountains, Sugarloaf, and Trellech Ridge.

In the south of the region, a band of limestone extends from the east, and is then overlain by younger sandstone rocks, which border the Severn Estuary. The differing colours of the rocks give many place names, such as Goldcliff and Black Rock.

To the west of the region, the younger South Wales Coal Measures dominate, surrounded by a band of limestone outcrop. Together, these provided the coal, iron and lime that fuelled the industrial revolution, a legacy that shapes the landscape seen today²⁵.



Landscape types and land use

Fig. A9: LANDMAP visual and sensory statistics 2017



Fig. A10: Level 1 & 2 Classification (South East Wales Local Planning Authority (LPA) Group)

The largest landscape component within Gwent is upland (706km² or 43%) including 25% of hills, lower plateau and scarp slopes. The majority of the remaining land is lowland (672km² or 41%), with just over half of this amount being lowland valleys. Water takes up just 8.53km² (0.53%) within (Fig. A10²⁶).

Agriculture currently accounts for the largest land use area in Gwent (~65%) (Welsh Government, 2018²⁷). In Gwent, there were an estimated 2084 active farms in 2018, covering 105,199ha²⁸, giving an average farm size of 50ha. This is similar to the Welsh average of 45ha (Welsh Government 2019²⁹). Grassland accounts for 78% of this, and arable and horticulture 13%. There are also 6,654ha of woodland within farms, accounting for 6%. The majority of farmland is in Monmouthshire, which has the most high-quality agricultural land. Farmed land also makes up the majority of the Gwent Levels³⁰.

Urban

LANDMAP³¹ areas classified as development take up 216km² (13%) of the region, significantly more than the 5.14% national average (Fig. A10).

What are the well-being strengths?

Soils

Fully functioning soils provide rich biodiversity, sequester and maintain carbon, slow the flow of water, help to regulate the climate and air quality, and produce a sustainable supply of food, fibre and timber. The way land and soils are used can deliver several functions or services at the same time and place, providing multiple benefits³².

Land use



Fig A11: LANDMAP visual sensory and landscape evaluations for Gwent

As well as producing food, the agriculture sector is positively contributing to the delivery of highly valued landscapes. 10% of Gwent (153km²) is evaluated as a nationally outstanding visual and sensory landscape, associated with both uplands and lowlands. 49% of the region (790km²) is evaluated as high, regionally important landscapes (Fig. A11³³).

Gwent contains two protected landscapes. Part of the <u>Brecon Beacons National Park (BBNP)</u>, totalling 153km² falls within Monmouthshire, Torfaen and Blaenau Gwent, and extends north and west into Powys and beyond. The <u>Wye Valley Area of Outstanding Natural Beauty (AONB)</u> has 117km² within Monmouthshire, running along the English border and extending into Gloucestershire and Herefordshire³⁴. Collectively, these valued landscapes provide multiple aesthetic, mental and physical well-being benefits for rural communities and visitors.

Urban

By definition, urban areas are where most people live, so they are the source of most human created impacts on other ecosystems. At the same time, this concentration of people presents opportunities for innovation that helps to reduce impacts on the wider environment (World Wildlife Foundation (WWF), 2019)³⁵. The preservation of existing green space in built-up areas is important. Managed as part of a green infrastructure (GI) network, green spaces can deliver many benefits in the same place at the same time. GI can provide wildlife habitats, regulate temperature, absorb flood water, reduce public exposure to air pollution, promote mental health, encourage healthy exercise and attract people to use active travel routes instead of their cars³⁶. Gwent residents have interest in reducing carbon emissions, including addressing volume of traffic which is contributing to large carbon emissions and poor air quality³⁷.

Nature can deliver multiple well-being benefits for people and place, getting a clear picture on the effectiveness of the use of nature and GI in the urban environment is a difficult thing to quantify. However, there are indicators which can give an impression of the overall use of GI across Gwent. Keep Wales Tidy issues Green Flag Awards for sites which meet minimum management standards and will be suitable to meet most peoples' needs for access to green space. There are 48 Green Flag sites in Gwent (Caerphilly 19; Monmouthshire 12; Torfaen 7; Blaenau Gwent 5; Newport 5 (the Wales average by local authority area is 10).



Social Farms & Gardens has recently mapped the current provision of allotments.

Fig. A12 Slide produced for Climate Ready Gwent Carbon Literacy training by Manchester Metropolitan, Great Places Housing Group and Cynnal Cymru

Urban tree canopy cover in many disadvantaged areas is less than the 20% suggested by the Welsh Government and the Future Generations Commissioner for Wales (FGC, 2020)³⁸. While Gwent has rates of urban tree coverage above the national average of 16% (Fig. A12³⁹), there is still room for improvement as all areas have towns below the national average⁴⁰.

What are the issues impacting well-being?

Contaminated land

Land that was previously industrial (metalworks, coal or lead mines, gasworks, etc.) or used as landfill may be contaminated by metals, organic compound contaminants (such as polycyclic aromatic hydrocarbons (PAHs)), hydrocarbons or pesticides (ADAS, 2019⁴¹). In Wales, the most common contaminants are benzo(a)pyrene, lead and arsenic, all of which were identified at over 60% of contaminated land sites (NRW, 2016⁴²). Land affected by contamination can pose a risk to both human health and the wider environment. It is an issue jointly regulated by Local Authorities and NRW, with responsibility for human health and controlled waters primarily falling to each respectively⁴³. It is estimated by Local Authorities in Wales that 9,330 sites are yet to undergo detailed inspection across Wales, and of these, at least 414 sites (4.4%) are considered to be high priority⁴⁴ (Gwent breakdown not available).



Fig. A13 Total number of substantiated pollution incidents to land recorded in Gwent (South East Wales) for the period 01/03/2016 to 30/12/2020

Fig. A13⁴⁵ details the pollution incidents to land as substantiated by NRW for the period 2016-2020 across Gwent. Agriculture, domestic and residential and waste management services make up the greatest proportion of substantiated incidents with waste and sewage materials making up the primary pollutant type, with a total of 285 incidents listed.

What are the gaps in understanding?

It is recommended that the following gaps in understanding are given due consideration in the development of the Gwent Well-being Plan:

- Wales' ambitious policy frameworks do not yet provide a coherent and integrated approach to land use change priorities across national to community levels. A better land use change decision making framework could help to support place-based delivery for Public Service Boards and Area Statements⁴⁶.
- Rates of soil loss by erosion and rates of soil formation have not been directly measured to assess if rates of soil loss exceed soil formation rates in Gwent.
- National monitoring to observe trends and to assess the potential impact of soil pollutants have not been updated and are not currently included in national monitoring.
- Urban and coastal margins ecosystems are not currently represented in national soils monitoring.
- Where soil data and evidence is collected, it is not easily shared or combined.
- Biological data is not collected at scales which reveal what is happening in urban areas. For example, it may be shown as presence or absence in 1km squares which cut across urban boundaries.
- Species are not surveyed systematically in urban areas, so it is hard to assess trends. In other words, if there is a record of a species in an urban area it may only show that someone who can identify that species lives there.
- Data series which show long term trends, for example urban tree canopy, cover and green space distribution, may be interrupted unless long term funding is put in place.

• Data on some important topics is patchy and has not been collected systematically, for example green space quality.

Future trends and challenges

Brexit





The most immediate pressure on the current pattern of land use provisioning services is the uncertainty in future policies relating to funding and market access following Brexit⁴⁷. Overall, 73% of Welsh food and drink exports value are to the European Union (EU) (Welsh Government, 2019⁴⁸), highlighting the importance of this market to the overall food production system.⁴⁹ Key findings from an estimated assessment of the potential impact under different trading scenarios (assuming basic payments continue at current rates) are demonstrated in Fig. A14⁵⁰.

Population, cultural and behavioural changes

The world's population continues to grow (United Nations, 2019⁵¹). Similarly, the population of Wales is projected to increase by 2.7% to 3.22 million by 2028 (ONS, 2019⁵²). As such, there may be an increase in the demand for food⁵³ as well as increased housing demand and need in the future. The demand for construction of new developments could strain the stock and condition of existing GI in the urban and rural environments, thereby limiting their ability to provide much needed wellbeing benefits to people and place.

Climate change

Responding to climate change is likely to lead to trade-offs, particularly between competing land uses. For instance, setting aside land for biodiversity protection, ecosystem restoration or bioenergy could take space away from agriculture. Tree planting on agricultural land may involve excluding grazing in the short to medium term as mature trees take decades to develop. There are limited areas of high value agricultural land in Gwent (Monmouthshire and Newport) and strong pressure for development on flood plains due to topography. Such challenges mean that competition for land will be an increasing issue in the future.

Bioenergy crops will be necessary to achieve a low carbon economy, but this could lead to significant trade-offs (UK Climate Change Committee, 2019; 2020⁵⁴). Some bioenergy crops can have negative effects on biodiversity, food security, water security and local livelihoods (IPBES, 2019⁵⁵). Trade-offs could be minimised by making better use of existing agricultural and forestry waste for energy to reduce the need for planted energy crops. The Future Trends Report 2021 identifies that the

generation of energy (both from fossil fuel and renewable sources) drives a number of local and global pressures on land use in Gwent⁵⁶.

Decision making

Making soil management and land use change decisions which balance all ecosystem services is not a straightforward equation, indeed they are classic conflicts of interest. Prioritising the provisioning service demand of our natural environments (e.g. food, fibre, infrastructure) can pose a potential risk to cultural and regulating service provision such as an increased risk to soils from intensive land management, a decrease in pollinators, increased risk of pests, reduced access to green space, fragmentation of human connection to place and history and a depreciation of employment skills whereby employment becomes too specialised and/or low skilled for local supply.

Residents in Gwent praise the access to greenspace and having large quantities of attractive surroundings available in the region⁵⁷.

<u>Air quality</u>

Clean air is a critical natural resource and is essential in protecting not only human health, but also Wales's natural and built environment. Although air pollution from industry and transport has declined in recent decades, nitrogen-containing air pollutants continue to cause significant environmental harm where previous emissions of sulphur caused widespread acidification of water resources and damaged trees and forest soils⁵⁸.

Air quality monitoring in Wales is primarily undertaken by Local Authorities and, through several national networks, managed by the Welsh Government.

Ammonia



Fig. A15 Ammonia concentrations in Wales

All air pollutants have declined in Wales in recent decades except for ammonia and ozone. Ammonia and nitrogen pollution from agriculture is harming 56% of Wales's land area and is having an adverse effect on the most sensitive habitats for plants and wildlife (Guthrie et al., 2018⁵⁹). More than half of Wales now experiences ammonia concentrations that are too high for lichen- and bryophyte-rich

ecosystems to function properly; these include ancient woodland, bog, heathland and acid grassland (Monmouthshire, Newport, Torfaen South) (Rowe et al., 2020) (Fig. A15⁶⁰).



Fig. A16 Air quality, average micrograms of NO₂ at residential dwelling locations per m^3



Fig. A17 Population weighted average concentration value for NO_2

Fig. A16⁶¹ and Fig. A17⁶² demonstrate the average micrograms of nitrogen dioxide (NO₂) at residential dwelling locations per m³. Newport was the only LA area in Gwent to exceed the Welsh average of $9\mu g/m^3$ and although decreasing in the period between 2014 and 2018 has consistently recorded higher than average NO₂ readings. The annual limit value for NO₂ (UK 40 $\mu g/m^3$) has been exceeded in Caerphilly, at Hafod-yr-ynys, and at five other locations on the motorway and trunk road network in Wales (2017). The hourly limit value for NO₂ has been achieved in all locations throughout Wales and Gwent, with the exception of Hafod-yr-ynys (2017). All exceedances are primarily due to traffic⁶³.

Particulate matter (PM)



Fig. A18 Average micrograms of PM2.5 at residential dwelling locations per m³



Fig. A19 Population weighted average concentration value for particulates less than 2.5



Fig. A20 Average micrograms of PM10 at residential dwelling locations per m³



Fig. A21 Population weighted average concentration value for particulates less than 2.5

Particle matter (PM) is the term for a mixture of solid particles and liquid droplets found in the air. PM can be emitted directly from a source, known as primary PM, whereas secondary PM can form in the atmosphere due to chemical reactions between pollutant gases. Overall concentrations of PM2.5 ($10 \mu g/m^3$) across Gwent are below World Health Organization (WHO) guidelines (Fig. A18⁶⁴), although there are hotspots in industrial and densely populated urban areas when the data is viewed at ward level (Fig. A19⁶⁵). PM10 data is shown in Fig. A20⁶⁶ with Fig. A21⁶⁷ giving a more localised view of impact at ward level. Non-exhaust road transport emissions, domestic and industrial emissions contribute to the local peaks in urban areas. Domestic wood and coal burning also make a significant contribution.

What are the well-being strengths?

Measures to combat air pollution, for example GI, can help transform urban and rural spaces by improving enjoyment and promoting positive behavioural changes. In addition, the cultural services imparted by ecosystems often depend on nitrogen-sensitive biodiversity, for example, in flower-rich meadows or lichen-draped woodlands.

The Welsh Government is committed to building healthier communities and better environments. Clean air has a central role in creating the right conditions for better health, well-being and greater physical activity in Wales. In September 2017, the Welsh Government published its national strategy, <u>Prosperity for All</u>, which sets out a cross-government commitment to reducing emissions and delivering vital improvements in air quality through planning, infrastructure, regulation, and health communication measures.

The existing vegetation in Wales takes up a significant amount of air pollutants. Restoring land cover and changing land use practice to maximise the regulating provision of the ecosystems can further reduce air pollutants. Studies have shown that this approach could be more beneficial than traditional abatement technologies and can be especially effective in combination⁶⁸.

What are the issues impacting well-being?

Poor air quality in the UK is estimated to cause 40,000 early deaths annually (Air Quality Expert Group, 2020⁶⁹), with 2,000 deaths in Wales alone, which amounts to 6% of total deaths (Public Health Wales, 2016⁷⁰) This was demonstrated during the COVID-19 pandemic where lockdown restrictions affected energy use, emissions and some air pollutants across the UK. Initial assessments suggest a reduction in nitrogen oxide (NOx), including NO₂ emissions in urban areas during lockdowns, as a result of lower traffic volumes (Clean Air Advisory Panel, 2020⁷¹). This and the associated reduction in traffic noise is likely to have had a positive impact on well-being⁷².

A growing body of evidence indicates that the impact of air pollution goes beyond physical health and can impact on human well-being due to people's personal connections to the richness of their natural environment⁷³.

Nitrogen dioxide (NO₂)

In Wales, 88% (2018), of sensitive habitats exceed their critical load for atmospheric nitrogen, down from 98% (2009). Almost 60% of habitat or species 'features' on European protected sites are adversely affected by nitrogen deposition (Rowe et al., 2020⁷⁴).

NOx contributes significantly to nitrogen deposition in all ecosystems. NO₂ also reacts with other pollutants in the presence of sunlight to form ozone which can further impact the environment through oxidative damage to vegetation, including crops.

NOx also has direct impacts on human health, causing respiratory and cardiovascular effects. Encouraging the use of the cleanest modes of transport for freight and passengers, active travel and the creation of urban green space, are likely to be key in reducing emissions in the future⁷⁵.

Short term, highly concentrated, exposure to NO_2 is a respiratory irritant that can lead to cough, production of mucus and shortness of breath. Concentrations of NO_2 in the natural environment can cause reduced lung development and respiratory infections in early childhood⁷⁶.

Particulate matter (PM)

The size of PM (soot) and the length of exposure are key determinants of the potential of adverse health conditions and will determine where, physiologically, the impact will be. Small particles less than 2.5μ m in diameter pose the greatest problems because they can get deep into the lungs and bloodstream leading to respiratory problems. When exposure to PM reduces lung function, it also reduces the ability of people to access nature and benefit from it; as a result, this also reduces their quality of life⁷⁷.

There is extensive evidence to show that long term exposure to PM increases mortality and morbidity from cardiovascular and respiratory diseases. PM has also been classified as carcinogenic to humans and causing lung cancer⁷⁸.

What are the gaps in understanding?

It is recommended that the following gaps in understanding are given due consideration in the development of the Gwent Well-being Plan:

- Expansion of the air quality monitoring network in Wales, in both the urban and rural environment would help strengthen our evidence and reliance on computer modelling, to better understand the scale and impact of key pollutants such as ammonia on the environment. Better data sharing as a result of new legislation, especially within the agricultural sector, will also allow us to target our interventions and policy to ensure pollution can be minimised.
- Some issues, such as air pollution, are only monitored at sampling sites which may be insufficient in number and distributed too unevenly to reveal what is happening across the whole of the urban area.

Future trends and challenges

Climate change

The drive towards a low carbon economy comes hand in hand with the drive to improve air quality. The reduction in the use of fossil fuels has a subsequent effect on fewer products of combustion, such as NOx and sulphur oxides (SOx). The opportunity to develop a hydrogen-based economy will also help achieve this.

The Future Trends Report 2021 identifies that projections from the Air Quality Expert Group (2019) suggest that while exhaust emissions are likely to continue to fall, following a move toward electric and ultra-low emission vehicles, non-exhaust emissions are likely to grow in line with increasing traffic levels⁷⁹.

The recently published Third Climate Change Risk Assessment Technical Report: Summary for Wales (Netherwood, 2021)⁸⁰ has identified the risk to health from poor air quality in the future. The report assessed the following risks to be at the highest level of urgency where **more action is needed**:

Risk H7. Health and well-being: Changes to indoor and outdoor air quality. Climate change is expected to affect outdoor air quality in both urban and rural areas by directly and indirectly modifying ground level ozone concentrations. There may be an increase in pollution episodes associated with weather patterns, even if the general trend indicates that air quality is improving.

Section B: Ecosystems are resilient to expected and unforeseen change

To realise the benefits that nature can provide, our natural areas must be healthy and resistant to threats and disturbance. The capacity of natural resources to provide this function (ecosystem resilience) is dependent on the relationship between four main attributes;

- **Diversity:** the range of variation, from genes to species and from habitats to landscapes, which supports the complexity of ecosystem functions and the delivery of ecosystem services;
- Extent/scale: habitat area that supports species diversity and ecosystem function;
- **Condition:** how a system is managed, inputs applied, resources extracted and impacts from management of surrounding land; and
- **Connectivity:** the movement that occurs within and between ecosystems, increasing the effective habitat range of species and the source pool for seed and genetic dispersal.

The components work together to form a fifth attribute; adaptability, which refers to the dynamic nature of ecosystems and their ability to adapt to change. Ecosystem resilience can be considered a measure of health.



Fig. B1 ONS broad ecosystem classes in Gwent

The evidence provided interprets the data and understanding we have into a coherent evidence base for Gwent (under a framework of broad habitats) and in doing so provides a place-based interpretation of the health of the broad habitats which make up the Gwent landscape (Fig. B1).

Woodland

Practical habitat unit	Diversity	Extent	Condition	Connectivity
Native woodland	Medium-High Overall, some of Wales's most diverse habitats. More than half of native stands are favourable for tree and shrub species diversity (64%) and structural diversity (55%).	Medium 51% of native stands (76,000 ha) are in woodlands greater than 20ha and score favourably for size.	Medium 91% of native stands are in intermediate ecological condition and 9% of native woodlands are in favourable ecological condition.	Medium Connectivity with other habitats is good but native woodland is a much fragmented resource. The majority have a favourable proportion of semi- natural habitat nearby (100 km ²) but 25% are less than 5 ha in size.
Non-Native woodland	Low to medium Despite extensive improvements, 45% of stands remain even- aged and forests are dominated by a few species (approx. 60% of non-native trees are Sitka spruce (Forest Research, 2019a).	High 89% (138,000 ha) (89%) of non-native stands score favourably for size as they are part of large forests.	Medium 98% of non-native stands are in intermediate ecological condition. A lack of veteran trees and deadwood is a key factor.	High Good by virtue of large size of non-native blocks across Wales. Internal ecological connectivity within forest blocks is good due to networks of rides, roadside verges, riparian zones and permanent canopy cover.

Fig. B2 Ecosystem resilience assessment for woodlands in Wales (SoNaRR2020)

<u>The State of Natural Resources Report 2020 (SoNaRR2020)</u> assessed the overall resilience of the Welsh woodland resource as 'medium' however this masks significant variation in the assessment of individual attributes of resilience (Fig. B2)⁸¹.



Fig. B3 Welsh woodland resource

Woodlands in Gwent contribute to approximately 6.7% of the total Welsh resource (for Gwent read South East Wales), around 22,000ha in extent (Fig. B3⁸²). The county of Monmouthshire contains the lion's share of that contribution with the Wye Valley landscape area making up a significant proportion of that.

Gwent covers a wide range of ecological conditions and consequently, native woodlands are also very diverse, with species composition and structure reflecting soil type, climate and hydrology, as well as management history and natural variations in species ranges. In common with native woodlands across Wales, condition assessments frequently show native woodlands in Gwent to be 'unfavourable', although management is often in place to improve the situation. <u>Habitat Network</u> <u>Maps</u>⁸³ show that native woodland connectivity is good in many areas of Gwent, with extensive networks flowing north-south down valleys in the west, down the Wye Valley and westwards from Chepstow to Wentwood.⁸⁴

What are the well-being strengths?

Woodlands deliver a range of ecosystem services which are important for well-being. Depending on woodland type, management and location, ecosystem services may include biodiversity, fibre provision, climate regulation and hazard regulation (for example, flood risk or air pollution mitigation), as well as opportunities for recreation, education and learning.⁸⁵

Important woodlands designated as <u>Special Areas of Conservation (SACs</u>) are found along the Wye Valley, at Cwm Clydach, Coed y Cerrig and the Sugarloaf. Outstanding ecological features of the Gwent's native woodlands are⁸⁶:

- The extensive, high quality and highly diverse woodlands of the lower Wye Valley, one of the most significant areas for native woodland in the UK
- The highest quality remnants of floodplain woodland in Wales (probably!) along the River Usk and its tributaries
- The greatest extent of native beech woodland in Wales, at the edge of its UK and European range at Silent Valley in the Eastern Valleys
- The most south-eastern examples of SAC quality upland oak woods in the UK
- The highest representation of lowland woodlands in Wales, often occurring on rich, lowland soils.

The woodland habitats of Gwent support many species including (amongst others) Dormouse, several bat species, Beech and Oak fungi, Hawfinch, Pied Flycatcher, Marsh Tit, Willow Tit, Wood White, saproxylic invertebrates and the Spreading Bellflower.⁸⁷



Opportunities to improve ecosystem resilience through the creation of nature networks

Fig. B4 Priority, core and focal broadleaf woodland habitat network map

Opportunities for improving the resilience of our woodland habitat are shown in Fig. B4⁸⁸.

Landscape Profile	Spatial Opportunity to increase resilience of Woodland habitat
Eastern Valleys	 Silent Valley: There are huge opportunities for improved habitat connectivity both east to west across the Valleys and indeed north into the Brecon Beacons and the southern urban areas e.g. Carn y Cefn and Cefn yr Arail hill ranges Caerphilly woodlands to Cardiff Beech Woods SAC: Maintenance of these woodland connections and improvements of condition of the woodlands themselves, along with conversion of plantation to semi-natural broadleaf woodland in this area would increase Ecosystem Resilience. Lowlands: Hedgerows
Wye Valley and Wentwood	 Wentwood to Chepstow Park Wood (crossing the B4235) and Trellech to Hendre (crossing the A40): Improve woodland linkages. Woodland Ensure woodlands habitats and features of the designated sites series are in favourable condition. Enhance public and privately owned ASNW Enhance public and privately owned ASNW Inhance existing hedgerows and veteran trees planting of fruit trees or other trees with blossom (e.g. blackthorn, hawthorn, elder) could be incorporated as part of wider tree planting initiatives (see below). The importance of traditional orchards should also be highlighted to smallholders and community groups etc. who may be more likely to create orchards or plant the odd tree Promote natural regeneration of floodplain woodlands (within flood zones 2 & 3 of the Castrogi and Mounton Brooks) and riparian woodlands (along the) to improve woodland connectivity between Wentwood & Chepstow Park Wood. Also between the Trellech Plateau and the Hendre. This farmed landscape would also benefit from widened hedgerows and more trees planted within fields. Desclaration provide the forementated but bin woodlands is provide the starting of the description of the dust trainer is the starting of the forementation.
Central Monmouthsire	 Developing networks to link the fragmented but high quality of patches of floodplain woodland along the Usk and its tributaries would be extremely valuable. E.g Great Triley Woods. enhance links between the River Usk, River Gavenny, A465, A4143 and railway corridors with the semi-natural habitats around Llanfoist, including Grove Farm grassland SINC and the Monmouthshire and Brecon Canal, as well as the ancient woodlands of the Blorenge. strengthen and enhance links between the River Gavenny railway corridor and the woodland habitats and watercourses surrounding St Teilo's vicarage enhance connectivity between sections of the Afon Cibi in central Abergavenny with the trees and watercourse of Bailey Park Safeguard and enhance Hedgerows and veteran trees
Gwent Levels	 Cardiff East "habitat ring" (Gwent Levels, South Central Area) – intervention on the western Gwent Levels south of the suburb of Rumney to 'close' a circle woodland and grassland habitat around urban East Cardiff and link the Gwent Levels through Cardiff and into the Valleys habitat network. Llanwern – significant block of woodland where improvement, enlargement and connection to other woodlands may be possible. NRW's Natural Flood Management – SE Wales Potential Sites analysis identifies floodplain and riparian planting locations on the Monks Ditch that could mitigate flooding of Llanwern Village. Habitat connectivity mapping suggests this might also be a strategic location for improving resilience by enlarging and connecting woodland habitat (see maps). Caldicot Castle Country Park and Nedern Wetlands SSSI – opportunities to improve habitat networks and connectivity west to Caerwent and east to Farthing Hill. Wyelands Estate – area of parkland that supports veteran trees of possible national or international importance to saproxylic invertebrates. Evidence gaps, a lack of awareness and long-term management for saproxylic invertebrates). Management to enhance and expand habitats at this location could also built connectivity to the Wye Valley Woodlands and other Gwent Levels habitat types. Higher ground around Castleton and Coedkernow near the M4 A48 east of Duffryn

Fig. B5 Specific opportunities for improving ecosystem resilience across Gwent

Fig. B5 identifies specific opportunities for improving the health of our Gwent woodland resource in Gwent as a matter of priority. These opportunities were identified by Environment stakeholders during production of the South East Area Statement (2020)⁸⁹.

In the less well-wooded areas in the south and centre of Gwent, there may be relatively little opportunity for developing large-scale networks. Instead, it may be more appropriate to have an emphasis on extending and buffering individual woodlands to make them as large and resilient as possible, together with other actions such as promoting stepping stones (e.g. individual trees) and improving corridors (hedges and water courses).

What are the issues impacting well-being?

Some of Gwent's best woodland sites have been designated as sites of local, national and international importance and should provide some of the healthiest examples of woodland habitat in the region. The condition of our best woodland sites can provide some indication as to the health of the wider Gwent based woodland resource.

There are 32 <u>Special Scientific Interest (SSSIs</u>) where woodlands are a qualifying feature in Gwent. Of these, it has been possible to make an assessment and determine the condition of 50% during Natural Resources Wales (NRW)'s <u>Protected Sites Baseline Assessment</u> (2020). Of those assessed, 2

SSSIs are in a 'favourable' condition and 14 SSSIs are in an 'unfavourable' condition⁹⁰. This information suggests that our woodland habitats are under increasing pressure across the region.

Species are both a component and product of our ecosystems, so looking at what is happening to individual species can indicate what is happening within the wider environment.

Woodland Birds				
Species	Conservation Status	Trend Gwent	Data availability	
Brambling	Amber (was Green) (Wales) Green (UK)	Fairly Common	Good	
Hawfinch	Red (UK) Amber (Wales) UKBAP Priority Species, Wales Section 7 List	Decline	Poor	
Pied Flycatcher	Red (UK & Wales), Wales Section 7 List	Decline	Poor	
Spotted Flycatcher	Red (UK & Wales), UKBAP Priority Species, Wales Section 7 List	Significant decline	Poor	
Willow Tit	Red (UK & Wales), UKBAP Priority Species, Wales Section 7 List	Significant decline at risk of extinction in Gwent	Poor	
Willow Warbler	Amber (UK) Red (Wales)	Significant decline	Good	
Marsh Tit	Red (UK & Wales), UKBAP Priority Species, Wales Section 7 List	Decline	Moderate	
Cuckoo	Red (UK2 & Wales1) UK BAP Priority Species, Environment (Wales) Act Section 7 Species.	Decline	Good	

Fig. B6 Woodland bird species trends for Gwent (data extracted from Gwent State of Nature (GSoN) report 2021)

Evidence from the <u>Gwent State of Nature (GSoN) Report 2021</u> assessed the status and regional trend of six woodland bird species and concluded that all six were suffering population trends of 'dramatic decline', 'significant decline' or 'decline' across the region (Fig. B6)⁹¹.

Threats

Pests and diseases

<u>The State of Natural Resources Report (SoNaRR2020)</u> identifies that pests and diseases have had a deteriorating impact on both past trends and future prospects for the woodland resource with *Phytophthora Ramorum* causing the widespread death of Larch and Chalara Ash dieback taking hold.



Fig. B7 Invasive non-native species (INNS) occurrences in Gwent by woodlands

NRW data indicates that the top three <u>Invasive Non-Native Species (INNS)</u> impacting Gwent's woodland resource are, Eastern Grey Squirrel, Cherry Laurel and Rhododendron (Fig. B7⁹²).

Fallow Deer (Wye Valley Woodlands SAC, near Tredunnock) can change the structure of woodland, with consequent negative effects on other elements of woodland ecosystems. Fallow Deer, especially where they occur at high density, can cause economic damage to crops and to tree shoots by their grazing and browsing. Currently they are having some significant impacts in localised areas and control measures are needed to reduce their impact.

Himilayan Balsam is a pressure on woodland resource in the Wye Valley, as is the presence of Buddleia⁹³.

Pollution

Air pollution has a deteriorating impact on the woodland ecosystem. The impact of nitrogen on woodlands are highlighted by designated sites monitoring (NRW, 2015; Joint Nature Conservation Committee (JNCC), 2019). Assessment of the proportion of ancient woodland sites exposed to critical levels of ammonia (NRW, 2020) found that 61% of ancient semi-natural woodland in Wales is modelled as experiencing ammonia concentrations above the 'critical level' for lichen and bryophyte-rich ecosystems⁹⁴.

Habitat loss and degradation

Gwent is relatively densely populated for Wales, with woodland often closely associated with urban areas. While beneficial in terms of human well-being, this can also increase certain impacts on woodland condition, connectivity and extent.

Land use and land use management change is a significant driver affecting woodlands in Wales. It is relevant to the extent and condition of existing woodlands, as well as affecting opportunities for new woodland creation⁹⁵.
What are the gaps in understanding?

It is recommended that the following gaps in understanding are given due consideration in the development of the Gwent Well-being Plan:

- The resilience of woodlands and the flow of ecosystems services and well-being benefits from them;
- The impact of pests and diseases on woodlands;
- The condition of woodlands;
- The extent of woodlands;
- The role of timber in supporting a regenerative economy;
- Ecosystem trade-offs and synergies relevant to woodland (and wider land use) and
- The economic contribution of the wider woodland sector.⁹⁶

The extent to which development is driving permanent woodland resource loss and impacting connectivity is unknown.

A better understanding of climate risk factors impacting our woodland resource is required⁹⁷.

What are people telling us?

The most recent Public Opinion of Forestry Survey (Forest Research, 2019)⁹⁸ reported that 97% of people named at least one benefit of woodlands in Wales, the most frequently cited one being that 'they provide places for wildlife to live'. In contrast, 47% of people named at least one disadvantage of woodlands in Wales, the most frequently cited one being that woodlands were 'used for fly-tipping'. The results also showed that 77% of adults surveyed in Wales had visited woodland for recreation in the last twelve months, the most popular activity being walking (89%). The most commonly stated reasons for not visiting woodlands were 'other personal mobility issues' or 'too busy/not enough time'. The Space for People report (Woodland Trust, 2017) states that people in Wales have better access to woodlands (2ha+ within 500m and 20ha+ within 4km) than the UK average.⁹⁹

Future trends and challenges

Climate Change

The impact of future climatic change on woodlands is projected to be greater than those experienced to date. The recently published <u>Third Climate Change Risk Assessment Technical Report:</u> <u>Summary for Wales</u> (Netherwood, 2021)¹⁰⁰ has identified a number of specific future climate risks which are pertinent to the woodland resource. Those assessed to be in at the highest level of urgency where **more action is needed** include:

Risk N1. Terrestrial species and habitats: Changing climate conditions. Lowland landscapes (woodland and wetland) are likely to be affected by hotter, drier summers and upland woodlands by drought.

Risk N2. Terrestrial species and habitats: Pests, pathogens and invasive species. Pests, pathogens and invasive species continuing to increase.

Risk N4. Soils: Changing climatic conditions, including seasonal aridity and wetness.

Risk/opportunity N5. Natural carbon stores, carbon sequestration and greenhouse gas (GHG) emissions.

Limited actions to manage climate impact on woodland carbon stocks at the devolved level (including woodland carbon assessments).

Risk/opportunity N6. Agricultural and forestry productivity. Extreme events changing climatic conditions (including temperature change, water scarcity, wildfire, flooding, coastal erosion, wind). Tree suitability analysis has been conducted focusing on Sitka spruce and sessile oak in Wales which shows a declining suitable area for commercial production due to increased drought risk, although this does not preclude trees being grown for non-production purposes, including for ecosystem services such as flood mitigation, carbon storage, and supporting biodiversity (Bell et al., 2020).

The assessment also highlighted the following risk pertinent to woodlands which will require **further investigation** including:

Opportunity N3. Terrestrial species and habitats: New species colonisations. It is suggested that broadleaved tree species are likely to be more widespread in central and eastern Wales, which could present an opportunity for increased timber production, carbon sequestration and woodland habitat expansion for conservation. Opportunities have been identified for species and habitats with warmer mean temperatures lengthening the growing season and enabling trees to grow at higher elevations.

Semi-natural grassland

Practical habitat unit	Diversity	Extent	Condition	Connectivity
Lowland semi-natural grassland. Calcareous, neutral, acid, marshy, calaminarian	Low Naturally very high diversity and important for a wide range of flora and fauna. Loss of diversity due to huge decline in the habitat extent in the last half of the 20 th century, as well as current poor condition and connectivity. Large number of grassland species under threat.	Low >90% losses in the last half of the 20 th century. Losses continue. Main issues are agricultural intensification and undermanagement. Protected sites appear largely protected from loss, but 90% of grassland Priority Habitat not on protected sites.	Low Condition generally poor on both protected and unprotected sites, due largely to undermanagement, combined with factors such as atmospheric deposition. Some evidence suggests trend in condition has stabilised.	Low The least well connected of all main habitat groupings. Surveys in 1980s/90s revealed very high fragmentation which is highly likely to be still worsening due to continued losses in extent. Less mobile species severely affected. Several better-connected landscapes remain locally.
Upland semi-natural grassland. Calcareous, acid, calaminarian	Medium Diversity naturally lower than in lowlands, but with notable exceptions in calcareous and calaminarian grasslands. Fewer threatened flora and fauna than in lowlands.	High Extent of calcareous and calaminarian grasslands constrained by bedrock and probably little changed in recent history. Upland acid grassland increased at the expense of heathland in the past.	Medium Poor condition often caused by inappropriate grazing levels: overgrazing and, to a lesser extent, undergrazing. Atmospheric deposition the other main cause of poor condition. Recreation damage is locally significant.	High Connectivity relatively good and probably little changed in recent decades.

Fig. B8 Ecosystem resilience assessment for semi-natural grassland in Wales (SoNaRR2020)

SoNaRR2020 assessed the overall resilience of the Welsh lowland semi-natural grasslands as poor across all four attributes of resilience. Upland semi-natural grassland however fared much better in the national assessment with calcareous, acid and calaminarian grasslands rated as medium and high across the attributes (Fig. B8)¹⁰¹.



Fig. B9 Welsh semi-natural grassland resource

Semi-natural grasslands in Gwent contribute to approximately 6.7% of the Welsh resource (for Gwent read South East), around 12,000 ha in extent. The Caerphilly area has the majority of that (Fig. B9)¹⁰².

While semi-natural grasslands account for a small proportion of the Gwent broad habitat types, the region is nevertheless considered a stronghold for the UK's few remaining species-rich grasslands, which have suffered drastic declines. Particularly extensive and diverse stands of unimproved neutral grassland can be found in the south east of Gwent, notable at Cwrt y Bela and Springdale Site of SSSI, which supports the second largest area of the habitat recorded in Wales. Substantial areas of the habitat can also be found at Plantation Farm and the Gethley SSSI, Dinham Meadows SSSI and the non-statutory site Woodcock Hill/Five Lanes. Sizable areas of unimproved neutral grassland can also be found in the north of Gwent, notably at The Fferm, Blaentrothy Meadows and Pentwyn Farm Grasslands SSSIs. The most significant site for lowland marshy grassland in Gwent is Aberbargoed Grassland SAC and National Nature Reserves (NNR).

Grassland connectivity is very poor across most of Gwent, and grassland habitats are particularly fragmentary across the more agriculturally modified lowland landscapes of Monmouthshire, although the county does have a network of high quality locally designated grassland sites, for example Cwrt y Bela and Springdale SSSI. Grassland connectivity is generally better further west, particularly in the upland fringes of the eastern coalfield valleys between Merthyr Tydfil and Pontypool, although grassland diversity here is not particularly high, lowland dry acid grassland being largely dominant¹⁰³.

What are the well-being strengths?

Most ecosystem services are higher in semi-natural grasslands than in agriculturally improved grassland, particularly those relating to biological diversity, crop pollination, carbon storage, pollution control, and cultural heritage. Compared with other semi-natural habitats, grasslands score particularly well for crop pollination and higher food production levels. More sustainable management of grassland in Wales would help advance Wales's well-being goals related to

resilience, health, culture and global responsibility,¹⁰⁴ and contribute to targets in the <u>South East</u> <u>Wales Green Infrastructure Action Plan for Pollinators</u>.

The semi-natural grasslands of Gwent support many species including the Marsh Fritillary Butterfly, Grassland Waxcaps, Greater Butterfly Orchid, Green Winged Orchid, Small Blue, Shrill Carder Bee, Blunt-flowered Rush, Hornet Robberfly, Brown Banded Carder Bee and pollinators¹⁰⁵.



Opportunities to improve ecosystem resilience through the creation of nature networks

Fig. B10 Priority grassland networks in Gwent

Opportunities for improving the resilience of our semi natural grassland habitat can be seen in Fig. B10.¹⁰⁶

Landscape Profile	Spatial Opportunity to increase resilience of Semi Natural Grassland habitat
Eastern Valleys	 Aberbargoed Grasslands SAC/SSSI/NNR is one of the most important areas of semi-natural grassland in SE Area. This site acts as a feeder source from which species can re-colonise habitat in the wider landscape. Opportunities for improved connectivity exist due south (towards Maes-y-cwmmer/Nant-y-twyn and Heol Ddu nr Wyllie) and to the north west (to Parc Cwm Darran, where there are historic records, and even over the Heads of the Valleys to link up with populations around Merthyr/Hirwaun). Better condition of the land within Penllwyn Grasslands SSSI (there is a current example of partnership working between the Fire Service and NRW to improve management of the grassland here and reduce fire risk) and Memorial Park Meadows SSSI is also important.
Wye Valley and Wentwood	 A key area for grasslands of a calcareous nature (typically MG5b) falls roughly within the settlements of Crick, Magor, Llanvaches and Shirenewton. This area includes a handful of protected grassland sites including Dinham Meadows SSSI (and wider Caerwent Military Base) & Brockwells Meadows SSSI, along with other significant grassland sites around Five Lanes, Woodcock Hill and Slade Wood. Other smaller parcels of calcareous grassland are present on shallow unimproved soils within this location and further north west following the route of the underlying limestone bedrock The potential for creation of additional calcareous grassland habitats at sites with an appropriate soil profile and underlying geology (e.g. Caerwent Quarry, lifton Quarry, Livox Quarry) should be identified and approached with appropriate incentives to encourage promotion of this rare habitat. Lowland neutral grasslands make up the largest proportion of the unimproved grassland resource in the Wye-Wentwood area. There are two key strongholds that should be the focus of efforts to improve the condition, extent and resilience of the resource. These are:- • Cwrt-y-Bela a Springdale SSSI (Central Monmouthshire), Plantation Farm and the Gethley SSSI & the wider Earlswood area • Penallt through Trellech and on to Tintern, taking in Pentwyn Farm Grasslands SSSI, Narth Fen, Pen-y-fan Marsh, Cleddon Bog SSSI & Barbadoes Hill Meadows SSSI – with potential to tie in with bog/fen/heathland connectivity.
Central Monmouthsire	 Enhance links between the River Usk, River Gavenny, A465, A4143 and railway corridors with the semi-natural habitats around Llanfoist, including Grove Farm grassland SINC and the Monmouthshire and Brecon Canal, as well as the ancient woodlands of the Blorenge.
Gwent Levels	 Consideration should be given to connectivity of semi natural grassland areas by for example Identifying opportunities to extend and connect ecological habitats along embankments including the sea wall, reens and ditches, roads and driveways giving priority to corridors that link existing core habitats. Cardiff East "habitat ring" (Gwent Levels, South Central Area) – intervention on the western Gwent Levels south of the suburb of Rhumney to 'close' a circle woodland and grassland habitat around urban East Cardiff and link the Gwent Levels through Cardiff and into the Valleys habitat network.

Fig. B11 Specific opportunities for improving ecosystem resilience across Gwent

Fig. B11¹⁰⁷ identifies specific opportunities for improving the health of our semi-natural grasslands across Gwent as a matter of priority. These opportunities were identified by Environment stakeholders during production of the South East Area Statement (2020)¹⁰⁸.

What are the issues impacting well-being?

Losses of this habitat have been severe in the Welsh context and continued decline in the 21st century must be viewed in the context of more than a 90% loss of lowland grassland habitat in the later part of the 20thcentury. The outlook for this habitat does not look good according to data from the European Habitats Directive (Article 17) which details that all grassland habitats had negative or very negative prospects for condition¹⁰⁹.

Some of Gwent's best semi-natural grassland sites have been designated as sites of local, national and international importance and should provide some of the healthiest examples of grassland habitat in the region. The condition of our best grassland sites can provide some indication as to the health of the wider Gwent based grassland resource.

There are 27 SSSIs where semi-natural grasslands are a qualifying feature in Gwent. Of these, it has been possible to make an assessment and determine the condition of 41% during NRW's Baseline Assessment Project (2020). Of those assessed, one SSSI is in a 'favourable' condition and 10 SSSIs are in an 'unfavourable' condition. This information suggests that our semi-natural grassland habitats are under increasing pressure across the region¹¹⁰.

Species are both a component and product of our ecosystems, so looking at what is happening to individual species can indicate what is happening within the wider environment. There has been an overall decrease in the UK biodiversity pollinator indicator from 1987 onwards.



Fig. B12 Change in the distribution of UK pollinators, 1980-2017 (Government Office for Science Trend Deck)

In 2017, the indicator had declined by 30% compared to its value in 1980. Over the long term, 19% of pollinator species became more widespread (7% showed a 'strong increase') and 49% became less widespread (24% showed a 'strong decline'). By contrast, over the short term, a greater proportion of species were increasing (46%, with 34% exhibiting a 'strong increase') than decreasing (43%, with 36% exhibiting a 'strong decline') (Fig. B12¹¹¹).

Threats

Pollution

Intensive farming practice and the use of artificial fertiliser is still resulting in loss of lowland seminatural grassland, decline in grassland diversity and condition, and fragmentation of habitat patches.¹¹²

Atmospheric pollution, including the deposition of nitrogen oxides (NOx), from the burning of fossil fuels by traffic and industry, and local sources of ammonia (NH₃) deposition, arising mainly from intensive poultry and dairy enterprises. These pollutants are known to cause decreased species-richness of grassland through the effects of eutrophication and soil acidification (Stevens et al., 2004; Van den Berg et al., 2011)¹¹³.

These threats are affected by a range of wider system pressures such as farm economics, changing land use priorities and consumer behaviour.

Habitat loss and degradation

Lack of ecological connectivity of semi-natural grasslands leads to isolation of less mobile species, making them at much greater risk of extinction¹¹⁴ It is vital therefore to take direct action which improves the health of our grassland resource across all the attributes of resilience, including connectivity.

SoNaRR2020 identified that pressures and threats relating to level of grazing were listed as 'high' for all grassland European Protected Habitats in Wales, from either under-grazing, including abandonment and succession to scrub/trees, or over-grazing, or both¹¹⁵.

Unsustainable use

Some important grassland sites need statutory protection, and existing protected sites are in many cases not being appropriately managed, which leads to poor condition. Protected sites need to be part of ecological networks rather than being isolated¹¹⁶.



Fig. B13 Invasive non-native species (INNS) occurrences in Gwent by semi-natural grassland

Indian Balsam and various cotoneaster are significant INNS having an impact on semi-natural grasslands in Gwent (Fig. B13¹¹⁷). The latter is likely to be the greatest threat to the condition of this habitat and is a significant issue on a number of calcareous grassland sites across Wales (Stroh et al., 2019)¹¹⁸.

What are the gaps in understanding?

It is recommended that the following gaps in understanding are given due consideration in the development of the Gwent Well-being Plan:

- More evidence is needed to fully evaluate the effects of atmospheric pollution on seminatural grasslands, including general levels of atmospheric nitrogen and local sources of ammonia, for example to confirm which grassland species are most vulnerable to elevated nitrogen/ammonia levels¹¹⁹.
- The extent to which development is driving permanent semi-natural grassland resource loss and impacting connectivity is unknown.

Future trends and challenges

Climate Change

Higher temperatures, drier summers and extreme rainfall events caused by climate change are likely to lead to harmful changes to grassland hydrology and decrease the frequency and abundance of certain grassland species, as well as promoting damaging land use and land management changes.¹²⁰

As the climate changes, land use pressures are highly likely to intensify, with calls for increased woodland planting (Welsh Government, 2018¹²¹) and growing of more biofuel crops (UKCCC, 2020¹²²), along with a possible increase in the area covered by solar farms. Such needs should be viewed alongside the need for sustainable, low-carbon food production, as well as enhancing and restoring habitats and reversing the decline of biodiversity (UKCCC, 2020¹²³).

The recently published Third Climate Change Risk Assessment Technical Report: Summary for Wales (Netherwood, 2021)¹²⁴ has identified a number of specific future climate risks which are pertinent to the Semi-Natural Grassland resource. Those assessed to be in at the highest level of urgency where **more action is needed** include:

Risk/opportunity N6. Agricultural and forestry productivity. Extreme events changing climatic conditions (including temperature change, water scarcity, wildfire, flooding, coastal erosion, wind). important knowledge gaps remain which necessitate continuing research on adaptation strategies (e.g., grassland and livestock systems).

Risk H7. Health and well-being: Changes to indoor and outdoor air quality. Changes in indoor and outdoor air quality: Wildfire risks may increase due to projected changes in temperature and rainfall (hot and dry weather). It is likely that the frequency of moorland, grassland and forest fires may increase with regional differences.

The assessment also highlighted the following risk pertinent to woodlands which will require **further investigation** including:

Opportunity N3. Terrestrial species and habitats: New species colonisations. Opportunities have been identified for species and habitats with warmer mean temperatures lengthening the growing season and enabling trees, grasses and shrubby plants to grow at higher elevations, resulting in a raising of the moorland line. While this change could lead to the expansion of grazing and an increase in grassland productivity, this could be at the expense of semi-natural habitats, such as upland heath.

Mountains, moorland and heathland (MMH)

SoNaRR2020 assessed the overall resilience of the Welsh mountain, moorland and heathland (MMH) resource as generally quite poor, with significant intervention needed across all four resilience attributes¹²⁵.



Fig. B14 Welsh mountain, moorland and heath (MMH) resource

MMH in Gwent contributes to approximately 4.4% of the Welsh resource (for Gwent read South East Wales), around 16,000ha in extent (Fig. B14¹²⁶). The main upland blocks occur in the west of Gwent.

It comprises the south easterly part of the Black Mountains, the southern slopes of Mynydd Llangynidr/Llangatwg, the Blorenge/Gilwern Hill area and the south-easterly trending ridges of the hills lying between the settlements of Rhymney, Tredegar, Ebbw Vale, Blaina, Abertyleri and Blaenavon (the "Gwent Uplands"). The highest point is Chwarel y Fan in the Black Mountains at 679m. The Wye to Wentwood landscape also contains fragments of bog, fen, swamp and lowland heath. In Wales, the upland fringe is called fridd, and can be an important habitat. In Gwent, the uplands are a complex mosaic of heathland, acidic grassland, bracken, blanket bog and flushes, with areas of woodland and scrub¹²⁷.

In Gwent, this habitat also includes substantial areas of post-industrial land such as coal spoil tips. These large areas of the Gwent uplands form distinctive features, hosting a unique wildlife community. Coal spoil forms a mosaic of bare ground with grass and heath, which is particularly important for invertebrates, lichens and bryophytes.

What are the well-being strengths?

The MMH ecosystems provide food and fibre to the people of Gwent. The predominant land use is stock rearing, with sheep being the major component, and there is also some commercial forestry (Mynydd Maen).

The uplands are crucial in supplying clean drinking water, sequestering carbon and providing renewable energy. MMH landscapes also have huge cultural and heritage value (<u>Blaenavon World</u> <u>Heritage Site (WHS)</u>), are key areas for access and recreation (Twmbarlwm, Blorenge, Sugar Loaf) and play important roles in physical, mental and spiritual well-being.

The MMH habitats of Gwent also support many species including Ring Ouzel, Red Grouse, Hen Harrier, Brown Hare, Silurian Moth, Small Pearl-bordered Fritillary and Scarce Blue-tailed Damselfly.

Opportunities to improve ecosystem resilience through the creation of nature networks

Habitat extent is not realistically expandable for habitats which are topographically contained, such as mountain heaths and willow scrub or inland rock outcrops and scree, and for these habitats, the suggested opportunities related more to improvement in condition.



Fig. B15 Priority heathland networks in Gwent

Fig. B15¹²⁸ shows opportunities for improving the health and resilience of MMH habitat and take action to improve condition, by considering where areas of acid grassland would be better considered as potential areas of heath, scrub or even woodland.

Local technical specialists also identified the need for specific targeted action to improve the condition of Waun Afon Bog, a wetland site that occupies the northern end of the Afon Lwyd valley¹²⁹. It is the largest peatland in Gwent and is 'an area of upland-edge blanket' or 'intermediate bog that has developed on a watershed'. Appropriate management and better overall habitat condition would improve the biodiversity value and improve capacity for water storage to mitigate flooding and carbon sequestration.

Appreciation of the value of brownfield, post-industrial sites across Gwent is key. Colliery spoil and other post-industrial landscapes are important for their biological diversity and for the range of habitats they support, particularly open ground habitats and the range of specialist fauna and flora associated with them.

What are the issues impacting well-being?

Gwent has a below average representation of upland protected sites compared to the other areas of Wales. There are no upland SACs, <u>Special Protection Areas (SPA)</u> or NNRs. SSSIs occur on the Black Mountains, Gilwern Hill, Blorenge, the eastern part of Mynydd Llangatwg and Cefn y Brithdir.

There are seven SSSIs where MMH habitats are a qualifying feature in Gwent. One of these has three separate qualifying features of these habitat types and another has two, bringing the total features across the two sites to ten. Of these, it has been possible to make an assessment and determine the condition of four features (40%) during NRW's Baseline Assessment Project (2020)¹³⁰. Of those assessed, all four SSSI features are in an 'unfavourable' condition. This information suggests that our MM habitats are under increasing pressure across the region.

The condition of priority habitats in Gwent is subject to a number of drivers, several of which are complex and difficult to control. The main drivers are the intensity of grazing, under grazing, burning, degree of recreational disturbance and anti-social behaviour, deposition of atmospheric nitrogen and invasion of bracken. The vast majority of the upland areas in Gwent are common land with the main exception being part of the Black Mountains. This makes effective management more difficult to achieve.

Species	Conservation Status	Trend Gwent	Data availability
Hen Harrier	Red (UK & Wales) Wales Section 7 Priority Species	Mixed, gentle increase in past recent downturn	Poor
Nightjar	Amber (UK& Wales) UKBAP, Wales Section 7 Priority Species	Generally quite stable	Poor/ moderate
Red Grouse	Red (Wales), Amber (UK). UKBAP Priority Species, Wales Section 7 Priority Species	Decrease (bias in recording on shoot sites)	Moderate
Ring Ouzel	Red (UK1 & Wales2) UKBAP Priority Species, Wales Section 7 Priority Species	Decline of population to extinction	Poor

Species are both a component and product of our ecosystems, so looking at what is happening to individual species can indicate what is happening within the wider environment.

Linland and Heathland Birds

Fig. B16 Upland and heathland bird species, trends for Gwent (data extracted from Gwent State of Nature (GSoN) report 2021)

Evidence from the GSoN report 2021 assessed the status and regional trend of four upland and heathland bird species and concluded that all four were experiencing a trend of population decline with the ring ouzel extinct to region (Fig. B16)¹³¹.

The <u>SE Wales Resilient Uplands</u> <u>Natural Resource Management Plan</u> identifies numerous reasons for why habitat quality is poor in the uplands and provides useful toolkits and case studies.

What are the gaps in understanding?

It is recommended that the following gaps in understanding are given due consideration in the development of the Gwent Well-being Plan:

- The evidence needs for MMH are broad and often complex reflecting the diverse nature of these habitats, the gaps in our understanding of condition and pressures and the long-term outcomes of conservation measures.
- Effective management firstly requires a better understanding of the condition of existing MMH habitat, particularly in protected area land management units but also more widely, alongside the causes of poor habitat condition and the direction of change.
- To improve the function of MMH, we need to identify where there are opportunities, particularly for peatland and heathland ecosystem restoration. Many lowland heathlands are fragments of their previous extent, and many former upland heaths are reduced to acid grassland. Target areas for restoration and reconnection should be identified¹³².

Future trends and challenges

Climate Change

Direct impacts include summer drought on peatlands and heathlands. Habitats which are in poor condition as a result of other pressures, such as drained and degraded bogs, are also likely to be sensitive to drought. Climate change will become an increasing threat with wetter, warmer winters, more surface run-off and erosion. Climate change can also have indirect effects, such as uncontrolled damaging wildfires on moorland vegetation in dry periods. Habitats that are already under stress through sub-optimal management are more likely to suffer detrimental impacts from climate change (Welsh Government, 2020)¹³³. Wildfire risks may be increased due to projected changes in temperature and rainfall (hot and dry weather). It is likely that the frequency of moorland, grassland and forest fires may increase¹³⁴.

The recently published Third Climate Change Risk Assessment Technical Report: Summary for Wales (Netherwood, 2021)¹³⁵ has identified a number of specific future climate risks which are pertinent to the Semi-Natural Grassland resource. Those assessed to be in at the highest level of urgency where **more action is needed** include:

Risk N1. Terrestrial species and habitats: Changing climate conditions. Changing climatic conditions and extreme weather events, including temperature change, water scarcity, wildfire, flooding, wind, and altered hydrology (including water scarcity, flooding and saline intrusion). While there are already a range of policies and measures in place aimed at facilitating adaptation and reducing the impacts of climate change on upland resource, there is lack of evidence of the effectiveness of these measures to date.

Risk/opportunity N5. Natural carbon stores, carbon sequestration and greenhouse gas (GHG) emissions.

Freshwater

Practical habitat unit	Diversity	Extent	Condition	Connectivity
Rivers upland	Low The physical and biological diversity of rivers has been severely reduced in Wales over the 20 th Century.	Medium The extent of rivers has declined over the 20th Century although less in upper reaches due to accessibility.	Medium Under WFD 44% of all rivers in Wales are at good ecological status. There are no Welsh rivers in High Ecological Status.	Medium Connectivity of upper reaches (longitudinal and lateral) has been less degraded than lower due to accessibility.
Rivers lowland	Low The physical and biological diversity of rivers has severely reduced in Wales over the 20 th Century.	Low The extent of rivers has declined dramatically over the 20 th Century particularly in the lower reaches.	Low Article 17 reporting in 2018 assesses rivers (water courses of plain to montane levels) with <i>Ranunculion fluitantis</i> and <i>Callitricho-Batrachion</i> vegetation as Unfavourable – Inadequate and declining.	Low 42% of flood plains in England and Wales are no longer connected to the river system (Maltby <i>et al.</i> , 2011).

Fig. B17 Ecosystem resilience assessment for freshwater in Wales (SoNaRR2020)

SoNNaRR2020 assessed the overall resilience of the Welsh freshwater resource as low for rivers (Fig. B17¹³⁶), with significant intervention needed across all four resilience attributes¹³⁷.

Practical habitat unit	Diversity	Extent	Condition	Connectivity
Lakes – low nutrient and upland	High The majority of this lake type in Wales has a good habitat structure and biodiversity that reflects the expected range of species.	High There has been no significant loss of extent of this habitat type in Wales.	Medium The main pressures affecting this lake type in Wales are acidification, invasive species, and nutrient enrichment (Hatton-Ellis 2012, 2018a, b).	High No significant loss of connectivity.
Lakes – lowland / higher nutrient	Low	Low	Low	High No significant loss of connectivity.
Marl Lakes	Medium	Low	Low	High No significant loss of connectivity.

Fig. B18 Ecosystem resilience assessment for lakes in Wales (SoNaRR2020)

Lakes fare slightly better for resilience with a medium to high rating (Fig. B18¹³⁸).



Fig. B19 Water Framework Directive (WFD) 2018 interim classification Gwent

NRW released interim data in 2018 showing that most of the rivers in Gwent are not achieving at least the desired 'good' status under the Water Framework Directive (WFD) (Fig. B19). This indicates that the resilience of our Gwent freshwater habitats reflects low levels of resilience in this habitat at an all-Wales scale.

Some of our best freshwater resources are located in the east of Gwent; the Rivers Wye and Usk are designated riverine SACs. In January 2021, NRW published evidence on phosphate levels for all river SACs across Wales. The evidence was extracted data from the water quality database for a three-year period from January 2017 to December 2019, for all sample points within the 125 water bodies in the nine SAC rivers. The evidence shows that overall, phosphorus breaches are widespread within Gwent's SAC rivers. The River Usk was assessed to have an 88% failure rate and the River Wye a 60% failure rate for phosphorus.

What are the well-being strengths?

Rivers, lakes, flood plains and ponds, as well as connected groundwaters, are fundamentally important for human survival. They provide drinking water and contribute to well-being through the

opportunities they provide for recreation and the appreciation of landscape. Participating in waterrelated recreation such as kayaking, wild water swimming and angling can make a significant contribution to the physical and mental health of the population. In order for us to benefit from the services provided by freshwater ecosystems, we need to balance the needs of the environment, society and the economy.

The Rivers Wye and Usk in the east of Gwent have well established and nationally significant rod fisheries for Salmon, Brown Trout, Grayling and coarse fish such as Barbel. The River Wye is also highly valued for recreation and navigation. The Welsh angling industry is worth around £200million per annum and it is thought that this could be increased¹³⁹. The River Usk floodplain retains several important geomorphological features and associated wetland habitats e.g., Llanviangel Gobion, south of Abergavenny. The River Usk flows through the city of Newport, where it merges with the strong tidal waters of the Severn Estuary. This is a unique section of the river where the large tidal range leaves much of the riverbed exposed as mud banks at low tide. These mud banks may look bare and unattractive, but they contain a wealth of life beneath the surface and birds such as redshank and oystercatcher can often be seen feeding. At intervals along the banks, small areas of saltmarsh and fringes of common reed can be seen along with native shrubs and trees higher up.

The Gwent Levels either side of Newport are designated SSSI due to their unique reen and ditch network. These interconnected waterways are an example of one of the most extensive areas of reclaimed wet pasture in the UK (which also includes the Somerset Levels, Romney Marsh and the Pevensey Levels) and is the largest area of its kind in Wales.

Gwent's lakes, rivers, ponds, and flood plain habitats support rich biodiversity including some of the rarest and most iconic wildlife in Wales such as Otter, Water Vole, Common Toad, Great Crested Newt, migratory fish, European Eel, Dipper, Snipe, Cetti's Warbler, Bittern, Reed Warbler, Waterfowl, all odonata, and invertebrates of the Gwent Levels¹⁴⁰.



What are the issues impacting well-being?

Fig. B20 Reasons for not achieving "good" Water Framework Directive (WFD) status in Gwent Rivers

Fig. B20 shows the failing elements according to WFD classifications. It gives an indication of the impact and significance that a particular water management issue is having on the elements which

make up WFD classification. These water management issues will be impacting the condition of our freshwater habitats to a greater or lesser extent as indicated by the data.

There are 10 SSSIs where Freshwater habitats are qualifying features in Gwent, including the six Gwent Levels SSSIs and the Rivers Wye and Usk. Some of these SSSIs have more than one Freshwater qualifying feature. Of the total 16 features, it has been possible to make an assessment and determine the condition of 12 (75%) during NRW's Baseline Assessment Project (2020)¹⁴¹. Of those assessed, all 12 qualifying features are in an 'unfavourable' condition. This information suggests that our freshwater habitats are under increasing pressure across the region.

Species are both a component and product of our ecosystems, so looking at what is happening to individual species can indicate what is happening within the wider environment.





Fig. B21 Wye and Usk catchment salmon catch

Evidence from the GSoN 2021 assessed the status of Salmon numbers in our designated rivers by interrogating declared catches and the Catch Per Licence Day (CPLD) available for the Rivers Usk and Wye catchments (Fig. B21¹⁴²). Both show a large variation between years and a population crash in

2018. A by-law to release all rod-caught Salmon was introduced on the River Wye in 2012. This now applies to all rivers in Wales.



Fig. B22 Egg deposition and conservation limit River Usk and Wye

Estimates of egg deposition show the conservation limit, which aims to protect an optimum level of stock (i.e. the number of eggs needed each year in order to conserve salmon stocks for the future). Egg deposition estimates for both rivers are currently below their conservation limits (Fig. B22¹⁴³).

Pollution

Wales' Environme	ntal Pollution In	cidents					Ś	Reset filters	View table	⊞
Operational area	Local authority	Catchment			Environm	ent		Date range		
South East Wales $\qquad \checkmark$	All	∽ All	`	\sim	Air	Land	Water	01/03/2016	30/12/2020	0
								I		
Total number of substantiated incidents		Proportion of substan premises type	tiated incide	ents p	per	Total number of substantiated incidents primary pollutant type			icidents p	er
		Water Industry		24.2	2%	Primary Pollu	utant		Incid	lents
		Domestic & Residential		17.	.61%	Sewage Mater	ial			199
54	-5	Premise Not Identified		15.23	%	Contaminated	Water			91
0		Other	12	2.84%		Inert Materials	and Was	te		57
		Agriculture	11.3	8%		Pollutant Not	Identified			54
		Natural Source	4.40%			Oils and Fuels				44
Proportion of substantiat	ed incidents per	Manufacturing	3.85%			Agricultural M	aterials ar	nd Waste		41
observational impact cate	egory	Service Sector	3.30%			Other Pollutar	it			20
100%		Retail Sector	2.39%			Organic Chem	icals / Pro	ducts		15
90.54%		Transport	2.39%			Specific Waste	Material			11
50%		Waste Management	1.10%			General Biode	gradable	Materials and Wa	ste	9
		Public Administration	0.92%			Inorganic Che	micals / P	roducts		4
	8.11%	Forestry	0.18%			Total				545
0%	Jigh High Major	Power Generation	0.18%							
Low F Sig	nign - Major Inificant	0'	%	20	%					

Fig. B23 Wales pollution incidents by water for Gwent

Data indicates that agricultural and rural inputs, sewage treatment works, and sewage related assets combined contribute most significantly towards the reasons for the failure of Gwent's river habitats to achieve the desired 'good' status (Fig. B23¹⁴⁴).

The urban areas of Gwent suffer from pressure on water quality from sewage, combined sewer overflows, misconnections and industrial sites and estates, impacting on the wider ecology. New developments can also increase these pressures. Chemical products of combustion are also present. Their diffuse nature makes them difficult to address.

In the rural areas there is pressure from diffuse rural pollution; sediment and nutrients, phosphate and nitrate. For example, in central Monmouthshire phosphate is the most common reason for not achieving 'good' ecological status, with 14 water bodies (>60 %) currently at 'moderate' status including the Trothy, Gavenny and Usk. Even in 'good' status water bodies, phosphate remains a pressure, risking deterioration to below 'good'.

The extensive phosphate failures of the Rivers Usk and Wye SACs are significant for Wales. These patterns likely reflect a combination of more intensive land use and higher population density, resulting in higher loading from sewage treatment works and private treatment plants. The River Usk is (by some distance) the worst performing SAC river in Wales with respect to its phosphorus targets and is the only river where there are extensive failures in the headwaters. In part this is likely to be a consequence of overgrazing, as the dominant Old Red Sandstone geology of the river creates relatively nutrient-rich soils that are prone to runoff and bank erosion during wet weather¹⁴⁵.

Groundwater quality has the potential to impact on surface water through coal mine water discharges. Pontlottyn and Hengoed mine waters that discharge to the Rhymney catchment are ranked numbers 10th and 20th in the <u>Coal Authority</u> assessment on mine water impact, while Cwm Sychan, Trosnant and Nant Froed Oer discharging to the River Lywd catchment are ranked 12th, 49th and 56th respectively.

Habitat loss and degradation

The urban areas of Gwent suffer from physically modified and degraded habitat. In the valleys rivers, physical modifications are present such as reservoirs for water supply and man-made weirs due to industrialisation and urbanisation. These can present barriers to fish migration that prevent fish from migrating upstream to their spawning grounds.

Invasive Non-Native Species (INNS) Occurrences in Wales **Reset filters** View table **Operational** area Local authority Primary ecosystem Impacts Yea South East Wales All Freshwater 1969 2019 All Number of occurrences Number of species Number of occurrences by primary ecosystem Number of occurrences by common name 16.27K 37 Canada Goose 13K Canadian Waterweed Number of species by habitat Mandarin Duck. Mandarin American Mink, Mink 0K Nuttall's Waterweed 0K Ruddy Duck 0K Barnacle Goose Freshwater 16K Jenkins' Spire Snail 0K Least Duckweed OK Water Fern OK European physa 0K New Zealand Pygmyweed 0K 28 Curly Waterweed 0K Parrot's Feather 0K Freshwater Terrestrial 0K 10K 10K Fig. B24 Invasive non-native species (INNS) occurrences in Gwent by freshwater

Invasive Non-Native Species (INNS)

INNS can impact freshwater ecosystems by reducing biodiversity and abundance, disrupting trophic levels, acting as a vector for diseases and parasites, reducing amenity value, causing water quality issues and blocking waterways and structures, leading to reduced access and localised flooding¹⁴⁶.

Fig. B24¹⁴⁷ shows numbers of recorded INNS which have an impact on freshwater resource in Gwent. Floating Pennywort is present in the River Usk catchment and has historically been on the Gwent Levels; Parrot's Feather is found in isolated ponds near Caerphilly and Newport; Curly Waterweed is found in Ystrad Mynach and around Newport; Water Fern is present in Monmouthshire, on the Monmouthshire and Brecon Canal in Torfaen, Cwmbran and Newport; and New Zealand Pigmy Weed can be found in Wentwood Forest. These species have the potential to affect biodiversity, recreational activities and drainage and increase flood risk. Feasibility of eradicating/controlling the spread of these species at each site where they are present needs further investigation.

Signal Crayfish are present on the Afon Gavenny, Afon Llwyd, Dowlais Brook near Cwmbran, Pen y Fan Pond and the Afon Ebbw. This INNS is a significant issue in Gwent because of the impact it has on White Clawed Crayfish. Signal Crayfish are responsible for driving native White Clawed Crayfish towards extinction through the spread of Cray Fish plague and by outcompeting them. Signal Crayfish burrowing can cause riverbanks to erode and can take refuges from salmonid fish and prey on fish eggs, which could reduce the value of commercial fisheries.

What are the gaps in understanding?

It is recommended that the following gaps in understanding are given due consideration in the development of the Gwent Well-being Plan:

- Effective management of freshwater ecosystems relies on good quality evidence of existing and emerging pressures and their interactions, as well as biodiversity responses to these pressures. Long-term, high-quality data and expert analysis are vital in order to understand the processes that are taking place.
- Robust evidence is essential to inform prioritisation of actions. Evidence requirements for freshwater are broad due to the diverse nature of this ecosystem, with the main themes relating to assessment of condition and understanding the impacts of climate change, physical modification and pollution. For example, we need to understand and quantify expected changes in river flows, water temperatures and sea level. This will help identify which freshwater habitats and species are most vulnerable to climate changes impacts (low flows, extreme flood events, raised temperatures) and the location of these habitats and species in Wales.
- Better understanding is required of pollution source apportionment, the impacts of silt pollution in rivers and of new and emerging chemical pollutants and their interactions. The extent of the physical modification of rivers and floodplains across Wales is not quantified as there is currently no system in place to effectively monitor river habitat structure and geomorphology.
- A lack of information on the extent and condition of river gravels is of particular concern. In addition, the lack of reliable tools to measure the impact of physical modifications is a significant evidence gap¹⁴⁸.
- Further investigation of the widespread failures in the River Usk river is required¹⁴⁹.

Future trends and challenges

Climate Change

Climate change is affecting all Welsh freshwater habitats and is a serious threat to freshwaters globally (Reid et al. 2018). Climate change exacerbates flood and drought risk. Climate induced changes such as rainfall patterns, storminess, maximum temperature, and the number of frost days are having a significant and complex impact on freshwater ecosystems. The magnitude of current and future risks is judged to be medium by the 2050s (under +2°C at 2100 scenario). This increases to high magnitude for the 2080s (+4°C at 2100 scenario).

Longer and more frequent low flow events along with more sudden and severe storm events cause great stress to freshwater habitats and species. Increased temperatures can kill freshwater animals and plants directly or indirectly due to a reduction in dissolved oxygen (Crozier & Hutchings 2014). Additionally, warmer conditions combine with other pressures such as nutrient pollution to exacerbate impacts such as earlier, longer, or more acute algal blooms, deoxygenation of deeper lakes, and increased toxicity of other pollutants (Crozier & Hutchings 2014).

Climate change also intensifies other pressures. For example, storms increase soil erosion and other pollutants in surface run-off in rural and urban areas, as well as overwhelming sewage treatment facilities and remobilising legacy pollutants especially metals and persistent organic pollutants (POPs) in river systems and from moorland peats.

Finally, climate change alters patterns of human pressures, for example by changing land use and increasing demand for drinking water and hydropower¹⁵⁰.

CCRA3¹⁵¹ identified the following risks that are specific to the freshwater environment and **more action is needed**:

Risk N11. Freshwater species and habitats: Changing climatic conditions and extreme events. Risks from reduced water availability and higher water temperatures will increase the degradation of freshwater habitats and compromise the viability of some freshwater species.

Risk N12. Freshwater species and habitats: Pests, pathogens and invasive species. Future risks for freshwater species will increase through changed thermal regimes with impact on the distribution and spread of various diseases and INNS.

CCRA3 identified the following risks that are specific to the freshwater environment where **current** action should be sustained

Opportunity N13. Freshwater species and habitats: New species colonisations. Many of the adaptation actions that are taken to combat the risk to freshwater species (N11) will facilitate opportunities, therefore sustain current action is recommended. Opportunities for freshwater species may not only enhance biodiversity but they may also contribute to ecosystem services, especially cultural ones such as recreational angling and enjoyment of wildlife, with possible associated business opportunities.



Coastal margins and marine

Fig. B23: Welsh coastal margin resource

Coastal margins and marine habitats in Gwent contribute to approximately 0.6% of the Welsh resource (for Gwent read South East Wales) (Fig. B23¹⁵²). The coastline comprises the foreshore of the Severn Estuary and its tributaries including the Rivers Rhymney, Usk and Wye, with the extensive low-lying Gwent Levels behind sea defences. Whilst Gwent's rivers all meet the coast here, the coastal area sits within Monmouthshire and Newport. Gwent has an unusual coastline; the transition from terrestrial to marine is very abrupt in places, due to the fact that much of the Gwent Levels were claimed from the sea and are now protected by a sea wall.



Fig. B24 Extent of intertidal reef, saltmarsh and seagrass habitat in Gwent

Gwent is bounded by the Severn Estuary, an SPA, SAC and <u>Ramsar site</u> which is designated with key features: estuary, subtidal sandbanks, intertidal mudflats and sandflats, Atlantic salt meadow, reefs, river lamprey, sea lamprey and twaite shad, internationally important populations of migratory bird species, internationally important populations of wintering bird species and assemblages of nationally important populations of waterfowl (Fig. B24)¹⁵³.

Designated Features	Indicative condition assessment	Confidence in assessment	
Estuaries	Unfavourable	Medium	
 Mudflats and sandflats not covered by seawater at low tide 	Unfavourable	Medium	
 Atlantic salt meadows (Glauco- Puccinellietalia maritimae) 	Unfavourable	Medium	
 Sandbanks which are slightly covered by seawater all the time 	Favourable	Low	
Reefs	Unknown	Not Applicable	
Sea lamprey (Petromyzon marinus)	Unfavourable	High	
River lamprey (Lampetra fluviatilis)	Unfavourable	High	
• Twaite shad (Alosa fallax)	Unfavourable	High	

Table 1: Summary of indicative condition assessments for Severn Estuary SAC.

Fig. B25 Summary of indicative condition assessments for Severn Estuary Special Area of Conservation (SAC)

The inshore marine area extends out into the Severn Estuary and is classified as failing to achieve its required status under the WFD and SAC condition targets (Fig. B25¹⁵⁴).

What are the well-being strengths?

Ecosystem services provided at the coast make significant contributions to well-being, such as contributing to natural flood protection. The Welsh coastline has strong cultural associations and is celebrated for its iconic scenery, proving a draw for recreation and tourism, with positive effects for

both the economy and personal well-being¹⁵⁵. A healthy marine environment also has the potential to store and capture carbon.

The Severn Estuary supports major industry and port installations. Use of natural resources includes salmon fishing (e.g. using putchers and lave nets), an eel and elver fishery and aggregate extraction. Recreational activities include boating, wildfowling, angling and bait digging, and use of the <u>Wales</u> <u>Coast Path</u>.

The Severn Estuary is one of the largest coastal plain estuaries in the UK. Its classic funnel shape, unique in the UK, is a factor causing the Severn Estuary to have one of the highest tidal ranges in the world. It comprises extensive intertidal mudflats and sandflats, rocky platforms and islands. Saltmarshes fringe the coast. The subtidal seabed is rock and gravel, with subtidal sandbanks. The Severn Estuary supports a number of notable saltmarsh and corresponding species. An 80m width of saltmarsh has been estimated to reduce the height of seawall defence required from 12m to 3m, resulting in capital cost savings of £2,600-£4,600 per metre of seawall (ASC, 2016¹⁵⁶). Protecting, maintaining and restoring these natural features and habitats is fundamental to the people, communities, economy, and environment of Wales (Ibrahim, 2020¹⁵⁷).

The Gwent marine area is home to a significant proportion of the Welsh seagrass resource (WFD intertidal seagrass surveys (NRW)). Biogenic reefs formed by the tube-dwelling worm Sabellaria alveolata are predominantly intertidal habitats in the UK, but the Severn Estuary is one of the few places these reefs occur in the subtidal as well as intertidal areas. The Severn Estuary is one of the most important estuaries in the UK for three rare species of migratory fish: River Lamprey, Sea Lamprey and Twaite Shad which are designated features of the SAC. The tidal regime and intertidal areas give the area a unique coastal landscape character. There is a rich history of cultural heritage and archaeological discoveries. The Severn Estuary also supports unique traditions of fishing and agriculture, some of which are still used today, such as lave net fishing at Black Rock in Monmouthshire.

The Severn Estuary has the second highest tidal range in the world at over 12m and is one of only six estuaries in the UK to accommodate over 100,000 waders at peak times. Gwent's coastal and marine habitats support internationally important populations of Bewick's Swan Curlew, Dunlin, Redshank, Gadwall, and European white-fronted goose. It is also a key migratory route for salmon, sea trout, river and sea lamprey, and twaite and allis shad¹⁵⁸.

Opportunities to build resilience of intertidal habitats must be explored further; options such as the use of polders to increase saltmarsh extent need investigation and stocks of seagrass should be safeguarded and enhanced where possible.

What are the issues impacting well-being?

In 2018, NRW published an indicative assessment¹⁵⁹ of the <u>Severn Estuary SAC</u>. All but one of the designated features for which an assessment could be made were assessed to be in an 'unfavourable' condition with relevant activities likely to be impacting on condition including coastal squeeze, water quality issues and barriers to migration.

The current <u>Shoreline Management Plan</u> uses UK Climate Projections 2009 (UKCP09) data to ensure climate resilience. This management plan is currently being reviewed to consider whether any updates are required, for example to account for the new UKCP18 information. The Welsh Government is reviewing its climate change guidance to align with revised UKCP18 data¹⁶⁰ and has most recently published its <u>Guidance for Flood and Coastal Erosion Risk Management Authorities</u> in Wales, advising that additional sensitivity testing for a High Emissions Climate Projections (H++)

scenario is not normally required for sea level rise unless the consequences of flooding or erosion could be extreme.

Habitat loss

Climate change and the presence of the sea wall are predicted to lead to continued loss of the saltmarsh and mudflat habitat.

Pollution

Air and water pollution impact the condition of the coastal margin ecosystem. Contaminants originate from sources such as industry, transport, agriculture and litter derived plastics. Trends in critical load and critical level exceedances in the UK (Rowe et al., 2020¹⁶¹) for air pollution includes assessments for critical loads for saltmarsh. Pollution from shipping and industry is a pressure and a risk; small scale spills and the use of antifoulants contribute to overall pollution¹⁶².

Unsustainable practices

Many coastal vegetation communities are dependent on appropriate grazing levels grazing to maintain condition¹⁶³ and there is an identified need to work closely with landowners to achieve the desired level of saltmarsh grazing.

Historical unsustainable fishing practices over the longer term, in the absence of effective management and other drivers such as pollution and disease are likely to impact upon fish and shellfish populations in Wales¹⁶⁴.



Invasive Non-Native Species (INNS)

Fig. B26 Invasive non-native species by marine in Gwent

Fig. B26¹⁶⁵ shows the number of occurrences of common cord grass and the acorn barnacle which have been recorded on marine habitats in Gwent. These INNS can impact marine ecosystems by affecting biodiversity, altering trophic levels, exacerbating water quality issues such as red tides, smothering, predating or outcompeting native fauna and aquaculture species, affecting commercial fisheries, as well as biofouling marine structures, boats, and blocking intakes/pipes¹⁶⁶.

What are the gaps in understanding?

It is recommended that the following gaps in understanding are given due consideration in the development of the Gwent Well-being Plan:

- Basic extent, condition, connectivity and biodiversity data is out of date and incomplete in some areas, providing difficulties with evaluating stocks of natural resources or detecting trends.
- There is a need to predict future trends to enable preparation and planned response to changing pressures at the coast, for example the impacts of sea level rise.
- The contribution coastal margins make to well-being and the regenerative economy through the regulating, provisioning and cultural ecosystems services such as natural coastal defence, leisure and tourism and fisheries within a Welsh context has not yet been fully evaluated¹⁶⁷.
- The distribution and abundance of microplastics and micro-litter in the marine environment are poorly understood but have been subject to increasing focus and research (Environmental Audit Committee, 2016; Lindeque et al, 2020)¹⁶⁸.

What are people telling us?

The <u>Living Levels Landscape Partnership (LLLP</u>) has been delivering a programme of work to promote and reconnect people to the heritage, wildlife and wild beauty of the historic landscape of the Gwent Levels. Funded by the <u>National Lottery Heritage Fund</u> and running from 2018-2021, this project has captured a number of <u>valuable stories</u> from Gwent coastal communities.

Future trends and challenges

Climate Change

Mean sea level has already risen around the UK by about 16cm from the start of the 20th Century and climate projections across the four nations predict a future sea level rise of between 0.27 and 1.12 metres by the end of the century, depending on global temperature rise¹⁶⁹. SoNaRR2020 assessed the impact of climate change on the coastal habitat to be mainly associated with loss in extent of habitats due to sea level rise, increases in storminess, and increased erosion. However, changes in temperature and rainfall will also lead to impacts¹⁷⁰.

The coastal environment is expected to undergo significant change in the next ten to 20 years and beyond as a result of sea-level rise and increased erosion driven by climate change. Coastal margin habitats are reliant on coastal physical processes. Constraints to physical processes, such as the sea defences present for the entirety of the Gwent coastline, are affecting habitat extent, condition and overall resilience, by impeding their ability to move inland in response to sea level rise¹⁷¹.

CCRA3¹⁷² identified the following risks that are specific to the freshwater environment and **more action is needed**:

Risk N14. Marine species, habitats and fisheries: Changing climatic conditions, including ocean acidification and higher water temperatures. The magnitude of risk to coastal species and habitats from changing climate conditions is projected to increase from 'medium' at present to 'high' in the future. This risk is especially influenced by the rate and magnitude of sea level rise, which more recent projections (including UKCP18) suggest may be higher than assumed for the UK Climate Risk Assessment 2017 (CCRA2).

Risk N16. Marine species and habitats: Pests, pathogens and invasive species.

Risk/opportunity N17. Coastal species and habitats: Coastal flooding, erosion and climate factors. Climate change is an overwhelming concern for the future. In Gwent, coastal habitats cannot migrate inland due to the presence of a sea defence, and sea-level rise and increased erosion is likely to lead to 'coastal squeeze'. For Gwent, this impact is extreme.

Designated Natura 2000 site	2005 - 2025	2025 - 2055	2055 - 2105	2005 - 2105
Severn Estuary SAC (Welsh section only)	226	463	1,223	1,912
Burry Inlet / Carmarthen Bay SAC	59	163	411	636
Pembrokeshire Marine SAC	2	4	5	11
Pen Llŷn a'r Sarnau SAC	40	150	111	300
Glannau Môn Cors Heli SAC	1	4	11	16
Menai Strait and Conwy Bay SAC	3	12	1	16
Dee Estuary SAC	0	140	454	594
Total	331	936	2,216	3,485

Fig. B27 Predicted loss of intertidal habitats which includes saltmarsh from Natura 2000 sites in Wales (hectares)

Coastal squeeze on the Severn Estuary is predicted to be the highest in Wales (Fig. B27). Impact on Gwent's saltmarsh will be extensive¹⁷³. The <u>National Habitat Creation Programme</u> will manage the delivery of habitat creation to offset losses.

The loss of saltmarsh habitat will also impact Gwent's ability to reach net zero by 2050. Carbon sequestration and storage helps to regulate the increased CO_2 contributing to climate change. Coastal margin habitats hold significant stocks of carbon relative to their extent. Saltmarsh in particular is very efficient at carbon sequestration (Chmura et al., 2003^{174}); a recent study has shown that Welsh saltmarshes hold up to 50 tonnes of carbon per hectare in the top 10cm of soil (Ford et al., 2019^{175}) and sequestration rates have been estimated as 6,397 tonnes per year (Armstrong et al., 2020)¹⁷⁶.

Risk H4. Viability of coastal communities: Sea level rise. Adaptation strategies need to be designed to be more flexible and robust against the wider range of climate change projections and especially for higher rates and magnitudes of sea level rise¹⁷⁷. The increased realisation that it is unrealistic (i.e. prohibitively expensive) to promote a 'hold the line' policy for all of the coastline, raises questions of how to: (i) plan our future shoreline on the open coast and along estuaries, and (ii) deliver practical portfolios of adaptation options that are technically feasible, balance costs and benefits, can attract appropriate finance, and are socially acceptable. Shoreline Management Plans and other coastal plans need to be refined to recognise the uncertainties in planning for climate change risk by developing multiple adaptation pathways, with the preferred option¹⁷⁸.

The assessment also highlighted the following risk pertinent to the coastal margins and marine environments which will require **further investigation** including:

Opportunity N15. Marine species, habitats and fisheries: Changing climatic conditions. Detailed evidence for individual species in terms of expected rates of change in occurrence and abundance remains limited.

Section C: Wales has healthy places for people, protected from environmental risks

Carbon sequestration

What are the well-being strengths?

Nature based solutions

The ability of our natural resources to capture and store carbon (the process of sequestration) is well documented. The UK Government target and UK Climate Change Committee (UKCCC) recommendation for a Welsh net zero emissions target for 2050 necessitates our natural habitats playing a key role in their attainment (UKCCC, 2020)¹⁷⁹.

Safeguarding and enhancing existing and future stocks of woodland, hedgerows, peatlands, healthy soils, semi natural grasslands and coastal/marine ecosystems and the development of bioenergy crops, which can all store carbon and deliver across all of the seven Well-being Goals¹⁸⁰, is essential.

Spatial opportunities for carbon sequestration in Gwent

Mountains moorland and heathland (MMH)

Restoring peatlands and other soils is key to maintaining carbon storage and reducing greenhouse gas (GHG) emissions. Avoiding damage and erosion is important for retaining existing carbon stores in soils and vegetation. Peatland soils comprise the single largest terrestrial store of carbon in Wales with an estimated 66 mt. (megatons) across the Welsh peatland resource (Williamson et al., 2019)¹⁸¹. While Welsh peatlands store large quantities of carbon, the majority emit carbon due to poor condition (Evans et al., 2015).¹⁸²

In Gwent, spatial opportunities for the restoration of peat exist within the <u>South East Wales Resilient</u> <u>Uplands</u> area within the upland landscape across Torfaen, Caerphilly and Blaenau Gwent. Research from the South East Resilient Uplands project has recently identified that Mynydd Maen and Waun Afon Bog alone store upwards of 105,000tC (tonnes of carbon)¹⁸³. To store this much carbon in trees, you would need to plant millions of tree seedlings and wait for ten years¹⁸⁴.

Woodland

The Welsh Government plans to increase the tree cover in both urban and non-urban areas, including expanding both productive conifer forests and biodiverse broadleaved woodland. The target is to increase woodland cover by at least 2000ha per year from 2020 to 2030 (Welsh Government, 2019¹⁸⁵). All woodland restoration efforts must ensure that replanting uses species that are appropriate for the current and future climate. Restoring forests is less effective if delayed; therefore, it is important for ecological restoration to be prompt (UKCCC, 2020¹⁸⁶). It will be critical to ensure that new woodland is planted in the right place so that expanded woodlands are consistent with solutions to the nature emergency as well as capturing carbon.

Hedgerow management to enhance carbon storage through restoration and planting has been identified as another valuable action (UKCCC, 2020^{187}). The 61,670km of hedgerows in Wales reported by Maskell et al. (2019^{188}) has been estimated to sequester an additional 3.1mt of carbon dioxide equivalents (CO_2e^{189}) above the baseline carbon stocks for field margins (Axe, 2020^{190}). Improving all hedges to favourable condition and increasing their width and height provides the potential to sequester a further 3.0mt. CO_2e^{191} .

Opportunities to safeguard and enhance the woodland resource can also contribute to wider priority woodland networks for the region; these include specific landscape scale opportunities across the Wye Valley and Wentwood landscape, Central Monmouthshire (especially hedgerows) and the Eastern Valleys¹⁹².

Coastal / Marine

Enhancing blue carbon through protecting and restoring marine and coastal ecosystems is another contributor to meeting mitigation goals. Blue carbon is the term for carbon stored in marine and coastal ecosystems (salt marshes, seagrass beds and seaweed habitats (Senedd Research, 2019)¹⁹³).



Fig. C1 Summary of carbon sequestration and storage potential in Welsh seas

It has been estimated that Welsh marine habitats sequester at least 26,100tC each year (Fig. C1¹⁹⁴). This amount could be increased by protecting and restoring habitats such as saltmarsh and seagrass as well as greater protection of the seabed (Armstrong et al., 2020)¹⁹⁵.



Fig. C2 Extent of intertidal reef, saltmarsh and seagrass habitat in Gwent

Gwent supports a significant proportion of the Welsh seagrass resource (based on Water Framework Directive (WFD) intertidal seagrass surveys (Natural Resources Wales (NRW)¹⁹⁶). Similarly, the Severn Estuary supports 1400ha of saltmarsh (Fig. C2¹⁹⁷). These coastal habitats represent a significant opportunity for carbon sequestration in Gwent.

Urban

Retaining mature trees in the urban environment and planting additional trees of the right kind in the right places would enhance biodiversity, reduce pollution, regulate temperature, store carbon and manage stormwater (O'Sullivan et al., 2017¹⁹⁸).

There is scope to proactively decrease the impact of the built environment by using more sustainable building materials, such as timber, instead of steel and cement. The use of timber in buildings would also contribute to short to medium term carbon storage (UKCCC, 2019¹⁹⁹).

Key opportunities for low carbon electricity in urban areas include solar photovoltaics (PV), energy storage, electrification of transport and electrification of heating.

What are the issues impacting well-being?

Competing land use pressures

There are specific landscape scale spatial opportunities in Gwent for improving the health of our natural resources through the creation of 'natural networks'. Realising opportunities to sequester carbon and decrease GHG emissions and incorporate biodiversity is fundamental. Conflicts between 'action for climate' and 'action for biodiversity' must be anticipated and avoided²⁰⁰. Priority habitats and priority species are under threat in Gwent and realising our zero carbon ambitions will likely lead to trade-offs, particularly between competing land uses. Making soil management and land use change decisions which balance all ecosystem services is not a straightforward equation; indeed, they are classic conflicts of interest²⁰¹.

It is important that opportunities to exploit and accelerate renewable energy in Gwent do not do so at the expense of our priority habitats and species. Our decarbonisation challenge and climate emergency runs in parallel with a nature emergency and these challenges must be addressed together.

What are the gaps in understanding?

It is recommended that the following gaps in understanding are given due consideration in the development of the Gwent Well-being Plan:

- Improved data on changes in carbon stocks, especially in soils, through enhanced monitoring across diverse land use, management and climate combinations
- Improved assessment and integration of blue carbon into initiatives for coasts and marine environments, for managed coastal realignment restoration of intertidal areas and seagrass beds
- Targeted actions to restore degraded carbon stores, particularly peatlands
- A strategic approach to land use planning, integrating agriculture and forestry, based on linking net GHG gains with other multiple benefits
- Research is needed to account for climate change risks to carbon stores in the UK GHG inventory projections (including appraisal of emission factors, investigation of integrated adaptation and mitigation benefits from nitrogen use, efficiency in agriculture and developing a systematic programme of soil carbon monitoring).²⁰²

Future trends and challenges

The recently published <u>CCRA3 Technical Report for Wales</u>²⁰³ identified the following climate risks that are specific to carbon sequestration where **more action is needed**:

Risk/opportunity N5. Natural carbon stores, carbon sequestration and greenhouse gas (GHG) emissions. Spatial variations in the intrinsic properties of different carbon stores and land use decisions are major factors in influencing stores, sequestration and emissions.

CCRA3 identified the following risks that are specific to carbon sequestration that require **further investigation**:

Opportunity N3. Terrestrial species and habitats: New species colonisations.

The report also focuses on the role peatlands, soils, forestry, saltmarsh and blue carbon play in contributing to our decarbonisation targets and provides the following observations on factors which will influence the risk or opportunity for our natural habitats to play their part:

• The magnitude of risk increases from medium at present to high in future, but currently there is only limited inclusion of adaptation planning within carbon and GHG emissions assessments

• Only limited actions to manage this risk or to maximise the opportunity, considering the effects of climate change, have been developed at a UK or at devolved level. For example, the effects of climate risk factors on agricultural GHG emissions (especially N₂O) and woodland carbon stocks

• Marine carbon stocks are not included in the GHG Emissions Inventory (or current net zero planning), resulting in general under recognition of their importance for contributing to reduced atmospheric GHG emissions

• The need for more action is especially urgent given the commitment to reach net zero GHG emissions in the coming decades, and opportunities associated with better alignment of climate change adaptation and mitigation strategies.

Hazard regulation

Variable	Observed change in Wales
Average annual temperature	Increase in 0.9°C from mid-1970s to mid-2010s
Annual mean rainfall	Increase in 2.0% from mid-1970s to mid-2010s
Sunshine	Increase in 6.1% from mid-1970s to mid-2010s
Weather extremes	UK-wide increase in extreme heat events
	Little evidence yet on changes in extreme rainfail
Sea level rise	UK-wide increase of ~1.4mm per year since 1901 (16cm to date)

Fig. C3 Table detailing how our climate has already changed in Wales

	2050s		2080s	2080s	
	RCP2.6 (50th percentile)	RCP6.0 (50th percentile)	RCP2.6 (50th percentile)	RCP6.0 (50th percentile)	
Annual Temperature	+1.2°C	+1.1°C	+1.3°C	+2.3°C	
Summer Rainfall	-15%	-15%	-18%	-26%	
Winter Rainfall	+6%	+5%	+7%	+13%	
Sea level rise (Cardiff)	22cm	28cm*	43cm	76cm*	

Fig. C4 Table detailing how the climate in Wales could change in the future

Our climate is already changing and will continue to do so. Gwent is likely to experience hotter drier summers, warmer wetter winters and an increased frequency of extreme weather events. The values in Fig. C3²⁰⁴ and Fig. C4²⁰⁵ are taken from the UKCP18 probabilistic projections. Two emissions scenarios are used; RCP2.6 (roughly equivalent to a global warming +2°C above preindustrial scenario by 2100) and RCP6.0 (roughly equivalent to a global warming +4°C above preindustrial levels by 2100). The exception is sea level rise, where the RCP8.5 scenario is used, as for marine projections this is closer to a +4°C global warming scenario²⁰⁶. It is important to note that these projections show average changes for a 30-year period (and only the central estimate); changes in individual years would show a much greater range of change and could be significantly higher (or lower).

The extent of these changes and their likely impact is dependent on our ability to reduce GHG emissions and rapidly decarbonise on a global scale. The <u>Climate Action Tracker</u> (Paris Agreement) considers current policy and international commitments and translates these commitments into the likely impact on temperature rise. The tracker identifies that we have already reached 1.1°C of warming compared to pre-industrial levels. The Paris Agreement has committed us to restricting warming to below 1.5°C, but progress remains slow. Ambitious policies are beginning to be developed, however large-scale transformation is far from the norm. Based on current policies, pledges and targets, the action tracker predicts that we are actually on target to see increases of temperature to between 2.1 and 3.9 °C by 2100²⁰⁷.



Fig. C5 Projected temperature increases based on current global policies, pledges and targets

The Intergovernmental Panel on Climate Change (IPCC) report (IPCC, 2018²⁰⁸) indicates that global warming in excess of 1.5°C above pre-industrial levels will undermine life-support systems for humanity (Fig. C5²⁰⁹).

When healthy, our natural habitats can provide clean air, water and land and in doing so protect the people and places of Gwent from environmental hazards such as flood, fire and drought.

Flood

The continuous sea defence from Chepstow to Cardiff protects the coastal low-lying land from the extremely high tides of the Severn Estuary. Raised levels due to storm surges adds further pressure to the defences. The high tides also affect the lower river stretches of the Rivers Wye, Usk and Ebbw in Newport and Monmouthshire where the effects of 'backed-up' water can influence water levels a significant distance upstream. In recent years, major flood alleviation schemes have been completed at Chepstow, Caerleon and Crindau in Newport; with a further Newport scheme currently being planned for <u>Stephenson Street</u>. Tides also strongly influence the drainage of much of the Gwent Levels as many of the watercourses (reens) may only drain during sufficiently low tide levels.

The smaller river catchments in Torfaen, Blaenau Gwent and Caerphilly as well as north Monmouthshire are susceptible to very rapid rises in river levels during heavy rainstorms. The flood peaks cascade quickly downstream where, during exceptional events, flows may exceed channel capacity, spilling onto floodplains. The larger catchments of the rivers Wye and Usk generally respond slower, but flood waters often take longer to recede.

The most frequent and widespread cause of flooding is from surface water. The greatest impact generally occurs when there is a combination of capacity exceedance of watercourses and drainage systems; and often exacerbated by blocked culverts, seen in many areas across Gwent such as Skenfrith, Caldicot, Usk, Magor and Llanwenarth in Monmouthshire, the county town of Caerphilly, and Cwmbran in Torfaen.

		Present Day risk (defended)							
Local Authority	Tidal			Fluvial (River)			Surface Water		
Caerphilly	low	med	high	low	med	high	low	med	high
Residential	0	0	0	2687	503	456	4139	1021	1869
Non residential	0	0	0	440	75	61	515	114	276

Newport	low	med	high	low	med	high	low	med	high
Residential	11771	669	301	3815	214	38	4569	544	660
Non residential	1345	166	125	81	16	19	403	52	78
Monmouthshire	low	med	high	low	med	high	low	med	high
Residential	435	671	167	1754	252	80	1347	162	168
Non residential	54	163	15	474	58	25	154	32	31
Torfaen	low	med	high	low	med	high	low	med	high
Residential	0	0	0	933	167	253	1826	325	851
Non residential	0	0	0	150	55	39	232	56	153
Blaenau Gwent	low	med	high	low	med	high	low	med	high
Residential	0	0	0	1058	172	157	2429	612	1860
Non residential	0	0	0	85	31	26	300	78	282

Fig. C6 Properties at risk of flooding in Gwent

In Gwent, 14,014 residential properties are at risk of tidal flooding. 12,539 residential properties are at risk of fluvial (river) flooding. 22,382 residential properties are at risk of surface water flooding²¹⁰ (Fig. C6²¹¹).

Communities at	Local Authority	Top 5 communities	All Wales	Flood
Risk Register	Area	Max score ranking	Max score	source
(CaRR)		(undefended)	(undefended)	
'community'		(CaRR 2019)	(CaRR 2019)	
name				
Maindee	Newport	1	1	tidal &SW
Liswerry	Newport	2	6	tidal
Duffryn	Newport	3	10	fluvial &
				tidal
Crindau	Newport	4	20	fluvial &
				tidal
Marshfield	Newport	5	27	tidal

Fig. C7 Communities in Gwent at greatest risk of flooding where "max" score represents the worstcase scenario where defences fail or standards of protection are exceeded

Communities at	Local Authority	Top 5 communities	All Wales	Flood source
Risk Register	Area	Min score ranking	Min score	
(CaRR)		(defended)	(defended)	
'community'		(CaRR 2019)	(CaRR 2019)	
name				
Caerphilly	Caerphilly	1	7	fluvial & SW
Duffryn	Newport	2	19	fluvial &
				tidal
Tredegar	Blaenau Gwent	3	23	surface
				water
Cwm	Blaenau Gwent	4	24	fluvial & SW
Abergavenny	Monmouthshire	5	28	fluvial

Fig. C8 Communities in Gwent at greatest risk of flooding where "min" score takes into account the presence of defences, flood warnings and investment

Fig. C7 and Fig. C8 represent the communities most at risk of flooding in Gwent. This data combines all rankings including tidal/fluvial and pluvial (surface water) sources.

What are the well-being strengths?

Community Flood Plans (CFPs)

Through local community engagement campaigns, areas at risk of flooding have been encouraged to produce their own <u>Community Flood Plans (CFPs)</u>. The plans are voluntary, community-led and supported by NRW. Twelve communities have active plans; Rogerstone, Bassaleg, Pontymister (Risca), Cwm, Ynysddu, Caerleon, Liswerry and Maindee (Newport), Riverside Park (Monmouth), Ponthir, Llanbradach and Ystrad Mynach.

Natural Resources Wales (NRW) Flood Warning Service

Home or business owners whose properties are at risk of flooding can receive warning messages by phone, email or text message.

17,172 properties in Gwent are currently signed-up to receive flood warnings. This equates to 59% of the properties that are situated within Flood Warning Areas (80% in Blaenau Gwent, but less than 10% in Monmouthshire).

Natural flood management (NFM)

The Welsh Government's <u>National Strategy for Flood and Coastal Erosion Risk Management in Wales</u> recognises the need to consider Natural Flood Management (NFM) as a means of reducing flood and coastal risk. NFM is now an option for every Flood and Coastal Erosion Risk Management (FCERM) scheme. There is a requirement for developments to ensure sustainable drainage systems (SuDS) are considered. This helps reduce run-off and flood risk and may also relieve pressure on drainage systems. These schemes can provide multiple well-being benefits to communities.

What are the issues impacting well-being?

Flooding and coastal erosion can have a variety of consequences and impacts, not only on well-being but wider economic, environmental and social factors. The 2020 floods were a stark reminder of the devastating consequences of intense rainfall events. However, even modest flooding events can significantly impact homes, businesses, key infrastructure and whole communities.

Flooding of infrastructure, primarily road and rail networks, can be costly both in terms of repairs and the disruption to businesses; employees may not be able to access the workplace along with delayed movement of goods. Disrupted transport routes also effects people's access to education, shops and health services; rural communities can be particularly vulnerable where there is often a large dependency on access.

All types of flooding carry a risk to life. Public Health England reported in 2017²¹² (based on the winter 2013/14 floods) that floods are one of the most common environmental emergencies and have significant health impacts. Short term health impacts are usually due to injuries, infections, exposure to chemical hazards and disruption to health services; the longer-term effects are less well understood and may arise from the impact of damage to homes, loss of domestic utilities, having to move out until the home is habitable, and delayed recovery. The percentage of people with probable depression, anxiety or PTSD was high amongst people whose homes were flooded and the study found that the risk of poor mental health outcomes was greater the deeper the floodwater and that the risk was also raised with loss of a utility, evacuation of the property and duration. These effects can continue for many years after the actual flooding.

From a health perspective, quite often the worst affected are the more vulnerable in society. A 2017 report for Joseph Rowntree Foundation²¹³ found that socially vulnerable neighbourhoods are over-represented in areas prone to flooding, but most significantly in areas prone to coastal and tidal

flooding. Certain parts of society are less able to cope with the effects of flooding and impacts are often distributed unequally with the greatest burdens generally falling on the most vulnerable and disproportionately borne by marginalised households.

Likely increases in surface water flooding will probably have the greatest impact on well-being in valleys communities due to a combination of population density, property type, likely rapid onset of event, aging infrastructure (including drainage) and general vulnerability in terms of ability to cope, financially and otherwise.

The longer people live in stressful environmental, economic and social circumstances, the greater the physiological and psychological effects they suffer, and the less likely they are to enjoy a healthy old age. These disadvantages tend to concentrate among the same people, and the effects on health are cumulative. Health inequalities are estimated to cost the Welsh economy £1.8 to £1.9 billion in productivity losses and £1.1 to £1.8 billion in welfare costs per year²¹⁴.

Freshwater ecosystems are rich in biodiversity, and also provide important ecosystem services, including the provision of water resources and flood control. Disturbances, in the form of floods or droughts, are a natural part of these ecosystems, and play an important role in creating and regenerating habitats. However, extreme climatic events can cause damage to ecosystems and climate change means that these extreme events, which push ecosystems beyond the threshold of normal disturbance, are set to become more frequent. In many areas of Wales, rivers are also highly modified with altered hydromorphology and disrupted natural processes. This makes catchments less resilient and limits the ecological recovery of river ecosystems. It results in loss of biodiversity and compromises the ecosystem services we rely on, making communities and the environment more susceptible to the impacts of flood, drought, erosion or embankments including landslips and poor water quality.

What are the gaps in understanding?

It is recommended that the following gaps in understanding are given due consideration in the development of the Gwent Well-being Plan:

- It is becoming increasingly unrealistic (i.e. prohibitively expensive) to promote a 'hold the line' policy for all coastline. This raises questions of how to:
 - (i) plan our future shoreline on the open coast and along estuaries, and
 - deliver practical portfolios of adaptation options that are technically feasible, balance costs and benefits, can attract appropriate finance, and are socially acceptable²¹⁵.

What are people telling us?

The South East Area Statement sets out a sustainable vision for the management of Gwent's natural resources. This vision has been developed collaboratively and is underpinned by what specialists and wider stakeholders identified they want to see in Gwent.

With regards to flooding and climate change, stakeholders identified the following²¹⁶:

- "Financial investments factor in climate impact."
- "Decadal and multi-decadal planning for sites and towns, factoring in worst case scenarios as well as gradual change."
- "Landowners and managers are incentivised to deliver nature-based solutions to climate action."
- "Land use, catchment and ecosystem level planning for place."
• "Homes, communities and businesses will be less vulnerable and more resilient to climate risk and protected against flooding, drought and heat."

Future trends and challenges

Flooding and coastal change risks to homes, communities, businesses and infrastructure have been identified as one of the top areas of climate change risk. It is now generally accepted that future river and surface water flooding and coastal inundation from climate change impacts are a major high-level risk and that despite progress with flood defences, it is unlikely that we will ever be able to fully manage and mitigate against all events. The population at risk of exposure to flooding is expected to increase over time as a result of changes in population size, land use and climate.

The Future Trends Report 2021 identifies that increasing climate risks will affect all of Wales, but some people and areas are especially vulnerable to change with a risk of exacerbating inequalities. This is also the case for those communities in Gwent where areas with higher risk of flood exposure and socio-spatial vulnerability have a higher flood disadvantage risk. This means that while areas may have a similar number of properties at risk of flooding, particular areas have higher vulnerability to impacts on their health and wellbeing as a result of floods and so have a higher level of flood disadvantage²¹⁷.

Climate change

Climate change will increase sea levels and associated coastal flooding and erosion, as well as altering rainfall patterns leading to changes in river, surface water and groundwater flooding.

Projected changes:

Three key climate change impacts relative to flood risk are extreme rainfall events, river flood flows and sea level rise. In winter, rainfall is expected to increase by approximately 6% by the 2050s and by between 7% to 13% by the 2080s from a 1981-2000 baseline (Fig. C4), this is projected to lead to an increase in the likelihood of flooding of infrastructure, businesses, and homes. The frequency and intensity of extreme rainfall events may also increase in future.

Total potential change anticipated for the 2020s (2015-2039)					
	Changes to river flood flows (1961-90 baseline)	Change to extreme rainfall			
Upper estimate	25%	10%			
Central estimate	10%	5%			

Fig. C9 Total change in river flood flows and extreme rainfall in Wales

Fig. C9²¹⁸ shows estimates on the impact of climate change on extreme rainfall and river flow for Gwent. Increases in rainfall intensity due to climate change is likely to effect river levels, particularly within smaller catchments (less than 5km²) and on land and urban drainage systems. The change to relative mean sea level for the Newport and Monmouthshire Coastline is estimated to reach between 0.85cm (70th percentile) and 1.11m (95th percentile) by 2100. Figures here are projections based on UKCP18 and Welsh Government guidance.

It will not be possible to prevent all flooding; there is therefore a need to use a range of approaches to not only reduce the risk where possible, but to adapt our communities and infrastructure to be prepared for severe weather events and rising sea levels. This may involve improving defences, but equally will also mean better management of land and water across catchments to reduce run-off, intelligent planning and retrofitting of our towns and cities and, in some cases, creating space for water and recognising the need to move out of harm's way.

The recently published <u>CCRA3 Technical Report for Wales</u>²¹⁹ identified the following climate risks that are specific to Flooding and Coastal Change where **more action is needed**:

Risk/opportunity N17. Coastal species and habitats: Coastal flooding, erosion and climate factors.

Risk I2. Infrastructure services: River and surface water flooding.

Risk I5. Transport networks: Slope and embankment failure.

Risk H3. People, communities and buildings: Flooding.

Risk H4. Viability of coastal communities: Sea level rise.

Risk B1. Flooding of business sites: Increase in flood risk.

Risk B2. Business locations and infrastructure: Coastal flooding, extreme weather, erosion and sea level rise.

CCRA3 identified the following risks that are specific to flooding and coastal change that require **further investigation**:

Risk N10. Aquifers and agricultural land: Sea level rise, saltwater intrusion.

Risk I3. Infrastructure services: Coastal flooding and erosion.

Risk I4. Bridges and pipelines: Flooding and erosion.

CCRA3 identified the following risks that are specific the Water Supply where it is recommended that we **sustain current action**:

Risk I8. Public water supplies: Reduced water availability.

Fire

All fires have a detrimental effect on air quality, particularly large fires in outdoor areas. South Wales Fire and Rescue Service (SWFRS) aims to reduce the incidence and impact of fire on local communities, landscape, species and habitats through effective prevention and response.



Fig. C10 Incidents attended by South Wales Fire and Rescue Service (SWFRS) in 2020-2021 SWFRS attended 16,700 incidents (across all of south Wales) in 2020-21 (Fig. C10).

Current State of Play



Fig. C11 South Wales Fire and Rescue Service (SWFRS) incidents by type 2009-2010 to present

The overall trend of incident response is indicated in Fig. C11²²⁰.

Refuse fires, which include loose refuse, bin and skip fires, were identified as an area of focus for SWFRS in 2018 as they account for around 40% of all fires attended. The onset of the pandemic and lockdown restrictions saw a jump in refuse fire numbers from spring 2020, as civic recycling and waste sites were temporarily closed and then reopened with controlled access. Overall, there was an increase of 11% in refuse fires attended in 2020/21 compared with 2019/20.

A wildfire is defined as any uncontrolled vegetation fire where a decision or action is needed about its suppression. A wildfire will meet one or more of the following criteria:

- Involves a geographical area of at least one hectare (10,000m²)
- Has a sustained flame length of more than 1.5m
- Requires a committed resource of at least four fire and rescue service appliances/resources
- Requires resources to be committed for at least six hours
- Presents a serious threat to life, environment, property and infrastructure.

Local Authority	WILDFIRE CAT 1	WILDFIRE CAT 2	Total
Blaenau Gwent	24	15	39
Caerphilly	48	24	72
Monmouthshire	3	3	6
Newport	2	1	3
Torfaen	8	6	14
TOTAL	85	49	134 ²²¹

Fig. C12 All grassland fires categorised as "deliberate" "wildfire" (2018-2020)

Wildfires deliberately caused by arson affect the South Wales Valleys every year (Fig. C12²²²).



Fig. C13 Worst affected wildfire areas in south Wales

The priority areas identified for deliberate wildfires are the old south Wales industrial valleys which lie north of the M4 from Swansea in the West to Pontypool in the east (Fig. C13²²³).

2018 was warmer than average for the UK. High pressure dominated the summer; the warmest for the UK since 2006, the driest since 2003 and the sunniest since 1995²²⁴. Further analysis identified that the total crewing cost for attending these fires totalled approx. £215,800 for the 2018 calendar year²²⁵.

What are the well-being strengths?

Proactive land management techniques can help reduce the extent of wildfires, to prevent them spreading across whole hillsides, devastating local wildlife and endangering communities.

What are the issues impacting well-being?

Wildfires can result in multiple impacts to local wildlife, air quality, water quality, access and recreation, fire officer safety, community safety and human health. Wildfires can emit particulate matter (PM) (soot) and toxic products, and can create extensive and long-lasting air pollution events, particularly during hot weather. Fires can also have severe impact on water quality²²⁶. There are multiple drivers that affect wildfire frequency and intensity including human triggers, vegetation type and wind patterns.

Wildfire can result in serious localised damage to, or loss of, habitats and species, which may show varying degrees of recovery in the years afterwards. Several types of habitat and ecosystem are at risk, especially upland and lowland heath, peatland, grassland, woodland and arable land.

Some of the serious recently recorded incidents of wildfires in the UK have occurred on heath or moorland, including peatlands²²⁷. Wildfires on peat soils can lead to large amounts of carbon being released into the atmosphere, contributing further to climate change. The wildfire risk magnitude is of high local importance rather than being a threat to overall national production levels for food or timber.

The size of PM and the length of exposure are key determinants in the potential of adverse health conditions and will determine where, physiologically, the impact will be. There is extensive evidence

to show that long term exposure to PM increases mortality and morbidity from cardiovascular and respiratory diseases. PM has also been classified as carcinogenic to humans and causing lung cancer²²⁸.

What are the gaps in understanding?

It is recommended that the following gaps in understanding are given due consideration in the development of the Gwent Well-being Plan:

• There is currently very little data on the impact of grassland fires on receiving waters. There is currently more literature on the risk of wildfire in forests compared to agricultural land.

Future trends and challenges

Climate change

Annual temperatures in Wales are expected to rise between approximately 1.2°C by the 2050s and between 1.3°C and 2.3°C by the 2080s from a 1981-2000 baseline. Risks associated with rising temperatures, such as more extreme heatwave events causing impacts on people's health and wellbeing, are likely become more prevalent as a result (Fig. C4). The risk could double in a 2°C global temperature increase scenario and quadruple in a 4°C scenario.

It is likely that the frequency of moorland, grassland and forest fires may increase with regional differences. Iconic landscapes and cultural heritage assets could also be more vulnerable to wildfire exposure in future.

CCRA3²²⁹ identified the following wildfire related risks that require more action:

Risk N1. Terrestrial species and habitats: Changing climate conditions.

Risk/opportunity N5. Natural carbon stores, carbon sequestration and greenhouse gas (GHG) emissions.

Risk/opportunity N6. Agricultural and forestry productivity.

Risk N11. Freshwater species and habitats: Changing climatic conditions and extreme events.

CCRA3 identified the following wildfire related risks that require **further investigation**:

Risk/opportunity N18. Landscape character: Climate change.

Risk H7. Health and well-being: Changes to indoor and outdoor air quality.

Risk I7. Subterranean and surface infrastructure: Subsidence.

COVID-19

Changes in behaviour as we emerge from the COVID-19 pandemic, including increased working from home, more use of outside space and local amenities, higher visitor numbers as people holiday in the UK and ongoing restrictions on waste disposal routes for some businesses and communities, have already resulted in increased refuse fires and may continue to put pressure on SWFRS in the coming months.

Public health

Predictions in public health highlight the effect an ageing population has on how each of the other main health issues impact our frontline services (e.g. obesity increases will impact fire and rescue services' bariatric rescues; an increase in dementia and living alone will impact the likelihood of an increase in accidental fires in dwellings).

Housing

Ageing residents, the increase in rental housing, aging housing stock and an increase in homelessness all have the potential to increase the risk of fire on residents and communities across Gwent in the future.

Recreation, access and tourism

This section considers the role of ecosystem services in contributing to well-being in Gwent, in terms of providing a vital service for access, recreation and tourism.

What are the well-being strengths?

Access and recreation

Healthy, active and resilient natural and built environments provide opportunities for people to be physically active outdoors. While time in nature is beneficial by itself, exercise or physical well-being also scored highly as a motivation for visiting nature during the COVID-19 pandemic. This accrues health benefits associated with tackling many of the key health issues in Wales, particularly the rise in obesity and Type 2 Diabetes²³⁰. Sports participation also improves self-reported mental health²³¹.

Increasing access to green and blue spaces and providing community facilities to bring people together is a 'best buy' when it comes to preventing mental ill health and improving mental wellbeing. Those who regularly attend or participate in cultural activities are more likely to report higher subjective well-being in Wales²³². Natural heritage is also an important component of cultural wellbeing²³³. Freshwater features like rivers provide a sense of place and often act as a physical boundary between communities, while designated landscapes contain areas of enclosed farmland and associated patterns of crops, buildings and field enclosures, creating a unique natural environment, appreciated by residents and visitors alike²³⁴. Living in 'historic' areas also increases social capital, connectedness and builds a sense of place²³⁵. Gwent is rich in these environmental and historical features, which contribute to the vibrant identity and well-being of our communities²³⁶.

Welsh landscapes are accessible via a vast network of <u>Public Rights of Way (PRoW)</u>, allowing members of the public to access and enjoy both urban green space and the countryside for their cultural, mental and physical well-being. In Gwent, the Welsh Government Woodland Estate (WGWE) contains 269km of PRoW which are maintained in line with the <u>Countryside and Rights of</u> <u>Way Act 2000</u>, and therefore kept open and accessible for recreational use by the general public. WGWE freehold land (not leasehold) is dedicated as open access land under this legislation.

Other public green spaces such as parks, <u>National Nature Reserves (NNR)</u> and allotments, are owned and managed by Local Authorities or Environmental Non-governmental Organisations (eNGOs) to provide opportunities for play, recreation, exercise and volunteering²³⁷. The most common activity undertaken on publicly accessible land is walking (hiking and dog walking)²³⁸, but other recreational uses include walking trails (self-guided and led), live action roleplay, horse riding, mountain biking, sports coaching, photoshoots, orienteering, forest bathing and festivals²³⁹. Across the public sector estate, visitor experience, site presentation and public risk are taken seriously by land managers, which allows access for activities that contribute to well-being across Gwent.

Tourism

Wales' main attraction as a tourist destination is "the perceived quality of our landscape and environment"²⁴⁰ and 'landscape' features as one of <u>Visit Wales</u>' three promotional themes²⁴¹. The tourism industry contributes some £6.2 billion which equates to (13.3%) of the national economy. 170,000 people are in employment generated by the industry, equalling 12.7% of the Welsh workforce²⁴². For example, <u>The Fishing Passport for recreational salmon and freshwater fisheries</u>

along the Wye and Usk attracts many tourists and inputs £16,500,000 per year to the local economy²⁴³.

Across Gwent there are several key outdoor sites and landscapes that are multiuse and are both regularly visited by locals and draw tourists from further afield. These include:

- <u>The Valleys Regional Park</u> Discovery Gateway sites (<u>Caerphilly Castle</u>, <u>Cwmcarn Forest</u>, <u>Parc</u> <u>Penallta</u>, <u>Parc Bryn Bach</u> and <u>Blaenavon World Heritage Site (WHS)</u>
- <u>Newport Wetlands Nature Reserve</u>
- The Wye Valley Area of Outstanding Natural Beauty (AONB)
- Brecon Beacons National Park (BBNP)

What are the issues impacting well-being?

Inequalities

Inequality is a relatively well understood concept; it illustrates the difference in access to and use of scarce and valued resources among individuals or social groups. This may be related to the resources they hold as individuals (education, income, social and cultural capital and so on) or to their position in society (housing, employment situation). This is a social inequality. Inequalities can also be spatial; some places do not benefit from the same services or economic dynamics as others (e.g. digital access). Environmental inequalities intersect socio-economic and spatial inequalities, and this burden is borne primarily by socially and/or spatially disadvantaged and/or vulnerable populations. Those most vulnerable in society, or in vulnerable situations, such as the elderly, those living in relative poverty, the inactive, the unemployed, those at risk of flood or those living in areas of poor air quality or high levels of environmental noise, are at a higher risk of increasing health burdens and lower levels of healthy life expectancy because of known and avoidable environmental risk. These challenges can exacerbate the use of natural resources and increase pressure on ecosystem goods and services. The move towards health prevention to ease the burden on the NHS and associated services provides amplified opportunity for increasing the resilience of ecosystems and human health.

Green space accessibility can be limited by several factors. Resultant well-being benefits are therefore received inequitably across communities in Gwent, as they are across Wales, the UK and globally. Well-being can be associated with changes in economic prosperity or deprivation at the local level²⁴⁴. Many Gwent residents do not live within the recommended²⁴⁵300m of a green space. It is also important to note that households identified as 'living within the recommended distance of a green space' does not mean that that green space is classed as accessible (i.e. it is an 'as the crow flies' calculation).

The National Survey for Wales (2019-20) found that 51% of people agreed that they would attend cultural events more frequently if events were closer to home²⁴⁶. Therefore, improving accessibility of outdoor spaces and activities, including by public and active transport for those without access to a car, may help to increase participation rates²⁴⁷ and reduce inequalities.

The <u>UK Equality Act 2010</u> protects individuals from unfair treatment in relation to protected characteristics. All organisations that own and manage outdoor spaces in Wales have a duty to not discriminate against people's protected characteristics in their service provision, where possible²⁴⁸. There are several well-developed recreation sites in Gwent (e.g. Cwmcarn Forest, <u>Goytre Wharf</u> and <u>Barged Woodland Park</u>) that have all-ability attractions.

COVID-19

There is no doubt that the COVID-19 pandemic and the subsequent government response have had and continue to have an on-going profound effect on the everyday lives of everyone. As the situation continues to evolve, it has become increasingly clear that both the disease and the responses to it are having wide-ranging impacts on the health and well-being of the population. Many of these impacts are significant and will extend beyond the short term. Although everyone has been affected in some way by the pandemic, the impacts for some people have been, and will continue to be, far starker than for others. COVID-19 has served to amplify existing inequalities.

The COVID-19 pandemic has been a compounding factor which has emphasised inequalities and inequities over the last 18 months. With restrictions urging people to stay home and only visit green space within five miles of their front door, most NRW managed woodland sites and NNRs in Wales saw a 90% reduction in visits during the first lockdown (March to June 2020)²⁴⁹. In Gwent, the picture was no different, with a reduction in visitor numbers at many key sites, including Newport Wetlands Nature Reserve. Van Road Mountain Biking Trails in Caerphilly was the only WGWE site monitored in Gwent that saw an increase in visitor numbers during the first lockdown²⁵⁰, its close location to communities demonstrating people's use of only very local green space in adherence to restrictions²⁵¹.

The inability for some to visit green space across this time will undoubtedly contribute to worsening physical and mental health and will have been particularly difficult in communities where immediate access to green space is lacking, generally areas of greater deprivation.

Tourism has also been heavily affected by the pandemic, with businesses and the extended economy hit during some of the peak holiday times²⁵². The impact of lockdown-related economic constriction may be felt in the South Wales Valleys area, particularly by women and minority ethnic individuals²⁵³.

Following an easing of lockdown restrictions, outdoor recreation sites saw a substantial rebound (July to September 2020), with visitor numbers at some NRW and NNR sites in Wales almost doubling compared to previous years²⁵⁴. Many UK residents are now choosing to stay in the UK for day trips, short breaks and holidays instead of flying abroad, which is good for the economy but is increasing human impacts on some 'honeypot' sites²⁵⁵.

Anti-social behaviour (ASB)

A commonly reported issue at outdoor tourism and recreation sites across Gwent is anti-social behaviour (ASB). The three most problematic issues identified by land managers are off-road vehicle use, wildfire arson and fly tipping. These activities can cause damage to land and vegetation and destroy and disturb important habitats²⁵⁶. In a recent study by <u>Coed Lleol</u>, 'community safety and ASB' was also reported as one of the top four barriers to engaging with woodland well-being activities in Gwent²⁵⁷. ASB commonly leads to user conflict and can make other users fearful or avoid visiting due to the unpleasant visitor experience.

Negative impacts on biodiversity

Use of 'hot spot' tourist sites in Gwent needs to be well managed. Overuse or misuse of sites can lead to declining environmental quality and biodiversity through path erosion, littering and disturbance. Closing sites and paths, however, merely displaces activity and so there is a need for behaviour change, which takes a shift in culture and significant time to achieve.

Collaboration

Strong partnership working between public, private and third sector organisations is required to develop the access, recreation and tourism offer in Gwent. Many public sector departments are experiencing cutbacks and a reduction in capacity, with local land managers reporting that it can be difficult to capitalise on nature's multiple well-being benefits as a result. Additionally, there is a disconnect between elements that contribute towards management of our landscapes, such as between sustainable travel design, planning and development, and health and ecological expertise.

Nature based solutions to environmental and human health and resilience should be seen as a 'best buy'. Green and blue spaces are not in fact 'free' health interventions, but resources that require significant management to maintain in a way that is inclusive, high quality and ecologically sensitive. A shift in funding from treatment to preventative care through a 'Natural Health Service' and green prescriptions, is called for in the South East Area Statement²⁵⁸ and should be explored in Gwent. Additionally, it is important to recognise that the greatest environmental risks to human health can be mitigated and/or improved by the way in which ecosystems are managed (e.g. by improving air quality, reducing flood risk/incidence, controlling invasive non-native species (INNS), controlling illegal waste management and protecting fresh and marine water quality).

Brexit

The Welsh tourism sector, of which the environment is a vital element, has faced particular difficulties due to the impact of Brexit; mainly due to the loss of European Union (EU) funding, which is unlikely to be matched domestically, and increased border checks, although overseas visitors make up a small proportion of visitors. Impacts on the 170,000 employees in this sector will particularly affect rural communities²⁵⁹ such as rural Monmouthshire and the BBNP.

What are the gaps in understanding?

It is recommended that the following gaps in understanding are given due consideration in the development of the Gwent Well-being Plan:

Greenspace

 There is little recent research on those accessing Gwent's green spaces for recreation and tourism. Visitor surveys could help ensure that land managers are providing appropriate facilities for users. This would also provide the opportunity to address inequalities, by listening to what makes an environment attractive and accessible to lesser seen groups like minority ethnic and deprived communities. This will be addressed in the Wales People and Nature Survey 2021/22 (figures due late spring 2022).

Anti-social behaviour (ASB)

 A consistent approach to recording ASB incidents is required across all land managers and areas, in order to gain a better local and national understanding of this issue. Accurate recording will help to identify priority areas and the need for targeted local multi-agency operations as well as national initiatives and preventative work²⁶⁰.

Climate change

• Further investigation is needed into the risk that climate change poses in terms of people, communities, health and well-being, answering questions like: How will access, recreation and tourism in Gwent be affected by changing weather, sea levels, air quality and water quality?

What are people telling us?

When asked about their most recent visit to the outdoors in Wales, 25% of respondents had visited a park or other local space, 19% the beach, sea or coastline, 14% woodland or forest and 6% a river, lake or canal²⁶¹.

The South East Area Statement sets out a sustainable vision for the management of Gwent's natural resources. This vision has been developed collaboratively and is underpinned by what specialists and wider stakeholders identified they want to see in Gwent.

With regards to recreation, access and tourism, stakeholders identified the following²⁶²:

"The wildlife, habitats, landscapes and seascapes of Gwent are a source of inspiration and enjoyment for people who live and work here. They are healthy and thriving, providing essential natural benefits to the residents and visitors to the region."

"Nature and the outdoors are a mainstream part of people's lives and 'the system' (healthcare, planning, education, etc.)."

"People have access to safe natural spaces in which to exercise, play, grow food, unwind and relax."

"Children feel inspired, safe and encouraged to play outside."

"Communities benefit from increased physical activity, better mental health and the prevention of chronic health conditions."

However, some challenges to achieving this vision, identified through further engagement with the Healthy Active Connected Gwent network in 2020²⁶³, are as follows:

- Designing active travel solutions that are geographically and socially appropriate in historical towns and accounting for ageing populations
- Having access to limited funding and resources for action, in proportion to the population of Gwent
- The 'low profile' of nature-based solutions to health issues and inequalities across the adult population
- Navigating the complex risk and permissions processes for hosting activities outdoors

Over the last 18 months, it has also been particularly difficult to maintain momentum around nature-based solutions to health issues and inequalities, with the COVID-19 pandemic being a priority for many public services.

Greatest barriers to use of woodlands across Gwent

Consultations with third sector groups and green prescription participants by <u>Coed Lleol</u> in 2020- 21^{264} highlighted barriers to engaging with woodland well-being that were common across Gwent. These were as follows:

- Access, including a lack of greenspace, disabled access, transport infrastructure and local knowledge
- Physical state of the woodlands; concerns about unmanaged, unsafe and unwelcoming woodlands
- Provision; lack of local woodland well-being opportunities or lack of support in accessing them
- Community safety and ASB in woodlands.

Future trends and challenges

COVID-19

Evidence shows there are new user groups accessing green space and woodlands in the UK that, prior to the COVID-19 pandemic, were seldom seen²⁶⁵. Some have different expectations and behaviours that current management practices are not designed to deal with. There is a need to ensure new users are engaged through educational campaigns to build respect and understanding for the countryside and for personal safety. Dog ownership has also increased over COVID-19, and dog-walking should be monitored for impacts on biodiversity and public safety²⁶⁶.

The pandemic has also seen a change in patterns of where people access the environment. Remote working allows more choice of where to live, which could reshape local communities, and is likely to draw more people to rural areas, rather than economic centres²⁶⁷.

Climate change

The specific health and well-being impacts of climate change on individuals and communities from expose to future climate risk is detailed in the social chapter.

The recently published CCRA3 Technical Report for Wales²⁶⁸ identified the following climate risks that are specific to the environments provision of cultural and heritage services where there is **more action needed**:

Risk H11. Cultural heritage: Changes in temperature, precipitation, groundwater, land, ocean and coastal change. Climate impacts that affect heritage assets may have knock on effects upon other sectors – including tourism, health and wellbeing, and natural environment and vice versa.

Risk H3. People, communities and buildings: Flooding.

CCRA3 identified the following risks to the environments provision of cultural and heritage services that require **further investigation**:

Risk/opportunity N18. Landscape character: Climate change.

Opportunity H2. Health and well-being: High temperatures. Possible outcomes of this may be an increase in use of outdoor space for both physical activity, leisure activities, cultural activities, and domestic tourism.

Risk/opportunity N18. Landscape character: Climate change.

Food and agriculture



— Source: 🗹 June Survey, 🗹 Agriculture in the UK 2019, 🗹 Welsh Government press release, 🗹 Agriculture in Wales 2019 and 🗹 Agriculture facts and figures: 2019.

Fig. C14 Welsh farming statistics (figures for 2018 or 2019 depending on the most current available)

According to the most recent <u>Welsh farming statistics</u> (Fig. C14²⁶⁹), Welsh agriculture accounts for 0.45% of gross value added (GVA), is worth £7.47 billion to the food industry and accounts for 3.51% of the overall share of employment in Wales, and 90% of its land use. The average Welsh farm has a business income of £23,500, and 81% of the land classified as agricultural is designated as less favourable area land (Senedd Research, 2021²⁷⁰).

Beef, sheep, poultry, and dairy produce collectively made up 80% of Welsh agricultural forecasted output in 2018 (Welsh Government, 2019²⁷¹). Overall, UK meat and milk production has been increasing in the UK from 2016 to 2018 (Department for Environment, Food & Rural Affairs (DEFRA), 2020²⁷²).

Some sectors like the lamb sector are more reliant on export markets. Around 5% of lamb from Wales is consumed in Wales, approximately 60% is consumed in the rest of the UK, and 35% is consumed in export markets. 5% of beef from Wales is consumed in Wales, approximately 80% is consumed in the rest of the UK, and 15% is consumed in export markets (Hybu Cig Cymru, 2020²⁷³). Overall, however, 73% (Welsh Government, 2019²⁷⁴) of Welsh food and drink exports value are to the European Union (EU), highlighting the importance of this market to the overall food production system²⁷⁵.

Farmed land represents 65% of the area of Gwent²⁷⁶. There were an estimated 2,084 active farms in 2018, covering 105,199ha²⁷⁷, giving an average farm size of 50ha. Grassland accounts for 78% of this, and arable and horticulture is just 13%. There are also 6,654ha of woodland within farms. The majority of farmland is in Monmouthshire, which has the most high-quality agricultural land. Farmed land also makes up the majority of the Gwent Levels, a large area of land reclaimed from the sea over centuries.

Agri-environment schemes, such as <u>Environmental Stewardship</u> and <u>Glastir</u> aim to encourage management of farms for biodiversity. Only 199 farms in Gwent participated in Glastir in 2019²⁷⁸, with 12,374ha under some form of Glastir scheme. Compared to the number and area of farms in 2018, this represents less than 10% of farms, and 12% of farmed area. This is much less than the Welsh average, where 37% of the farmed area is under a Glastir scheme.

What are the well-being strengths?

Food and fibre production rely on air, soil, water and biodiversity. Sustainable farming methods offer huge potential and opportunities for farmers. Sustainable methods not only provide healthier food but also considerably improve farmers' incomes. Studies show that throughout Europe, systems employing a range of more sustainable practices delivered between 10 and 110% increase in farm income (van der Ploeg et al., 2019²⁷⁹).

As well as providing food and fibre for current and future generations, agricultural holdings can provide a number of other well-being benefits to people and communities including regulating services like water storage, flood risk management, pollination opportunities and cultural services such as a sense of place, leisure and employment opportunities²⁸⁰.

What are the issues impacting well-being?

Child hunger, rising diet-related illness, an explosion of demand for food banks and the uncertainty faced by the thousands of people employed in the catering and hospitality industry have an impact on social and economic well-being, as well as the environmental well-being impact assessed here²⁸¹. The Future Trends Report 2021 identifies that as with the rest of the UK, Wales is currently reliant on food imports from other countries. These countries are often vulnerable to the impacts of climate change, with food production at particular risk. Recent research, for example, shows that the UK's fruit and vegetable supply is increasingly dependent on imports from climate-vulnerable producing countries, with the contribution of domestic production to total fruit and vegetable supply in the UK decreasing from 42 per cent in 1987 to 22 per cent in 2013 (Scheelbeek et al, 2020)²⁸².

Unsustainable practices

Land use is identified by the United Nations (UN) Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) report (2019)²⁸³ as one of the key drivers of the nature emergency. Emissions of pollutants, depletion of resources, biodiversity loss and ecosystem degradation are consequences of the current system in Wales and beyond²⁸⁴. It has been estimated that for every £1 consumers spend on food, another £1 of costs are borne by society in terms of health impact and water pollution (Fitzpatrick et al., 2017²⁸⁵).

In Wales, according to <u>Welsh June Agricultural Survey</u> data (Welsh Government, 2019²⁸⁶) and a range of other sources, almost 90% of land over recent years is utilised for agricultural production, with most of that land intensified for food production (Blackstock et al., 2010; Armstrong, 2016; Welsh Government, 2019)²⁸⁷. Semi-natural habitats and functioning ecosystems have reduced hugely in extent, becoming fragmented, and are often in poor ecological condition. These changes have caused the loss of more than 90% of semi-natural grassland habitats since the 1930s, negatively affecting the many species that rely on this habitat (Hayhow et al., 2019²⁸⁸).

Agricultural pollution



Fig. C15 Substantiated pollution incidents for Gwent by incident type

Agricultural practises involving manufactured fertilisers and animal waste cause pollution and eutrophication of both freshwater and terrestrial ecosystems. Between 2016 and 2020, 928 pollution incidents were substantiated in Gwent. Of those incidents, the third highest premises type was agriculture at 16% (Fig. C15²⁸⁹) Monmouthshire has a significantly higher proportion of agricultural premises contributing to a greater share of incidents at 29%, making this premises the highest contributor to pollution incidents in the county.

Loss of farmland biodiversity

The 2016 State of Nature Report concluded that the intensification of agriculture had caused largest long-term negative impact on wildlife²⁹⁰. Specific factors included loss of marginal habitats such as ponds and hedgerows, intensification of grazing regimes, changes from spring to autumn sowing, and increased use of pesticides and fertilisers. Specialist farmland species are declining the most rapidly across all ecosystems. Overall, the index of change in abundance and occupancy for farmland species has fallen by 20% since 1970. The UK farmland bird indicator has fallen by 54% in the same period.





Figure 3. Multi-species lowland farmland bird indicators for Wales and the Greater Gwent region from 1994 to 2018 for the same 11 indicator bird species.⁶





Fig. C17 Multi species upland farmland bird indicators for Wales and Gwent from 1994 to 2018 for the indicator species listed

In Gwent, the figures taken from the recently published <u>Gwent State of Nature Report (GSoN)</u> (RGG, 2021) indicate that lowland (Fig. C16) and upland (Fig. C17) farmland birds show declines of 45% and 30%, respectively over the British Breeding Survey (BBS) period, largely in accordance with UK as well as Wales patterns for farmland and upland birds²⁹¹.

Farmland Birds						
Species	Conservation Status	Trend Gwent	Data availability			
Barn Owl	Green (UK & Wales)	Fluctuating for the UK, insufficient data available at the Gwent level to determine trend	Moderate			
Fieldfare	Amber (Wales) Red (UK)	No concern	Good			
Northern Lapwing	Red (UK & Wales) Wales. Section 7 Priority Species	Decline to below sustainable limit	Good			
Tree Sparrow	Red (UK& Wales) Wales Section 7 Priority Species	Decline of population to near extinction	Poor			
Turtle Dove	VULNERABLE (Global)	Extinct in Gwent	Poor			

Fig. C18 Overall health of five specific species as taken from the Gwent State of Nature (GSON) report, 2021

The report also took a closer look at the health of five specific farmland related species, one of which was extinct in Gwent (Turtle Dove), one below sustainable limits (Northern Lapwing), and one in decline to near extinction (Tree Sparrow), the Fieldfare and Barn Owl fared slightly better.



Agriculture is responsible for 14% of Welsh GHG emissions (Welsh Government, 2019²⁹²; UK National Atmospheric Emissions Inventory (NAEI), 2020²⁹³); livestock and fertilisers being the major sources.

Fig. C19²⁹⁴ compares the daily carbon footprint of different UK diets demonstrating the impact of a high meat content diet compared to that of an increasingly meat free choice.



Fig. C20 Carbon footprint of lamb and beef production around the world

Fig. C20²⁹⁵ compares the emissions of beef and lamb consumption based on farm level analysis with data on emissions to farm gate (does not include processing, packaging, transport and retail, but does include land use change and farm feed). This indicates that Welsh meat is among the lowest emissions in the world. Both data sets together indicate that there are considerable gains to be had from decreasing the quantity of meat in our diets, increasing its quality and buying local.

What are the gaps in understanding?

It is recommended that the following gaps in understanding are given due consideration in the development of the Gwent Well-being Plan:

- There is very limited information available on how much food production in Wales is sustainable. To effectively balance the improvement of the structure and function of ecosystems alongside the provision of food, fibre, and places where people live and work (infrastructure), 'good' must be defined and described.
- If farming is to be resilient and profitable, food must be produced in a sustainable way which safeguards the natural resources on which future food depends. Most importantly, to do so, systems and standards of soil and nutrient management need to evolve²⁹⁶.
- While there is a growing body of research on a wide range of sustainable farming practises, there is little information on their take up in Wales nor on the impact these are having at a landscape scale.
- Research to better understand the range, extent, spatial distribution and impact of the many different sustainable practises and their trade-offs would enable informed policy decisions to be taken to support farmers move towards sustainable practises.
- There is a need to predict future trends to enable us to prepare and respond to these pressures, for example the impacts of climate change. These are areas where there would be a need for strategic research and targeted long-term monitoring.

- Identification of opportunities for restoration of habitats and nature-based solutions are also key evidence needs to respond to the climate and nature emergencies.
- Current land management strategies do not include consideration of future climate risks including the potential impacts of up to a +4°C at 2100 scenario.

What are people telling us?

The South East Area Statement sets out a sustainable vision for the management of Gwent's natural resources. This vision has been developed collaboratively and is underpinned by what specialists and wider stakeholders identified they want to see in Gwent.

With regards to food and agriculture, stakeholders identified the following²⁹⁷:

- "Agricultural land managed for food and ecology which is also profitable."
- "Respect for home produced (local) food which is delivered to high animal health and environmental standards which enhance the environment; buy local."

Welsh Government's recent publication <u>Climate Change and Reaching Net Zero: Perceptions and</u> <u>Awareness in Wales (Welsh Government, 2021²⁹⁸)</u> summarises the findings from a survey which explored awareness, attitudes and preferences towards different pathways to reduce carbon emissions and reach net zero in Wales. One of the key findings was that whilst the majority of the respondents were concerned about climate change and agreed with the need to see a variety of societal changes to help reduce carbon emissions the option of switching to greener diets was the change least respondents wanted to see.

Future trends and challenges

Economic and market changes

In 2019, the UK produced 55% of the population's food requirements (Department for Environment, Food & Rural Affairs (DEFRA), 2020²⁹⁹), showing that that just under half the UK's food is imported. To continue to supply the same proportion of food and meet increasing population requirements, without expanding the annual area managed intensively, crop and livestock yields will need to increase by more than 9% by 2050, based on current diets and consumption rates³⁰⁰.

The Future Trends Report 2021 identifies that this will be a continuing trend with demand for food increasing globally, driven by population growth and changing diets this report has also identified that the actions associated with feeding our population are driving significant environmental damage³⁰¹. There is a major challenge to reduce agriculture's negative impact on the environment while simultaneously maintaining food production for a growing population. Managing environmental sustainability on farms in some circumstances is linked to a decrease in food production. If not balanced by measures such as improving efficiency, reducing food waste and modifying diets and technological advances, the area of land required for agricultural production may need to expand. This would risk increasing environmental pressures within Wales and abroad.

COVID-19

The COVID-19 pandemic has disproportionately and negatively impacted shut down sectors. The accommodation and food sector has probably been the most negatively affected in Wales, contributing more to the Welsh economy than to the UK economy³⁰².

The pandemic impacted the dairy sector, with the closure of the food service and hospitality sectors leaving some processors without a viable market for their milk and milk products³⁰³.

Brexit

Many farmers in Wales have relied heavily on the <u>Common Agriculture Policy (CAP)</u> for income, particularly the <u>Basic Payment Scheme (BPS)</u>, more so than in any other UK country³⁰⁴. Now the UK has left the CAP, an interim CAP-style system is being maintained under the <u>UK Agriculture Act 2020</u>, until Wales transitions to new domestic schemes. There has been <u>disagreement between the Welsh</u> <u>Government and UK Government</u> over whether commitments to provide full replacement funding for the schemes have been met. This is due to <u>different interpretations</u> of ongoing EU funding being provided through the <u>Rural Development Programme</u>. The future agricultural policy will be developed in the context of new trade agreements. <u>Farmers are calling for a trade strategy</u> that seeks to both maximise access to overseas markets while safeguarding Wales's high food and farming standards³⁰⁵.





The Welsh food and drink export market relies heavily on European trade (overall, 73% (Welsh Government, 2019³⁰⁶) of Welsh food and drink exports value are to the EU). Fig. C21³⁰⁷ demonstrates the key findings from an estimated assessment of the potential impact under different trading scenarios. This study suggests that the total area potentially affected by the Brexit trade scenarios is 3 to 17% of current farmland depending on the future trade scenario (Emmett et al., 2019³⁰⁸).

Climate change

Recent <u>UK Government analysis³⁰⁹</u> indicates that in the Intergovernmental Panel on Climate Change Special report (IPCC, 2018³¹⁰), for shared Socio-economic pathways (SSPs)³¹¹ 1 2, and 3, global crop and economic models project a 1–29% cereal price increase by 2050 which would impact consumers globally through higher food prices. Low-income consumers are particularly at risk.



Fig. C22 Interlinkages between the climate system, food system, ecosystems and socio-economic system

Fig. C22³¹² demonstrates the interlinkages between the climate system, food system, ecosystems (land, water, oceans) and socio-economic system. These systems operate at multiple scales. Food security is an outcome of the food system leading to human well-being which is also indirectly linked with climate and ecosystems through the socio-economic system.

The recently published CCRA3 Technical Report for Wales³¹³ identified the following climate risks that are specific to the Agriculture and Food sectors where there is **more action needed**:

Risk N4. Soils: Changing climatic conditions, including seasonal aridity and wetness

Risk/opportunity N6. Agricultural and forestry productivity.

Risk N7. Agriculture: Pests, pathogens and invasive species.

Risk ID1. Food availability, safety, and quality: Decreasing yields from rising temperatures, water scarcity and ocean changes globally.

Further analysis on Risk N4:



Fig. C23 Predicted Agricultural Land Classification (ALC) grade using UKCP18 scenarios

The Capability, Suitability and Climate Programme (Welsh Government, 2020³¹⁴) modelled the changes in the <u>Agricultural Land Classification (ALC)</u> and the best and most versatile agricultural land (BMV) (Grades 1 to 3a) (Keay C.A and Hannam J.A. 2020) (Fig. C23).

	Current	2020 Low	2050 Low	2080 Low	2020 Medium	2050 Medium	2080 Medium	2020 High	2050 High	2080 High
BMV	20%	23%	24%	18%	23%	24%	16%	23%	22%	9%
Not BMV	80%	77%	76%	82%	77%	76%	84%	77%	78%	91%

Fig. C24 Changes in percentages of best and most versatile (BMV) and Not BMV land in Wales using UKCP18 scenarios

Overall, the assessment shows predicted climate change impacts on soils with some soils improving and others downgrading, with potential changes in crop suitability, cropping and land use patterns in response to changing conditions (Keay C. A and Hannam J. A 2020) (Fig. C24³¹⁵). A key finding from this research is that although drought risk is limited at present, it becomes a much stronger risk

factor for a significant proportion of the country (Welsh border, Pembrokeshire, Anglesey and north Wales) by the 2050s, and especially by the 2080s.

CCRA3 identified the following risks that are specific the Agriculture and Food sector that require **further investigation**:

Risk N10. Aquifers and agricultural land: Sea level rise, saltwater intrusion.

Opportunity N9. Agricultural and forestry productivity: New/alternative species becoming suitable.

Risk/opportunity N18. Landscape character: Climate change.

Risk H9. Food safety and food security.

CCRA3 identified the following risks that are specific the Agriculture and Food sector where we are advised to maintain a watching brief:

Opportunity ID2. UK food availability and exports: Increases in productivity and areas suitable for agriculture overseas.

Timber

In Gwent, there is roughly 24,000ha of woodland cover, approximately 15% of the total area³¹⁶. Productive woodland accounts for the smallest element of this overall figure with conifer plantations, making up just 31% of the overall woodland resource. 62% of woodland cover is attributed to broadleaves.

What are the well-being strengths?

Timber supports employment in small and large-scale business and community enterprises, rural livelihoods, green growth and a regenerative economy. As well as being a renewable, sustainable material for a range of products and construction applications, use of timber can lock up carbon and displace carbon emissions associated with other types of materials. It also has the potential to reduce carbon emissions associate with transport, if locally grown sources are used³¹⁷.

Management of woodland for productive timber can have a number of well-being benefits for local communities. This can include improved access opportunities, with increased thinning and structural diversity creating more attractive recreational areas and improved habitats for wildlife. This also has a benefit for carbon sequestration and soil management.

Productive conifer plantations are located in the valleys to the west on the higher more exposed valley tops, such as at Cwmcarn, although there are also large productive woodlands in the east as well, along the Wye Valley and at Wentwood. The Usk plain is characterised by smaller, more native, woodlands due to a density of farmland and intense agriculture.

The volume of timber from WGWE in Gwent, compared to other areas, provides an indication of the difference in availability of timber and woodland. 45,351 tonnes of timber has been harvested to date in 2021, compared to approximately 211,000 tonnes in Powys and Ceredigion.

There are approximately five timber mills/suppliers in Gwent, the largest of which is Pontrillas Timber, suggesting that timber production plays a part in the economy of the region, but timber and products from the mills can be shipped to other parts of the UK so it can be hard to confirm the true figure. Contractors and companies that harvest timber come from all over the UK to work in Gwent's woodlands.

What are the issues impacting well-being?

The challenges for timber production in Gwent are:

- Woodland size
- Intensive agriculture and urban development competing for land which means that it is harder to expand current woodlands or create new ones as well as development pressure on existing woods
- Higher urban populations
- Conifer plantations in the west being situated on valleys tops and alongside communities making access harder and meaning the ability to diversify species is reduced due to higher exposure and altitude
- Wildfires are an increasing risk
- Low diversity in productive timber stock

What are the gaps in understanding?

It is recommended that the following gaps in understanding are given due consideration in the development of the Gwent Well-being Plan:

- Currently there is incomplete data to accurately quantify the contribution that Welsh-grown timber makes to a regenerative economy and the more efficient use of natural resources in Wales. This is a future evidence need which has been identified by <u>Wood Knowledge Wales</u> (2020)³¹⁸.
- There are gaps in the knowledge of exactly how much timber production contributes to the economy of Gwent at the local level.

Future trends and challenges

Sector changes

Changes in softwood and hardwood timber availability will affect the forestry sector and the potential contribution that timber can make to resource efficiency as part of a regenerative economy unless more woodland is brought into sustainable commercial management and more new woodland is created that can produce utilisable timber³¹⁹.

While the forecasted availability of hardwood timber is increasing, market opportunities are currently limited. In the future, private businesses in the whole supply chain (from tree nurseries to final product), must have confidence in forestry in Wales to drive investment to support a regenerative economy and greater resource efficiency.³²⁰

The current forecast highlights a drop in softwood timber availability over the next 30 years, but it is hoped that this can be compensated for by smoothing out production levels, bringing more woodland into management and creating more new woodland that can produce utilisable timber. On the plus side, forecast data shows an increase in the availability of hardwood timber, although concerns remain over the quantity and quality of products (as a potential substitute for softwood) that could eventually be derived from this increasing resource.

Climate change

The impact of future climatic changes on woodland and forestry sector is projected to be greater than those experienced to date.

The recently published CCRA3 Technical Report for Wales³²¹ identified the following climate risks that are specific to the Forestry sector where there is **more action needed**:

Risk N4. Soils: Changing climatic conditions, including seasonal aridity and wetness.

Risk/opportunity N5. Natural carbon stores, carbon sequestration and greenhouse gas (GHG) emissions.

Risk/opportunity N6. Agricultural and forestry productivity.

Risk N8. Forestry: Pests, pathogens, and invasive non-native species.

CCRA3 identified the following risks that are specific the woodland and forestry sector that require **further investigation**:

Opportunity N9. Agricultural and forestry productivity: New/alternative species becoming suitable.

Risk/opportunity N18. Landscape character: Climate change.

Water supply

Abstraction is the removal of water from a surface water (river, lake, pond, reservoir) or groundwater source, usually for human use. Abstraction from groundwater can also have an impact on a surface water source depending on the connectivity between the aquifer and the surface water.

Surface water is the main abstraction resource in Gwent, with only about 4% of the total annual volume licensed for abstraction coming from groundwater aquifers. There is a moderate to low demand for abstraction licences in these catchments. In Gwent, the main pressures on water resources are centred on several public water supply reservoirs at the top of the Rhymney and Ebbw catchments and the large unlicensed dock feeder abstractions from the downstream end of the Ebbw³²².

The Usk catchment is a key strategic resource for supplying potable water to much of Gwent and an extensive system of water transfers has been developed to distribute this water across the region. There are two public water supply impoundment reservoirs in the catchment. These comprise the <u>Llandegfedd Reservoir</u> (designated a <u>Special Scientific Interest (SSSI)</u>) at the head of the Sor Brook; and the Pantyreos Reservoir in the Malpas Brook catchment³²³.

Some areas of Gwent are more rural and may rely on private water supplies. For example, there is an estimated 1000 properties in Monmouthshire utilising a private water supply (Monmouthshire Well-being Assessment 2016³²⁴).



Fig. C25 Location of licenced abstractions in Gwent

There are 149 abstraction licences in Gwent (not including abstractions that are under 20m³/day or certain private water supplies which may not require a licence) (Fig. C25³²⁵).



Fig. C26 Licences by purpose type in Gwent

The majority of these licences have an agricultural purpose which represents the largest total annual abstraction authorised for abstraction (Fig. C26³²⁶). Licences with an industrial purpose and water supply purpose both have a similar number of licences however, water supply has a considerable larger total annual abstraction quantity with just over half of the total annual volume authorised for

abstraction. Industrial purpose licences represent a negligible amount of the annual Gwent total. The number of hydropower generation licences has steadily increased within the catchment, currently accounting for 6% of the total annual licensed abstraction. There are a handful of amenity licences with maximum abstraction quantities for amenity being very little of the Gwent total. Environmental licences such as for wetland improvement or environment remediation are limited in the region (only three) and as such have a small total annual abstraction.

What are the well-being strengths?

Rivers, lakes, reservoirs, ponds and groundwater are important for human survival. They provide drinking water and contribute to well-being through the opportunities they provide for recreation, tourism, manufacturing, energy generation, agriculture, connection to nature and blue space and the appreciation of landscape. Wetlands are linked to surface water which are also an important ecosystem for biodiversity and human enjoyment. Economic prosperity and employment opportunities are derived from these natural benefits which our water resource provides.

What are the issues impacting well-being?

Impacts on the river environment will have a detrimental impact on well-being. Loss of habitat, species and biodiversity will reduce people's enjoyment of the river and reduce the amount of green and blue space for use.

Drought

Droughts are natural events which occur as a result of a prolonged period of low rainfall, creating a shortage of water. They affect the availability of water to different users as well as having an impact on people, the environment and businesses. Every drought is different in timescale, location and impact. Some can impact public water supply whilst others might have a greater impact on wildlife, riverine habitat and biodiversity.

River management

Licences may have conditions to reduce or cease abstraction when flows reach or are below a certain level to protect the environment. Low flows can cause problems for the enjoyment of the river from an aesthetic point of view and can also exacerbate other incidences such as algal blooms or fish kills from not enough water or water temperatures getting too high.

Blue-green algal outbreaks directly affect water usage and tourism. Algal blooms have a negative impact on anglers and the aesthetics of the river, and they also have a significant ecological impact.

Future trends and challenges

Climate change

Summer rainfall is expected to decrease by approximately 15% by the 2050s and by between 18% to 26% by the 2080s. Periods of water scarcity may become more prevalent under these scenarios, leading to possible implications in agriculture and industry (Fig. C4). The recently published CCRA3 Technical Report for Wales³²⁷ identified the following climate risks that are specific to water supply where there is **more action needed**:

Risk I1. Infrastructure networks (water, energy, transport, ICT): Cascading failures.

Risk I2. Infrastructure services: River and surface water flooding.

Risk N10. Aquifers and agricultural land: Sea level rise, saltwater intrusion.

CCRA3 identified the following risks that are specific to water supply that require further investigation:

Risk I3. Infrastructure services: Coastal flooding and erosion.

Risk I7. Subterranean and surface infrastructure: Subsidence.

Risk H10. Health: Poor water quality and household supply interruptions.

CCRA3 identified the following risks that are specific the Water Supply where it is recommended that we **sustain current action**:

Risk I8. Public water supplies: Reduced water availability.

Section D: A regenerative economy with sustainable levels of production and consumption

Net zero, zero waste and One Planet Wales

Gwent is living within its environmental limits, an underlying principle of environmental sustainability. For Gwent to succeed in living within its fair share of Earth's natural resources, we must be able demonstrate that our patterns of production and consumption do not place an environmental burden on the planet. We must assess to what extent Gwent is on track to meet its commitments to net zero, zero waste and One Planet living.

Greenhouse gas (GHG) emissions

The total carbon footprint of Wales is estimated at just over 34 million tonnes of carbon dioxide equivalent (tCO₂e). This equates to 11.11 tCO₂e per capita³²⁸. Approximately 75% of the greenhouse gas (GHG) emissions associated with Wales' carbon footprint are from products purchased domestically, with the remaining 25% from the final consumption of imported goods³²⁹. Further international comparisons can be made; China's consumption-based footprint is around 6.4 tonnes (with a production-based footprint of $8.6tCO_2e$). India's consumption-based figure stands at just $1.3tCO_2e^{330}$. This demonstrates the inequalities in carbon emissions currently present in consumption-based carbon footprints across the globe.



Fig. D1 Chart: Carbon footprint of Wales by consumption theme

Table: Carbon footprint of Wales dominant categories

Fig. D1³³¹ provides an analysis of the most important categories contributing to the Welsh carbon footprint. The table provides a breakdown of the data by dominant type. This data provides some insight into where targeted reduction policies may have the greatest effect. For instance, housing makes a significant contribution to emissions, specifically in relation to the requirement to heat space and water using fossil fuels. This also represents the best option for reducing emissions. It is worth noting that electricity is much easier to decarbonise than fuel use. Travel is also a significant contributor.



Fig. D2 Carbon footprint of Wales by region

Fig. D2³³² shows emissions per capita by local authority area. The areas with the lowest overall environmental burden per capita in Gwent are the more densely populated areas. Inherent limitations in the data prevent a detailed analysis of the difference between local authority areas.

Waste and ecological footprint

Wales uses many resources for activities in business and industry, farming and food production, home and office, and this impacts on the natural environment. When waste is generated, it can be detrimental to ecosystems, biodiversity and the well-being of the population, especially where it is not managed appropriately at authorised waste sites or is managed through illegal activity. Generating waste also increases pressure on the use of natural resources.

Waste generation

Quantifying waste generated by sector in Wales in a given year is difficult due to a lack of a regular comprehensive data source. In 2018, the total quantity of waste generated in Wales was estimated to be 8.9 million tonnes, excluding mining and quarrying wastes, agriculture, forestry and fishing.



Fig. D3 Wastes generated by economic activity and households, 2018 (excluding mining and quarrying, agriculture, forestry and fishing wastes) (Note: Construction and demolition waste includes dredging spoils)

Fig. D3³³³ shows that the majority of waste generated in Wales in 2018 was estimated to originate from the construction and demolition sector (53%), followed by the commercial (17%) and industrial

sectors (16%) (Department for Environment, Food & Rural Affairs (DEFRA), 2018³³⁴). In comparison, waste generated from household sources (14%) contributed the least to total waste generation (StatsWales, 2019³³⁵). These figures are not available at the regional level but are presented here to give an overall understanding of waste generation by sector. National trends have been analysed over the period 2012-2018. There was a statistically significant reduction in waste generated from households, industry, and commerce between these years³³⁶.



Fig. D4 Annual residual household waste produced per person (kgs by local authority)

Fig. D4³³⁷ shows the data for residual waste produced per person in kgs by local authority area. Waste generation per person is above average levels in four of the five local authority areas in Gwent, with Monmouthshire the only area to register a bellow average figure. Levels in Caerphilly considerably exceed the Welsh average.

Waste recycling



Fig. D5 Management of waste generated in Wales by origin

The Welsh Government Circular Economy strategy '<u>Beyond Recycling</u>' sets a one planet resource use and zero waste aspiration for 2050³³⁸ (zero waste means that 100% of waste that is still generated in 2050 will be re-used or recycled as a resource). Wales has made major improvements in managing waste over the last decade by increasing the amount sent for recycling, and reducing the amount sent for disposal (Fig. D5³³⁹). These statistics are not available on a Gwent scale but are provided here for context.



Fig. D6 % of municipal waste sent for reuse/recycling/composting

In 1998-99, only 5% of municipal waste was recycled; in 2018-19 this had reached 63%³⁴⁰. Wales is now recognised as having the highest household recycling rate in the UK; the second highest in

Europe and the third highest in the world. Wales is transitioning to a high recycling nation which is a necessary component of a circular and regenerative economy. Gwent recorded recycling rates at or above the Welsh average figure in 2019 (Fig. D6³⁴¹). However, the data demonstrates that more needs to be done in Gwent to prevent waste from being generated if we are to achieve zero waste and one planet living.

Ecological footprint

Ecological footprint is an indicator of the total environmental burden we place on the planet. It represents the area of land needed to provide raw materials, energy and food, and to absorb pollution and waste created by the population³⁴². The ecological footprint takes account of carbon dioxide (CO_2) emissions associated with Welsh consumption activities and expresses them as an area of land.

The ecological footprint also accounts for the area required to produce the food and fibre people consume and the area required to provide space for Welsh infrastructure such as roads and buildings. It is a separate indicator from the carbon footprint.

The last ecological footprint for Wales was calculated in 2011 and was 10.05 million global hectares. This is roughly five times the size of Wales and equivalent to 3.28 global hectares per person in Wales³⁴³. This means that if everyone in the world were to consume the same as the average Welsh resident, it is estimated that just over 2.5 Earths would be required to provide the resources and absorb the waste. This is slightly lower than the figure for the UK, which is 2.7 Earths. Although a few years old, our ecological footprint suggests that our key natural resources are being depleted faster than they can be replenished.



Fig. D7 2003 ecological footprint by local authority

In Gwent, Monmouthshire has the highest ecological footprint per person and Blaenau Gwent has the lowest (Fig. D7³⁴⁴). The variation in ecological footprint is influenced by a number of factors including income, demographics, patterns of household expenditure and the energy performance of housing stock.



Fig. D8 Ecological footprint of Wales by Welsh Government consumption theme

Fig. D8³⁴⁵ sets out consumption by theme (final demand) contributing to Wales's ecological footprint. By grouping the ecological footprint by theme, it is possible to identify four broad areas that contribute significantly to the ecological footprint of Wales; housing, food, transport (or personal travel), and consumer items. Together these items account for 78% of the ecological footprint of Wales.

What are the well-being strengths?

Net zero

The <u>Cardiff Capital Region (CCR</u>), which includes Gwent, has identified the need to transform the region's energy use across the heat, electricity, transport and fuel sectors in order to enable a transition to net zero by 2050.



Fig. D9 Cardiff Capital Region Energy Strategy

To achieve the energy system transformation, Welsh Government techno-economic analysis shows that the investment needed between now and 2035 totals £8.6 billion, with investments required from a range of stakeholders³⁴⁶. That investment would create 47,330 (mostly net) jobs and a £7.2 billion uplift in gross value added (GVA) (Fig. D9³⁴⁷).

Urban habitat makes up approximately 20,000ha of Gwent. Opportunities for renewable energy generation in the form of solar thermal energy are far from fully exhausted. Investment in low carbon heat and fuel alternatives at household and community scale will not only safeguard our existing non-renewable sources but also provide an income for current and future generations. Use of nature-based solutions to sequester carbon can also deliver multiple benefits to communities.

Meeting decarbonisation targets can also lead to improvements in the quality of life for communities which suffer from the adverse impacts of poor air quality. Poor air quality in the UK is estimated to cause 40,000 early deaths annually (Air Quality Expert Group, 2020³⁴⁸), with 2,000 deaths in Wales alone. This amounts to 6% of total deaths (Public Health Wales, 2016³⁴⁹). This was demonstrated during the COVID-19 pandemic where lockdown restrictions affected energy use, emissions and some air pollutants across the UK. Initial assessments suggest a reduction in nitrogen oxide (NOx) and nitrogen dioxide (NO₂) emissions in urban areas during lockdowns, as a result of lower traffic volumes (Clean Air Advisory Panel, 2020³⁵⁰). This and the associated reduction in traffic noise is likely to have had a positive impact on well-being³⁵¹.

Zero waste and One Planet Wales

Reducing and reusing waste is one way to reduce our consumption of resources and provide positive benefits to ecosystems in Wales. Wales is leading the way in the UK for providing separate food waste recycling for households, with 99% of households having access to a food waste collection. In 2018-19, Welsh Local Authorities reported that the majority (71%) of food waste that they collected from households and businesses was recycled at anaerobic digestion (AD) facilities located in Wales (Natural Resources Wales (NRW), 2020³⁵²).

In the UK, AD is the main source of biogas as a renewable energy technology. Food waste breaks down naturally in the AD plants in the absence of oxygen and produces a gas, which can then be used to produce electricity and heat. The leftover organic material, known as digestate, is rich in nutrients and can be used as a substitute to chemical-based fertilisers and as a soil improver. This high percentage of biodegradable waste, which is processed by Welsh recycling infrastructure and diverted away from landfill, demonstrates that Wales is moving towards a localised circular economy for this waste stream.

What are the issues impacting well-being?

Net zero

Some low-income households are subject to a triple climate change injustice; they make a relatively small contribution to carbon emissions, pay disproportionately for the policies to mitigate carbon emissions and benefit the least from those policies than higher income households³⁵³. As well as low-income households generally, there is a wider set of disadvantaged groups that can be described as 'energy vulnerable', who may struggle to pay their energy bills, potentially due to high energy needs as well as poverty³⁵⁴.

Vulnerability Socio-economic characteristics GB adults unless stated



Fig. D10 Socio-economic characteristics of vulnerability

Fig. D10³⁵⁵ demonstrates some of the social, cultural and economic determinants of energy vulnerability. It should be noted that policies which seek to accelerate decarbonisation through energy bills alone may exacerbate other inequalities for these groups.

Zero waste

The achievement of zero waste by 2050 and a move towards a one planet material footprint for Wales requires a circular economy that goes far beyond recycling. Waste generation is an indicator of how far Wales has yet to go to achieve sustainable production and consumption, starting with influencing societal attitudes towards waste norms. More needs to be done to prevent waste from being generated if we are to achieve zero waste and one planet living.

Despite the generally increasing recycling trend and decrease in waste sent to landfill, evidence indicates that there are considerable amounts of recyclable material still present within the mixed residual waste streams generated by industry, commerce and households in Wales. This waste is currently sent for landfill and incineration. In terms of waste generated by industrial and commercial sectors, the majority of residual waste (74.5%) could be diverted for recycling (WRAP Cymru 2020³⁵⁶). The most common material which could be diverted from residual waste is food waste. There are also significant opportunities to divert other recyclables such as packaging material generated by the commercial sectors.

In terms of waste generated by households, almost half (48.9%) of residual waste collected at the kerbside is widely recyclable. Food waste is the single biggest contributor to this, despite most households having access to a weekly separate food waste collection. Furthermore, of the food waste separately collected for recycling, almost half of it (45.4%) could be avoided and an additional 2.6% was avoidable food waste still in its packaging (WRAP Cymru 2016³⁵⁷). This indicates that there are still significant opportunities for preventing food waste generated by Welsh householders and increasing recycling rates by improving participation in existing recycling schemes.

Waste crime

Where a waste site operates outside of the legislative framework it may impact the surrounding environment and communities. Communities may suffer from odour, litter, dust, noise, vermin, and fly infestations from non-compliant permitted sites or illegal waste sites. In addition, ecosystems suffer where waste is inappropriately treated, stored or disposed of without the correct and proper infrastructure. Waste crime and poor waste management practices can lead to fires, which impacts on key infrastructure and local amenities and can risk the closure of main roads, railway lines, schools and hospitals, as well as damaging amenities for nearby communities. In addition, fire incidents consume a large amount of public sector resources, pollute the environment and disrupt communities. This impacts on the protection and health of people, places and ecosystem resilience. When Welsh waste is managed inappropriately abroad or illegally exported through mismanagement, there are global impacts such as marine pollution or waste abandoned at docksides.

Туре	Cost Range (£m)
Illegal waste sites	£2.3–5.6 million
Waste fires	£0.7–1.1 million
Fly-tipping	£4.7–11.8 million
Misclassification	£1.3–7.3 million
Permit breaches	£4.9 million
Illegal exports	£1.3–1.7 million
All types	£15.2–32.4 million

Fig. D11 Estimated costs of waste crime by type in Wales 2015-16

While the cost to legitimate businesses, landowners and the wider economy are difficult to quantify, it is estimated that misclassification, illegal exports and exemption abuses amounted to $\pm 15.2 \pm \pm 2.4$ million of economic impact to Wales in 2015/16 (Fig. D11) (Eunomia 2017³⁵⁸).

What are the gaps in understanding?

It is recommended that the following gaps in understanding are given due consideration in the development of the Gwent Well-being Plan:

Net zero

- Until emissions data are published in 2021 and 2022, we do not have an accurate estimate of emissions trends in Wales in 2019 and 2020.
- Furthermore there is no provision in Welsh climate legislation for how performance towards carbon budgets is measured (<u>Climate Change Committee</u>³⁵⁹).
- All public sector organisations across Gwent are required to undertake a carbon baselining exercise to inform and prioritise decarbonisation activity. Not all organisations have
undertaken this activity, however early information from those organisations that have undertaken this exercise indicates that procurement activity accounts for a considerable proportion of emissions (Blaenau Gwent Decarbonisation Plan 2020-2030³⁶⁰; Natural Resources Wales Carbon Positive³⁶¹).

Meeting our combined net zero carbon, waste and One Planet milestones is going to require
a significant shift in the energy, food, waste, transport and building sectors. This will require
new and different skills and technological capacity. The extent to which this transformation
will impact labour and capital supply and demand in the Gwent region is unknown, more
work will have to be undertaken to understand how best to support the shift in key
industries across the region.

What are people telling us?

Net zero

In 2020, the Welsh Government surveyed over 1000 Welsh residents via an online survey with the aim of developing the evidence base around public awareness, attitudes and preferences towards net zero pathways and societal change. The participants selected were representative of the Welsh population. The report, <u>Climate change and reaching net zero: perceptions and awareness in</u> <u>Wales</u>³⁶² made the following findings:

Climate change concern and perceptions

The majority of survey respondents reported being fairly or very concerned about climate change (86%). Despite this, only 22% of respondents thought that climate change would affect the UK 'A great deal', and only 15% thought this for their local area. Under half (46%) of respondents thought climate change would affect other countries 'A great deal'.

When asked how much a range of sectors contributed to the UK's carbon emissions, the majority of respondents thought that all sectors contributed at least to some extent. The sector respondents thought contributed the most was transport, and the sector respondents thought contributed the least was agriculture. 82% of respondents perceived transport to contribute to carbon emissions 'a great deal' compared to 55% who perceived the same about agricultural emissions.

Net Zero knowledge and support

The majority (84%) of respondents had heard of the net zero concept before. 57% reported knowing a little or a fair amount; only 8% reported knowing a lot about it.

80% of respondents reported that they strongly or somewhat support the UK commitment of reaching net zero by 2050. Over two thirds (68%) responded that they strongly or somewhat support the Wales net zero commitment of reaching 95% reduction in emissions by 2050, with an ambition to reach net zero by 2050.

At the time of data collection, the Wales net zero commitment was a 95% reduction in carbon emissions by 2050, and an ambition to reach net zero by 2050. Since data collection, this has now changed to a commitment to net zero by 2050, in line with the UK Government target.

Perceptions of carbon-reducing changes and technologies

Respondents were given a list of potential changes to society which could be made to reach the net zero target (e.g. greener industry, lower transport emissions, greener energy supply) and asked to state whether they would like to see this change. Across most of the listed changes to society, over 7 out of 10 of respondents would like to see some or a lot of a change. Waste reduction had the highest percentage (84%) of respondents who wanted to see a change. However, greener diets is an exception to this. The percentage of respondents who would like to see some or a lot of this change

is relatively low (47%) and one quarter (25%) of respondents would not want to see any or much of this change.

Respondents were provided with descriptions of GHG removal technologies and renewable energy supplies as options to help reach net zero and asked how positively or negatively they feel about them. Respondents were widely positive about these two options with slightly more respondents being positive about wind/nuclear energy supply (72%) than GHG removal technologies (67%).

Likelihood and perceptions of lifestyle changes

When asked how likely they thought a range of lifestyle changes would be to occur over the next few decades, respondents saw energy efficiency as the most likely to occur (67% perceived this as extremely or somewhat likely). The consumption of half as much meat and dairy was perceived as the least likely to occur (44% reported this as extremely or somewhat likely).

Respondents were then asked how likely they would be to make a variety of changes in their own lives. Responses were mixed. Around half (53%) said they were at least somewhat likely to reduce their thermostat temperature and use less heating (50%). Avoiding planes for holiday and business trips was likely to occur for four in ten respondents, although the impact of coronavirus restrictions should be considered here. Respondents were least likely to buy an electric car or switch to a low-carbon heating technology, with both being viewed as likely by only a third of respondents.

Perceptions of the future

At least half of the respondents view a net zero future as better for well-being, health and the economy. The positive impact on well-being and health was most certain among respondents (77% and 80% responding 'better' respectively). The impact on the economy was less certain; with 51% responding better, but just under a third (28%) responding worse.

The percentage of respondents who agreed or strongly agreed that the way we live our lives will need to change substantially to address climate change was considerably higher (84%), than respondents who agreed or strongly agreed that technology will help reduce most of our carbon emissions (41%).

Best Practice local involvement

In March 2021, Blaenau Gwent Public Services Board worked in partnership with Cynnal Cymru and the Electoral Reform Society Cymru to undertake a Climate Assembly. The Assembly took place online via Zoom. 50 residents of Blaenau Gwent were selected by sortition to address the question "What should we do in Blaenau Gwent to tackle the climate crisis in a way that is fair and improves living standards for everyone?" Citizens made the following recommendations when considering where they would like to see action:

Theme	Recommendation	% Support
Transport	Establish an affordable, integrated road & rail transport system accessible throughout BG. A one ticket system that links to bus, rail & cycle schemes - inclusivity for purchasing of tickets (digital or paper). Accessible all hours with safety via lighting, CCTV and to keep maintained.	91
Transport	Establish & improve a safe, easily maintainable infrastructure for walkers & cyclists, for either recreational or work purposes, with access to the public transport network. Including lighting & CCTV & storage for bikes.	88
House retrofit	Train local tradespeople, create qualifications and upskill local businesses, involve FE colleges and local Universities, future proof it and provide the right courses to enable them to do the work in all green construction.	86
Green space and nature	Implement a programme of woodland preservation and reforestation of BG, using the right tree in the right place for the right reason, increasing opportunities for jobs, biodiversity and connecting woodlands. Making sure the skills are available so we can create green jobs, e.g. saw milling and timber framed housing.	86
Housing new build	Ensure that all new build properties are built using the latest sustainable technologies (E.g. Glanffrwd development as a template), employing local builders and providing a variety of accommodation types appropriate for all inc. homeless/single occupancy up to large families.	81

Fig. D12 Five recommendations from the Blaenau Gwent Climate Assembly which received over 80% of the vote and were officially passed by the Assembly.

Fig. D12³⁶³ identifies the recommendations made which received over 80% of support from residents. These include activity focused on transport, housing, nature and green space.

Future Trends and challenges

Wales' GHG emissions have fallen by a quarter since 1990 (UK National Atmospheric Emissions Inventory (NAEI), 2020³⁶⁴). The UK Government target and UK Climate Change Committee (UKCCC) recommendation for achieving net zero emissions is 2050. A transition to net zero carbon has the potential to yield more than £90 billion of annual benefits to the UK because of the wider improvements to the environment and human health, alongside unlocking opportunities for innovation and employment (Vivid Economics, 2020³⁶⁵). In order to meet its commitments to net zero, the Climate Change Committee Advice Report: The path to a Net Zero Wales recommends action across four key areas³⁶⁶:

- Reducing demand for carbon-intensive activities: Reduced demand and improved efficiency
- Take-up of low-carbon solutions: Around 40% of the emissions saving is from people and businesses adopting low-carbon solutions as high-carbon options are phased out
- Expansion of low-carbon energy supplies: Low-carbon electricity can now be produced more cheaply than high-carbon electricity in the UK and globally. Low-carbon hydrogen scales up
- Land: A transformation is needed in Wales' land while supporting Welsh farmers

 Flexibility to meet net zero: Alongside the nature-based removals, by 2035 the UK should be using bioenergy (largely grown in the UK) with carbon capture and storage (CCS) to deliver engineered removals of CO₂ at scale (though these technologies may not necessarily be located in Wales).

Policy and practice at the regional level

If Gwent were to take a budgetary approach to emissions reduction in order to be compatible with the United Nations <u>Paris Agreement</u> on temperature goals, it would mean achieving a 13% year on year reduction in total emissions with a significantly sharp decline required over the next 10-15 years. Making a distinction between the target and budgetary based emissions trajectory is key. The following analysis was undertaken by Manchester Metropolitan University, Great Places Housing Group and Cynnal Cymru on behalf of the Gwent Public Service Board in 2020.



Fig. D13 Graph illustrating the difference between a taking a budgetary and a target-based emissions trajectory for emissions reduction

Fig. D13³⁶⁷ outlines the emissions trajectory we need to follow to 2050 to be compatible with the Paris Agreement goals. The blue area beneath the curve illustrates our cumulative emissions. In order to take a Paris Agreement compatible approach, our cumulative emissions in Gwent over that time would be 20.0MtCO₂. If we were to focus on delivering "headline net zero" however and assume a linear trajectory over time, then the grey area represents the extra emissions we would incur which amounts 45.6MtCO₂, more than the entire Paris Agreement compatible budget.



Fig. D14 Slide showing the budgets for 5 year period

Fig. D14³⁶⁸ demonstrates the ambition to take a budgetary approach with the "excess emissions" illustrated in grey for each budget period if a linear trajectory is followed. The data indicates that a budgetary approach provides one simple figure of the total amount of carbon that Gwent can emit, whereas percentage targets do not guarantee that Gwent will remain within this limit.

COVID-19

Climate policy and emissions will be impacted in ways that are difficult to predict by the response to the COVID-19 pandemic and its lasting effects³⁶⁹. The impacts of the pandemic on emissions in 2020 led to reduced energy demands during the lockdown period, however these impacts are considered to be transient, reversing as the economy opens³⁷⁰.

Lockdown restrictions led to a surge in online shopping and home deliveries. There were significant increases in the use of disposable single-use items, often plastic, like personal protective equipment (PPE). The recent outcome of the <u>Everyday Plastic Survey</u> completed during the pandemic indicated that domestic plastic waste production increased by 25% under lockdown conditions, particularly fruit and veg packaging, snack wrappers, parcel bags and PPE (Everyday Plastic 2020³⁷¹). It is likely that there has been an increase in the use of other single-use packaging items. For example, the closure of pubs and restaurants and restrictions in people movement led to an increase in food and drink takeaways. Some restaurants experimented with takeaways for the first time and may be permanent converts after realising the benefits of increasing profit margins (Citywire 2020³⁷²). It is too early to understand how the pandemic has impacted waste generation and the longer-term impact to consumer behaviours, where some progress had been made prior to the pandemic in raising awareness and encouraging re-use (i.e. coffee cups).

Brexit

Another important development that will shape UK and Welsh climate policy in the next few years is the UK's exit from the European Union (EU).

The UK's departure from the European Union will have implications for the UK's and Wales' environmental and decarbonisation policies. Key implications include:

- Leaving the EU's Emissions Trading System (EU ETS). Current Government proposals are to replicate this scheme, with a smaller UK ETS, with a view to linking to the EU ETS. A carbon tax has also been proposed.
- Product standards set at an EU level have been an important driver of energy efficiency, and emissions reductions in lights, appliances and vehicles.
- Leaving the Common Agricultural Policy (CAP), which provides direct income support for farmers, as well as payments for environmental services. Wales' replacement scheme, 'Sustainable Farming', aims to transition to rewarding farmers more for public goods including mitigating and adapting to climate change.
- Environmental governance to replace the role of the European Commission in enforcing environmental regulations in Wales. The Welsh Government has stated their preferred option is to establish a new environmental governance body in Wales, but this will not be legislated before the next Parliamentary term.²

As we noted in 2016, in areas where EU mechanisms are working effectively – such as product standards, which reduce emissions and save consumers' money, or targets for waste reduction - the aim should be to replicate them at UK or Welsh level. Some areas, such as leaving the Common Agricultural Policy, present an opportunity to better target public funds towards environmental goals.

Fig. D15 Impact of Brexit on Wales' climate objectives

The full scale of adjustments required will likely only be known after the end of the transition period, but a number of structural changes are already underway (Fig. D15³⁷³).

Market forces

Demand for using recycled materials is greatly influenced where it is cheaper than extracting and using virgin materials. Increased confidence in the quality and specification of recycled products to replace new or virgin materials will increase the market and demand for such materials. Frameworks like quality protocols (UK Government 2015³⁷⁴) and industry standards are a key tool in supporting waste recyclers to demonstrate this.

Many countries are now restricting the types of waste they will receive for recycling and reprocessing. Restrictions and bans on the import and export of waste and resources will mean that, while Wales continues to generate waste and resources, more domestic infrastructure is needed to treat these materials.

Technological advancement

Technological and innovative developments will provide new and better solutions for how Wales can deal with waste and resources and decarbonise.

The cost of key low-carbon technologies have continued to fall. For example, the contracted price for electricity generated by offshore wind fell again in the latest auction round by around a third compared to the previous auction two years earlier³⁷⁵. These cost reductions are driven by scale manufacturing, investor confidence and 'learning-by-doing' during deployment within an effective

low-risk policy framework. These effects can be replicated in other areas of the economy, as markets scale up globally and the costs of low-carbon technologies continue to fall.

What are people telling us?

Throughout the wellbeing questionnaire, residents across Gwent highlighted opportunities and suggested methods of improvement that helped us identify the environmental quality across Gwent.

Environmental wellbeing includes aspects such as Nature, greenspace and climate change. During our analysis it was important to keep in mind that Environmental wellbeing can encompass further aspects such as air quality, access to clean communities and sustainability.

Residents across Gwent expressed how they appreciated the *quality of their local environments* and how it is frequently used by residents across the region. People noted how they frequently go on walks and *enjoy the beautiful local scenery* within Gwent. Our analysis into environmental wellbeing has shown how communities are willing to pull together to ensure that the *local greenspace remains as visually pleasing as possible* through local people taking the initiative to *form action groups* to help tackle littering and working with agencies to clean up and develop local areas. People also expressed how the efforts of local communities have benefited in raising the profile of areas within Gwent through entering the *'Wales in Bloom' Competition*, a competition designed to showcase and *enhance the natural beauty within Wales*. This emphasises how communities are willing to take pride in their local environment to ensure that it is well looked after and maintained.

Another aspect that was raised throughout our Wellbeing Questionnaire related to the amount of *littering and fly tipping* occurring across Gwent that was affecting the *quality of the region's environment*. Residents expressed how the *volume of fly tipping, littering and dog fouling* incidents across Gwent that were not only affecting the appearance of local areas but also *residents' wellbeing*. However, residents also acknowledged how these issues could be down to a *lack of infrastructure* available within the environment, such as *litter bins* and *dog fouling bins* which are far too infrequent according to Gwent residents. Additionally, residents expressed how the issues raised regarding the *infrequent service delivery of rubbish collection* (which is often regularly missed) could be a *contributing factor to such large volumes of litter* (due to overflowing rubbish from bins being dispersed across streets during severe weather).

What is special about your community?	What would make it a better place?	What things are important to you and your family?	What would you like your community to look like in the future?	How can your community work with us to make that happen?
Attractive		Access to	Access to	
Surroundings	Maintenance	clean space	clean space	Maintenance of
(111)	of Litter (148)	(103)	(192)	Litter (27)
		Access to		
Access to	Traffic Volume	greenspace	Maintenance	Access to clean
greenspace (107)	(31)	(60)	of Litter (48)	space (8)
	Maintenance			
	of Dog Fouling	Maintenance	Community	Community
Air Quality (22)	(26)	of Litter (29)	Pride (26)	pride (8)

One of the most important aspects of Environmental wellbeing related to the maintenance of litter across Gwent as this topic frequently emerged within 4 out of the 5 questions we asked Gwent residents within our Well-being Questionnaire

Figure 1: Top 3 responses per wellbeing survey question

During our analysis of the Wellbeing questionnaire, we also identified how residents expressed interest in *reducing carbon emissions* across Gwent. Respondents raised issues regarding the *volume of traffic* which is *contributing to large carbon emissions and poor air quality*. This issue is largely in part due to a *dependency on personal vehicles* which respondents raised as an issue across the Gwent Region. Residents also expressed how the dependency on use of personal vehicles is contributing to *the reduction in effective traffic flow* through local towns and villages, consequently *contributing to air pollution*.



Figure 2: What residents say is special and what would make their community better?

What is special about your community? What would make your community a better place?

While many respondents praised aspects of Gwent's environment such as being able to access greenspace and having large quantities of attractive surroundings available, we acknowledge that more steps can be taken to improve the region's environment such as ensuring that litter and dog fouling rates continue to fall and taking steps to reduce traffic volume, therefore providing a healthier environment for all.

117

•

Endnotes

¹ Natural Resources Wales. 2020. State of Natural Resources Report (SoNaRR): Executive Summary. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693209/sonarr2020-executive-summary.pdf</u>

² Jones S M, Karran A, Bosanquet S, Barter G, Garrett H and Hancocks E. 2021. Greater Gwent State of Nature. Produced by the Resilient Greater Gwent Partnership Accessed here: <u>https://www.blaenau-gwent.gov.uk/en/resident/countryside/resilient-greater-gwent/</u>

³ Gwent Well-being Assessment Engagement Group, 2021, outputs from Well-being Assessment engagement survey, full results available on request

⁴ IPBES, 2019: Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. S. Díaz, J. Settele, E. S. Brondízio, H. T. Ngo, M. Guèze, J. Agard, A. Arneth, P. Balvanera, K. A. Brauman, S. H. M. Butchart, K. M. A. Chan, L. A. Garibaldi, K. Ichii, J. Liu, S. M. Subramanian, G. F. Midgley, P. Miloslavich, Z. Molnár, D. Obura, A. Pfaff, S. Polasky, A. Purvis, J. Razzaque, B. Reyers, R. Roy Chowdhury, Y. J. Shin, I. J. Visseren-Hamakers, K. J. Willis, and C. N. Zayas (eds.). IPBES secretariat, Bonn, Germany Accessed here: https://zenodo.org/record/3553579#.YUse4hmSmUk

⁵ Welsh Government, 2021, Future Trends Report 2021 Evidence Pack Accessed here: <u>https://gov.wales/sites/default/files/publications/2021-12/future-trends-report-wales-2021-evidence-pack.pdf</u>

⁶ Hayhow DB, Eaton MA, Stanbury AJ, Burns F, Kirby WB, Bailey N, Beckmann B, Bedford J, Boersch-Supan PH, Coomber F, Dennis EB, Dolman SJ, Dunn E, Hall J, Harrower C, Hatfield JH, Hawley J, Haysom K, Hughes J, Johns DG, Mathews F, McQuatters-Gollop A, Noble DG, Outhwaite CL, Pearce-Higgins JW, Pescott OL, Powney GD and Symes N (2019) The State of Nature 2019. The State of Nature partnership Accessed here:

https://nbn.org.uk/wp-content/uploads/2019/09/State-of-Nature-2019-UK-full-report.pdf ⁷ Government Office for Science (GO-Science) Trend Deck, N14 Accessed here:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/994400/ GO-Science_Trend_Deck - Natural Resources_section - Spring_2021.pdf

⁸ Jones S M, Karran A, Bosanquet S, Barter G, Garrett H and Hancocks E. 2021. Greater Gwent State of Nature. Produced by the Resilient Greater Gwent Partnership Accessed here: <u>https://www.blaenau-gwent.gov.uk/en/resident/countryside/resilient-greater-gwent/</u>

⁹ Jones S M, Karran A, Bosanquet S, Barter G, Garrett H and Hancocks E. 2021. Greater Gwent State of Nature. Produced by the Resilient Greater Gwent Partnership Accessed here: <u>https://www.blaenau-</u>

gwent.gov.uk/fileadmin/documents/Resident/Countryside/Nature Report files/GGSoN <u>3</u> Birds.pdf p107 ¹⁰ Jones S M, Karran A, Bosanquet S, Barter G, Garrett H and Hancocks E. 2021. Greater Gwent State of Nature. Produced by the Resilient Greater Gwent Partnership Accessed here: <u>https://www.blaenau-</u>

gwent.gov.uk/fileadmin/documents/Resident/Countryside/Nature_Report_files/GGSoN_3_Birds.pdf

¹¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Biodiversity. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693305/sonarr2020-theme-biodiversity.pdf</u>

¹² Emmett, B.A. et al. (2019) ERAMMP Report 11: Year 1 Summary. Report to Welsh Government (Contract C210/2016/2017) (CEH NEC06297) Accessed here:

https://erammp.wales/sites/default/files/ERAMMP%20Rpt%2011%20Year-1%20Summary%20v1.1.pdf ¹³ Welsh Government, 2021, Future Trends Report 2021 Evidence Pack Accessed here:

https://gov.wales/sites/default/files/publications/2021-12/future-trends-report-wales-2021-evidencepack.pdf

¹⁴Hayhow DB, Eaton MA, Stanbury AJ, Burns F, Kirby WB, Bailey N, Beckmann B, Bedford J, Boersch-Supan PH, Coomber F, Dennis EB, Dolman SJ, Dunn E, Hall J, Harrower C, Hatfield JH, Hawley J, Haysom K, Hughes J, Johns DG, Mathews F, McQuatters-Gollop A, Noble DG, Outhwaite CL, Pearce-Higgins JW, Pescott OL, Powney GD and Symes N (2019) The State of Nature 2019. The State of Nature partnership Accessed here: <u>https://nbn.org.uk/wp-content/uploads/2019/09/State-of-Nature-2019-UK-full-report.pdf</u>

¹⁵ IPBES (2019): Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. S. Díaz, J. Settele, E. S. Brondízio, H. T. Ngo, M. Guèze, J. Agard, A. Arneth, P. Balvanera, K. A. Brauman, S. H. M. Butchart, K. M. A. Chan, L. A. Garibaldi, K. Ichii, J. Liu, S. M. Subramanian, G. F. Midgley, P. Miloslavich, Z. Molnár, D. Obura, A. Pfaff, S. Polasky, A. Purvis, J. Razzaque, B. Reyers, R. Roy Chowdhury, Y. J. Shin, I. J. Visseren-

Hamakers, K. J. Willis, and C. N. Zayas (eds.). IPBES secretariat, Bonn, Germany Accessed here: https://zenodo.org/record/3553579#.YUse4hmSmUk

¹⁶ Welsh Government, 2021, Future Trends Report 2021 Evidence Pack Accessed here: <u>https://gov.wales/sites/default/files/publications/2021-12/future-trends-report-wales-2021-evidence-pack.pdf</u>

¹⁷ Government Office for Science (GO-Science) Trend Deck, N13 Accessed here:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/994400/ GO-Science_Trend_Deck_-_Natural_Resources_section_-_Spring_2021.pdf

¹⁸ Data can be accessed via the Wales Environment Portal here: <u>https://smnr-nrw.hub.arcgis.com/apps/3ad6560d23d243c29f4fabd99a42eaa9/explore</u>

¹⁹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Biodiversity. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693305/sonarr2020-theme-biodiversity.pdf</u>

²⁰ Third Climate Change Risk Assessment Technical Report: Summary for Wales (Dr. Alan Netherwood, 2021) <u>https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-Final.pdf</u>

²¹ Vision for the Sustainable Management of Natural Resources in Gwent as taken from the South East Area Statement <u>https://naturalresources.wales/about-us/area-statements/south-east-wales-area-statement/ways-of-working/?lang=en</u>

²² IPCC, 2018: Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty [Masson-Delmotte, V., P. Zhai, H.-O. Pörtner, D. Roberts, J. Skea, P.R. Shukla, A. Pirani, W. Moufouma-Okia, C. Péan, R. Pidcock, S. Connors, J.B.R. Matthews, Y. Chen, X. Zhou, M.I. Gomis, E. Lonnoy, T. Maycock, M. Tignor, and T. Waterfield (eds.)]. World Meteorological Organization, Geneva, Switzerland Accessed here: https://www.ipcc.ch/sr15/

²³Third Climate Change Risk Assessment Technical Report: Summary for Wales (Dr. Alan Netherwood, 2021) <u>https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-Final.pdf</u>

	More action needed
	Further investigation
	Sustain current action
24	Watching brief
24	

²⁵ Jones S M, Karran A, Bosanquet S, Barter G, Garrett H and Hancocks E. 2021. Greater Gwent State of Nature. Produced by the Resilient Greater Gwent Partnership Accessed here: <u>https://www.blaenau-gwent.gov.uk/en/resident/countryside/resilient-greater-gwent/</u>

²⁶ Natural Resources Wales and White Consultants, 2016 Update to LANDMAP Visual and Sensory Statistics, p. 7 Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/684054/landmap-visual-and-sensory-stats-by-area-statement-2017.pdf?mode=pad&rnd=131625598320000000</u>

²⁷ Statistics for Wales & Welsh Government (2019), Agricultural Small Area Statistics (2002-2018), Welsh Government Accessed here: <u>https://gov.wales/agricultural-small-area-statistics-2002-2018</u>

²⁸ Statistics for Wales & Welsh Government (2019), Agricultural Small Area Statistics (2002-2018), Welsh Government Accessed here: <u>https://gov.wales/agricultural-small-area-statistics-2002-2018</u>

²⁹ Welsh Government, 2019. Agriculture in Wales 2019. Accessed here: <u>https://gov.wales/agriculture-wales</u>

³⁰ Jones S M, Karran A, Bosanquet S, Barter G, Garrett H and Hancocks E. 2021. Greater Gwent State of Nature. Produced by the Resilient Greater Gwent Partnership. Accessed here: <u>https://www.blaenau-</u> <u>gwent.gov.uk/en/resident/countryside/resilient-greater-gwent/</u>

³¹ LANDMAP is the formally-adopted approach for landscape assessments in Wales, and is advocated by the Welsh Assembly Government. It is an all-Wales Geographic Information System (GIS)-based landscape information resource where characteristics, qualities and influences on the landscape are recorded as five themed spatial layers

³² Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Land use and soils. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693310/sonarr2020-theme-land-use-and-soils.pdf</u>

³³ Natural Resources Wales and White Consultants, 2016 Update to LANDMAP Visual and Sensory Statistics Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/684054/landmap-visual-and-sensory-stats-by-area-</u> <u>statement-2017.pdf?mode=pad&rnd=131625598320000000</u> ³⁴ Jones S M, Karran A, Bosanquet S, Barter G, Garrett H and Hancocks E. 2021. Greater Gwent State of Nature. Produced by the Resilient Greater Gwent Partnership Accessed here: <u>https://www.blaenau-gwent.gov.uk/en/resident/countryside/resilient-greater-gwent/</u>

³⁵ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Urban. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693301/sonarr2020-ecosystem-urban.pdf</u>

³⁶ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Urban. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693301/sonarr2020-ecosystem-urban.pdf</u>

³⁷ Gwent Well-being Assessment Engagement Group, 2021, outputs from Well-being Assessment engagement survey, full results available on request

³⁸ Future Generations Commissioner for Wales, 2020. The Future Generations Report 2020: Executive Summaries. Accessed here: <u>https://www.futuregenerations.wales/wp-content/uploads/2020/07/At-A-Glance-FG-Report.pdf</u>

³⁹ Natural Resources Wales, 2014 Tree Cover in Wales' Towns and Cities Understanding canopy cover to better plan and manage our urban trees Accessed here: <u>https://naturalresourceswales.gov.uk/media/3705/tree-cover-in-wales-towns-and-cities-2014-summary.pdf?lang=en</u>

⁴⁰ Natural Resources Wales, 2014 Tree Cover in Wales' Towns and Cities Understanding canopy cover to better plan and manage our urban trees Accessed here: <u>https://naturalresourceswales.gov.uk/media/3705/tree-</u> <u>cover-in-wales-towns-and-cities-2014-summary.pdf?lang=en</u>

⁴¹ ADAS, 2019. Assessment of Welsh Soil Issues in Context. Report to Welsh Government Soils Policy Unit. Accessed here: <u>https://gov.wales/assessment-soil-issues-context</u>

⁴² Natural Resources Wales, 2016. The State of Contaminated Land in Wales. Natural Resources Wales Accessed here: <u>https://naturalresources.wales/evidenceand-data/research-and-reports/state-of-the-</u> environment-reports/the-state-of-contaminated-land-in-wales/?lang=en

⁴³ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Land use and soils. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693310/sonarr2020-theme-land-use-and-soils.pdf</u>
 ⁴⁴ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the

achievement of sustainable management of natural resources. Land use and soils. Natural Resources Wales p. 42 Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693310/sonarr2020-theme-land-use-and-soils.pdf</u>

⁴⁵ Data can be accessed via the Wales Environmental Portal here: <u>https://naturalresources.wales/evidence-and-data/accessing-our-data/beta-environmental-data/?lang=en</u>

⁴⁶ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Land use and soils. Natural Resources Wales p. 11 Accessed here: https://cdn.cyfoethnaturiol.cymru/media/693310/sonarr2020-theme-land-use-and-soils.pdf

⁴⁷ Emmett, B.A. et al. (2019) ERAMMP Report 11: Year 1 Summary. Report to Welsh Government (Contract C210/2016/2017)(CEH NEC06297) Accessed here:

https://erammp.wales/sites/default/files/ERAMMP%20Rpt%2011%20Year-1%20Summary%20v1.1.pdf ⁴⁸ Welsh Government, 2018. Brexit & Our Land: Securing the Future of Welsh Farming. Accessed here: https://gov.wales/sites/default/files/consultations/2018-07/brexit-and-our-land-consultation-document 0.pdf ⁴⁹ Emmett, B.A. et al. (2019) ERAMMP Report 11: Year 1 Summary. Report to Welsh Government (Contract C210/2016/2017)(CEH NEC06297) Accessed here:

https://erammp.wales/sites/default/files/ERAMMP%20Rpt%2011%20Year-1%20Summary%20v1.1.pdf ⁵⁰ United Nations, Department of Economic and Social Affairs, Population Division, 2019. World Population Prospects 2019: Accessed here: https://population.un.org/wpp/

⁵⁰ Office for National Statistics (ONS), 2019. National population projections: 2018- based. Accessed here: <u>https://www.ons.gov.uk/releases/nationalpopulationprojections2018based</u>

⁵⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Land use and soils. Natural Resources Wales p. 49 <u>https://cdn.cyfoethnaturiol.cymru/media/693310/sonarr2020-theme-land-use-and-soils.pdf</u>
 ⁵⁰UKCCC. 2020. UK Committee on Climate Change. Land use: Policies for a Net Zero UK. Available from:

https://www.theccc.org.uk/publication/land-use-policies-for-a-netzero-uk/

⁵⁰ IPBES, 2019: Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. S. Díaz, J.

Settele, E. S. Brondízio, H. T. Ngo, M. Guèze, J. Agard, A. Arneth, P. Balvanera, K. A. Brauman, S. H. M. Butchart, K. M. A. Chan, L. A. Garibaldi, K. Ichii, J. Liu, S. M. Subramanian, G. F. Midgley, P. Miloslavich, Z. Molnár, D. Obura, A. Pfaff, S. Polasky, A. Purvis, J. Razzaque, B. Reyers, R. Roy Chowdhury, Y. J. Shin, I. J. Visseren-Hamakers, K. J. Willis, and C. N. Zayas (eds.). IPBES secretariat, Bonn, Germany Accessed here: https://zenodo.org/record/3553579#.YUse4hmSmUk

⁵⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Air Quality. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693285/sonarr2020-theme-air-quality.pdf</u>

⁵⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Air Quality. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693285/sonarr2020-theme-air-quality.pdf</u>

⁵⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Air Quality. Natural Resources Wales Accessed here: https://cdn.cyfoethnaturiol.cymru/media/693285/sonarr2020-theme-air-quality.pdf
 ⁵⁰ Data can be accessed via the Torfaen Council Research tableau here:

https://public.tableau.com/app/profile/torfaen.council.research/viz/Wellbeinggraphs/ThematicMaps ⁵⁰ Data can be accessed via the Torfaen Council Research tableau here:

https://public.tableau.com/app/profile/torfaen.council.research/viz/Wellbeinggraphs/ThematicMaps

⁵⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Air Quality. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693285/sonarr2020-theme-air-quality.pdf</u>

⁵⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Air Quality. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693285/sonarr2020-theme-air-quality.pdf</u>

⁵⁰ Air Quality Expert Group. 2020. Estimation of changes in air pollution emissions, concentrations and exposure during the COVID-19-19 outbreak in the UK. Rapid Evidence Review for DEFRA, SG, WG & Dept of Agriculture, Environment & Rural Affairs in Northern Ireland. Available from:

https://uk.air.defra.gov.uk/library/reports.php?report_id=1005

⁵⁰ Public Health Wales. 2016a. Estimating the Mortality burden of air pollution in Wales. in National Assembly for Wales. <u>https://senedd.wales/research%20documents/18-009/18-009-web-english.pdf</u>

⁵⁰ Welsh Government Clean Air Advisory Panel, 2020, Impacts of the COVID-19-19 pandemic on air quality in Wales: March to October 2020 Accessed here:

https://airquality.gov.wales/sites/default/files/documents/2021-01/Clean_Air_Advisory_Panel_report-Impacts of the COVID-19-19 pandemic on air quality in Wales English.pdf

⁵⁰ Wales Centre for Public Policy: Briefing on well-being and the impact of COVID-19-19 and Brexit June 2021 (unpublished)

⁵⁰ Natural Resources Wales. 2020. State of Natural Resources Report (SoNaRR): Assessment of the Achievement of SMNR Aim 3: Wales has Healthy Places for People, Protected from Environmental Risks. Natural Resources Wales p. 16 Accessed here:

https://cdn.cyfoethnaturiol.cymru/media/693612/165960736 8330461 1785381.pdf

⁵⁰ Natural Resources Wales. 2020. State of Natural Resources Report (SoNaRR): Assessment of the Achievement of SMNR Aim 3: Wales has Healthy Places for People, Protected from Environmental Risks. Natural Resources Wales p. 16 Accessed here:

https://cdn.cyfoethnaturiol.cymru/media/693612/165960736 8330461 1785381.pdf

⁵⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Air Quality. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693285/sonarr2020-theme-air-quality.pdf</u>

⁵⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Air Quality. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693285/sonarr2020-theme-air-quality.pdf</u>

⁵⁰Third Climate Change Risk Assessment Technical Report: Summary for Wales (Dr. Alan Netherwood, 2021) <u>https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-</u> <u>Final.pdf</u>

⁵⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Woodlands. Natural Resources Wales. Accessed here: https://cdn.cyfoethnaturiol.cymru/media/693279/sonarr2020-ecosystem-woodlands.pdf

⁵⁰ Data can be accessed via the Wales Environmental Portal, <u>https://naturalresources.wales/evidence-and-data/accessing-our-data/beta-environmental-data/?lang=en</u>

⁵⁰ The maps are downloadable from the Welsh Government <u>Lle Data Portal</u> NRW has produced a handbook on the use of the Habitat Network Maps (Latham J and Rothwell J. 2019. A handbook on habitat networks. Practical application for improving connectivity and building ecosystem resilience. NRW Evidence Report No. 275. NRW. Bangor).

⁵⁰ Wales Environment Information Portal Accessed here: <u>https://smnr-</u>

nrw.hub.arcgis.com/apps/036c04ccb85948d2abe7312de75ad318/explore

⁵⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Woodlands. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693279/sonarr2020-ecosystem-woodlands.pdf</u>

⁵⁰ South East Area Statement Landscape profiles unpublished, available from NRW on request.

⁵⁰ Jones S M, Karran A, Bosanquet S, Barter G, Garrett H and Hancocks E. 2021. Greater Gwent State of Nature. Produced by the Resilient Greater Gwent Partnership. Accessed here: <u>https://www.blaenau-</u>gwent.gov.uk/en/resident/countryside/resilient-greater-gwent/

⁵⁰ The maps are downloadable from the Welsh Government <u>Lle Data Portal</u> NRW has produced a handbook on the use of the Habitat Network Maps (Latham J and Rothwell J. 2019. A handbook on habitat networks. Practical application for improving connectivity and building ecosystem resilience. NRW Evidence Report No. 275. NRW. Bangor).

⁵⁰ South East Area Statement Landscape profiles unpublished, available from NRW on request.

⁵⁰ Baseline data can be accessed via the NRW website here: <u>https://naturalresources.wales/evidence-and-data/research-and-reports/protected-sites-baseline-assessment-2020/?lang=en</u>

⁵⁰ Jones S M, Karran A, Bosanquet S, Barter G, Garrett H and Hancocks E. 2021. Greater Gwent State of Nature. Produced by the Resilient Greater Gwent Partnership. Accessed here: <u>https://www.blaenau-</u>gwent.gov.uk/en/resident/countryside/resilient-greater-gwent/

⁵⁰ Data on INNS can be accessed via the Wales Environment Portal here: <u>https://smnr-nrw.hub.arcgis.com/apps/3ad6560d23d243c29f4fabd99a42eaa9/explore</u>

⁵⁰ South East Area Statement Landscape profiles unpublished, available from NRW on request.

⁵⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the

achievement of sustainable management of natural resources. Woodlands. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693279/sonarr2020-ecosystem-woodlands.pdf</u>

⁵⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Woodlands. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693279/sonarr2020-ecosystem-woodlands.pdf</u>

⁵⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Woodlands. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693279/sonarr2020-ecosystem-woodlands.pdf</u>
 ⁵⁰ CCRA-Evidence-Report-Wales-Summary-Final.pdf (ukclimaterisk.org)

⁵⁰ Forest Research. 2019c. Public opinion of forestry 2019. Wales. Accessed here:

https://www.forestresearch.gov.uk/tools-and-resources/statistics/statistics-by-topic/public-opinion-offorestry/

 ⁵⁰ Woodland Trust. 2017. A Space for people - Targeting action for woodland access. Accessed here: <u>https://www.woodlandtrust.org.uk/publications/2017/06/space-for-people-woodland-access</u>
 ⁵⁰Third Climate Change Risk Assessment Technical Report: Summary for Wales (Dr. Alan Netherwood, 2021) <u>https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-Final.pdf</u>

⁵⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Semi-natural Grasslands. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693298/sonarr2020-ecosystem-semi-natural-grasslands.pdf</u>

⁵⁰ Data can be accessed via the Wales Environment Portal:

https://app.powerbi.com/view?r=eyJrIjoiZmUyYzI1YTItZThkNy00MDJjLWEyZmEtYmY4NDFmOTE3YzU4IiwidCl6 Ijg4NjVlZjBmLWFjZGUtNDg3Yy1iZjE3LTVjYjUwMzc1ZDc1NyIsImMiOjh9&pageName=ReportSection1fb964ee46 46f4cbcb4e

⁵⁰ South East Area Statement Landscape profiles unpublished, available from NRW on request.

⁵⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Semi-natural Grasslands. Natural Resources

Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693298/sonarr2020-ecosystem-semi-natural-grasslands.pdf</u>

⁵⁰ Jones S M, Karran A, Bosanquet S, Barter G, Garrett H and Hancocks E. 2021. Greater Gwent State of Nature. Produced by the Resilient Greater Gwent Partnership. Accessed here: <u>https://www.blaenau-</u> gwent.gov.uk/en/resident/countryside/resilient-greater-gwent/

⁵⁰ The maps are downloadable from the Welsh Government <u>Lle Data Portal</u> NRW has produced a handbook on the use of the Habitat Network Maps (Latham J and Rothwell J. 2019. *A handbook on habitat networks. Practical application for improving connectivity and building ecosystem resilience*. NRW Evidence Report No. 275. NRW. Bangor).

⁵⁰ South East Area Statement Landscape profiles unpublished, available from NRW on request.

⁵⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Semi-natural Grasslands. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693298/sonarr2020-ecosystem-semi-natural-grasslands.pdf</u>

⁵⁰ Baseline data can be accessed via the NRW website here: <u>https://naturalresources.wales/evidence-and-data/research-and-reports/protected-sites-baseline-assessment-2020/?lang=en</u>

⁵⁰ Government Office for Science (GO-Science) Trend Deck, N14 Accessed here:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/994400/ GO-Science Trend Deck - Natural Resources section - Spring 2021.pdf

⁵⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Semi-natural Grasslands. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693298/sonarr2020-ecosystem-semi-natural-grasslands.pdf</u>

⁵⁰ Stevens CJ, Dise NB, Mountford JO, Gowing DJ. 2004. Impact of nitrogen deposition on the species richness of grasslands. Science 303, 1876-1879., Stevens CJ, Duprè C, Dorland E, Gaunik C, Gowing DJG, Bleeker A, Diiekmann M, Alard D, Bobbink R, Fowler D, Corcket E, Mountford JO, Vandvik V, Aarrestad PA, Muller S, Dise NB. 2010b. Nitrogen deposition threatens species richness of grasslands across Europe. Environmental Pollution 158, 2940-2945., Van den Berg LJL, Vergeer P, Rich TCG, Smart SM, Guest D, Ashmore MR. 2011. Direct and indirect effects of nitrogen deposition on species composition change in calcareous grassland. Global Change Biology 17, 1871-1883

⁵⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Semi-natural Grasslands. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693298/sonarr2020-ecosystem-semi-natural-grasslands.pdf</u>

⁵⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Semi-natural Grasslands. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693298/sonarr2020-ecosystem-semi-natural-grasslands.pdf</u>

⁵⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Semi-natural Grasslands. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693298/sonarr2020-ecosystem-semi-natural-grasslands.pdf</u>

⁵⁰ Data on INNS can be accessed via the Wales Environment Portal here: <u>https://smnr-nrw.hub.arcgis.com/apps/3ad6560d23d243c29f4fabd99a42eaa9/explore</u>

⁵⁰ Stroh PA, Walker KJ, Smith SLN, Jefferson RG, Pinches C, Blackstock TH. 2019. Grassland plants of the British and Irish lowlands: ecology, threats and management. Botanical Society of Britain and Ireland, Hertfordshire. ⁵⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Semi-natural Grasslands. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693298/sonarr2020-ecosystem-semi-naturalgrasslands.pdf</u>

⁵⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Semi-natural Grasslands. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693298/sonarr2020-ecosystem-semi-natural-grasslands.pdf</u>

⁵⁰ Welsh Government. 2017b. The Environmental Impact Assessment (Agriculture) (Wales) Regulations 2017. ⁵⁰ UKCCC. 2020. UK Committee on Climate Change. Land use: Policies for a Net Zero UK. Available from: <u>https://www.theccc.org.uk/publication/land-use-policies-for-a-netzero-uk/</u>

⁵⁰ UKCCC. 2020. UK Committee on Climate Change. Land use: Policies for a Net Zero UK. Available from: <u>https://www.theccc.org.uk/publication/land-use-policies-for-a-netzero-uk/</u>

⁵⁰Third Climate Change Risk Assessment Technical Report: Summary for Wales (Dr. Alan Netherwood, 2021) <u>https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-</u> Final.pdf

⁵⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Mountains, moorlands and heaths. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693306/sonarr2020-ecosystem-mountains-moorlands-and-heaths.pdf</u>

⁵⁰ Data can be accessed via the Wales Environmental Portal, <u>https://naturalresources.wales/evidence-and-data/accessing-our-data/beta-environmental-data/?lang=en</u>

⁵⁰ Jones S M, Karran A, Bosanquet S, Barter G, Garrett H and Hancocks E. 2021. Greater Gwent State of Nature. Produced by the Resilient Greater Gwent Partnership Accessed here: <u>https://www.blaenau-gwent.gov.uk/fileadmin/documents/Resident/Countryside/Nature Report files/GGSoN 1 Introduction Eco</u>systems Data.pdf

⁵⁰ The maps are downloadable from the Welsh Government <u>Lle Data Portal</u> NRW has produced a handbook on the use of the Habitat Network Maps (Latham J and Rothwell J. 2019. A handbook on habitat networks. Practical application for improving connectivity and building ecosystem resilience. NRW Evidence Report No. 275. NRW. Bangor).

⁵⁰ Baseline data can be accessed via the NRW website here: <u>https://naturalresources.wales/evidence-and-data/research-and-reports/protected-sites-baseline-assessment-2020/?lang=en</u>

⁵⁰ Jones S M, Karran A, Bosanquet S, Barter G, Garrett H and Hancocks E. 2021. Greater Gwent State of Nature. Produced by the Resilient Greater Gwent Partnership. Accessed here: <u>https://www.blaenau-</u> <u>gwent.gov.uk/en/resident/countryside/resilient-greater-gwent/</u>

⁵⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Mountains, moorlands and heaths. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693306/sonarr2020-ecosystem-mountains-moorlands-and-heaths.pdf</u>

⁵⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Mountains, moorlands and heaths. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693306/sonarr2020-ecosystem-mountains-moorlands-and-heaths.pdf</u>

⁵⁰ Third Climate Change Risk Assessment Technical Report: Summary for Wales (Dr. Alan Netherwood, 2021) <u>https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-Final.pdf</u>

⁵⁰Third Climate Change Risk Assessment Technical Report: Summary for Wales (Dr. Alan Netherwood, 2021) <u>https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-</u> Final.pdf

⁵⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Freshwater. Natural Resources Wales. <u>https://cdn.cyfoethnaturiol.cymru/media/693312/sonarr2020-ecosystem-freshwater.pdf</u>

⁵⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Freshwater. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693312/sonarr2020-ecosystem-freshwater.pdf</u>

⁵⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Freshwater. Natural Resources Wales. <u>https://cdn.cyfoethnaturiol.cymru/media/693312/sonarr2020-ecosystem-freshwater.pdf</u>

⁵⁰ Natural Resources Wales (2020) A Plan of Action for Salmon and Sea Trout in Wales – Tackling the Salmonid Emergency. Natural Resources Wales, Bangor Accessed here: <u>https://naturalresources.wales/about-us/strategies-and-plans/salmon-and-sea-trout-plan-of-action-2020/salmon-and-sea-trout-plan-of-action-for-wales-2020-overview/?lang=en</u>

⁵⁰ Jones S M, Karran A, Bosanquet S, Barter G, Garrett H and Hancocks E. 2021. Greater Gwent State of Nature. Produced by the Resilient Greater Gwent Partnership Accessed here: <u>https://www.blaenau-</u>

gwent.gov.uk/fileadmin/documents/Resident/Countryside/Nature_Report_files/GGSoN_1_Introduction__Eco systems Data.pdf

⁵⁰ Baseline data can be accessed via the NRW website here: <u>https://naturalresources.wales/evidence-and-data/research-and-reports/protected-sites-baseline-assessment-2020/?lang=en</u>

⁵⁰ Jones S M, Karran A, Bosanquet S, Barter G, Garrett H and Hancocks E. 2021. Greater Gwent State of Nature. Produced by the Resilient Greater Gwent Partnership Accessed here: <u>https://www.blaenau-</u>

gwent.gov.uk/fileadmin/documents/Resident/Countryside/Nature_Report_files/GGSoN_1_Introduction__Eco systems__Data.pdf

⁵⁰ Jones S M, Karran A, Bosanquet S, Barter G, Garrett H and Hancocks E. 2021. Greater Gwent State of Nature. Produced by the Resilient Greater Gwent Partnership Accessed here: <u>https://www.blaenau-</u>

gwent.gov.uk/fileadmin/documents/Resident/Countryside/Nature Report files/GGSoN 1 Introduction Eco systems Data.pdf

⁵⁰ Data can be accessed via the Wales Environmental Portal <u>https://naturalresources.wales/evidence-and-data/accessing-our-data/beta-environmental-data/?lang=en</u>

⁵⁰ Hatton-Ellis TW, Jones TG. 2021. Compliance Assessment of Welsh River SACs against Phosphorus Targets. NRW Evidence Report No: 489, 96pp, Natural Resources Wales, Bangor Accessed here:

https://cdn.cyfoethnaturiol.cymru/media/693025/compliance-assessment-of-welsh-sacs-against-phosphorustargets-final-v10.pdf?mode=pad&rnd=132557227300000000

⁵⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Invasive Non-native Species. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693300/sonarr2020-theme-invasive-non-native-species.pdf</u>

⁵⁰ Data can be accessed via the Wales Environmental Portal, <u>https://naturalresources.wales/evidence-and-data/accessing-our-data/beta-environmental-data/?lang=en</u>

⁵⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Freshwater. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693312/sonarr2020-ecosystem-freshwater.pdf</u>

⁵⁰ Hatton-Ellis TW, Jones TG. 2021. Compliance Assessment of Welsh River SACs against Phosphorus Targets. NRW Evidence Report No: 489, 96pp, Natural Resources Wales, Bangor Accessed here:

https://cdn.cyfoethnaturiol.cymru/media/693025/compliance-assessment-of-welsh-sacs-against-phosphorustargets-final-v10.pdf?mode=pad&rnd=132557227300000000

⁵⁰ Third Climate Change Risk Assessment Technical Report: Summary for Wales (Dr. Alan Netherwood, 2021) <u>https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-Final.pdf</u>

⁵⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Freshwater. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693312/sonarr2020-ecosystem-freshwater.pdf</u>

⁵⁰ Third Climate Change Risk Assessment Technical Report: Summary for Wales (Dr. Alan Netherwood, 2021) <u>https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-</u> Final.pdf

⁵⁰ Data can be accessed via the Wales Environment Portal

https://app.powerbi.com/view?r=eyJrIjoiZmUyYzI1YTItZThkNy00MDJjLWEyZmEtYmY4NDFmOTE3YzU4liwidCl6 Ijg4NjVlZjBmLWFjZGUtNDg3Yy1iZjE3LTVjYjUwMzc1ZDc1NyIsImMiOjh9&pageName=ReportSection1fb964ee46 46f4cbcb4e

⁵⁰ Data can be accessed via the Wales Environmental Portal, <u>https://naturalresources.wales/evidence-and-data/accessing-our-data/beta-environmental-data/?lang=en</u>

⁵⁰ NRW, 2018. Severn Estuary / Môr Hafren Special Area of Conservation: Indicative site level feature condition assessments 2018. NRW Evidence Report Series, Report No: 235, 41pp, NRW, Bangor Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/684391/severn-sac-ica-2018.pdf</u>

⁵⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Coastal Margins. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693314/sonarr2020-ecosystem-coastal-margins.pdf</u>
 ⁵⁰ ASC. 2016. UK Climate Change Risk Assessment 2017 Evidence Report – Summary for Wales. London: Adaptation Sub-Committee of the Committee on Climate Change.

⁵⁰ Ibrahim J. 2020. Public Service Boards in Wales: A review of marine and coastal priorities to improve wellbeing. NRW Evidence Report No. 433

⁵⁰ Jones S M, Karran A, Bosanquet S, Barter G, Garrett H and Hancocks E. 2021. Greater Gwent State of Nature. Produced by the Resilient Greater Gwent Partnership Accessed here: <u>https://www.blaenau-</u>

gwent.gov.uk/fileadmin/documents/Resident/Countryside/Nature Report files/GGSoN 1 Introduction Eco systems Data.pdf ⁵⁰ The term 'indicative condition assessment' describes the use of readily available evidence and expert judgement in an intensive, collective workshop process to provide an indication of feature condition at the site level

⁵⁰ Use of UK Climate Projections 2018 (UKCP18) - Revision 1, November 2020 (onr.org.uk)

⁵⁰ Rowe EC, Mitchell Z, Tomlinson S, Levy P, Banin L F, Sawicka K, Martín Hernandez C, Dore A. 2020. Trends Report 2020: Trends in critical load and critical level exceedances in the UK. Report to Defra under Contract AQ0843, CEH Project NEC05708.

⁵⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Coastal Margins. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693314/sonarr2020-ecosystem-coastal-margins.pdf</u>

⁵⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Coastal Margins. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693314/sonarr2020-ecosystem-coastal-margins.pdf</u>

⁵⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Marine. Natural Resources Wales., <u>https://cdn.cyfoethnaturiol.cymru/media/693277/sonarr2020-ecosystem-marine.pdf</u>

⁵⁰ Data can be accessed via the Wales Environmental Portal, <u>https://naturalresources.wales/evidence-and-data/accessing-our-data/beta-environmental-data/?lang=en</u>

⁵⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Invasive Non-native Species. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693300/sonarr2020-theme-invasive-nonnative-species.pdf</u>

⁵⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Coastal Margins. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693314/sonarr2020-ecosystem-coastal-margins.pdf</u>

 ⁵⁰ Environmental Audit Committee. 2016. Environmental impact of microplastics, HC 179, 2016-17.
 ⁵⁰ Findings from the third UK Climate Change Risk Assessment (CCRA3) Evidence Report 2021 <u>https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA3-Briefing-Marine.pdf</u>

⁵⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Coastal Margins. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693314/sonarr2020-ecosystem-coastal-margins.pdf</u>
 ⁵⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Coastal Margins. Natural Resources Wales

Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693314/sonarr2020-ecosystem-coastal-margins.pdf</u> ⁵⁰ Third Climate Change Risk Assessment Technical Report: Summary for Wales (Dr. Alan Netherwood, 2021) <u>https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-</u> Final.pdf

⁵⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Coastal Margins. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693314/sonarr2020-ecosystem-coastal-margins.pdf</u>
 ⁵⁰ Chmura GL, Anisfeld SC, Cahoon DR, Lynch JC. 2003. Global carbon sequestration in tidal, saline wetland soils Global Biogeochemical Cycles 17 (4).

⁵⁰ Ford H, Garbutt A, Duggan-Edwards M, Pagés JF, Harvey R, Ladd C, Skov MW. 2019. Large-scale predictions of salt-marsh carbon stock based on simple observations of plant community and soil type. Biogeosciences 16 (2), 425–436.

⁵⁰ Armstrong S, Hull S, Pearson Z, Wilson R, Kay S. 2020. Estimating the Carbon Sink Potential of the Welsh Marine Environment. NRW Evidence Report No. 428, Cardiff.

⁵⁰ Third Climate Change Risk Assessment Technical Report: Summary for Wales (Dr. Alan Netherwood, 2021) <u>https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-Final.pdf</u>

⁵⁰ Third Climate Change Risk Assessment Technical Report: Summary for Wales (Dr. Alan Netherwood, 2021) <u>https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-Final.pdf</u>

⁵¹ Office for National Statistics (ONS), 2019. National population projections: 2018- based. Accessed here: <u>https://www.ons.gov.uk/releases/nationalpopulationprojections2018based</u> ⁵¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Land use and soils. Natural Resources Wales p. 49 <u>https://cdn.cyfoethnaturiol.cymru/media/693310/sonarr2020-theme-land-use-and-soils.pdf</u>
 ⁵¹UKCCC. 2020. UK Committee on Climate Change. Land use: Policies for a Net Zero UK. Available from:

https://www.theccc.org.uk/publication/land-use-policies-for-a-netzero-uk/

⁵¹ IPBES, 2019: Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. S. Díaz, J. Settele, E. S. Brondízio, H. T. Ngo, M. Guèze, J. Agard, A. Arneth, P. Balvanera, K. A. Brauman, S. H. M. Butchart, K. M. A. Chan, L. A. Garibaldi, K. Ichii, J. Liu, S. M. Subramanian, G. F. Midgley, P. Miloslavich, Z. Molnár, D. Obura, A. Pfaff, S. Polasky, A. Purvis, J. Razzaque, B. Reyers, R. Roy Chowdhury, Y. J. Shin, I. J. Visseren-Hamakers, K. J. Willis, and C. N. Zayas (eds.). IPBES secretariat, Bonn, Germany Accessed here: https://zenodo.org/record/3553579#.YUse4hmSmUk

⁵¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Air Quality. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693285/sonarr2020-theme-air-quality.pdf</u>

⁵¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Air Quality. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693285/sonarr2020-theme-air-quality.pdf</u>

⁵¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Air Quality. Natural Resources Wales Accessed here: https://cdn.cyfoethnaturiol.cymru/media/693285/sonarr2020-theme-air-quality.pdf

⁵¹ Data can be accessed via the Torfaen Council Research tableau here:

https://public.tableau.com/app/profile/torfaen.council.research/viz/Wellbeinggraphs/ThematicMaps⁵¹ Data can be accessed via the Torfaen Council Research tableau here:

https://public.tableau.com/app/profile/torfaen.council.research/viz/Wellbeinggraphs/ThematicMaps ⁵¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Air Quality, Natural Resources Wales Ace

achievement of sustainable management of natural resources. Air Quality. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693285/sonarr2020-theme-air-quality.pdf</u>

⁵¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Air Quality. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693285/sonarr2020-theme-air-quality.pdf</u>

⁵¹ Air Quality Expert Group. 2020. Estimation of changes in air pollution emissions, concentrations and exposure during the COVID-19-19 outbreak in the UK. Rapid Evidence Review for DEFRA, SG, WG & Dept of Agriculture, Environment & Rural Affairs in Northern Ireland. Available from:

https://uk.air.defra.gov.uk/library/reports.php?report_id=1005

⁵¹ Public Health Wales. 2016a. Estimating the Mortality burden of air pollution in Wales. in National Assembly for Wales. <u>https://senedd.wales/research%20documents/18-009/18-009-web-english.pdf</u>

⁵¹ Welsh Government Clean Air Advisory Panel, 2020, Impacts of the COVID-19-19 pandemic on air quality in Wales: March to October 2020 Accessed here:

https://airquality.gov.wales/sites/default/files/documents/2021-01/Clean_Air_Advisory_Panel_report-Impacts of the COVID-19-19 pandemic on air quality in Wales English.pdf

⁵¹ Wales Centre for Public Policy: Briefing on well-being and the impact of COVID-19-19 and Brexit June 2021 (unpublished)

⁵¹ Natural Resources Wales. 2020. State of Natural Resources Report (SoNaRR): Assessment of the Achievement of SMNR Aim 3: Wales has Healthy Places for People, Protected from Environmental Risks. Natural Resources Wales p. 16 Accessed here:

https://cdn.cyfoethnaturiol.cymru/media/693612/165960736_8330461_1785381.pdf

⁵¹ Natural Resources Wales. 2020. State of Natural Resources Report (SoNaRR): Assessment of the Achievement of SMNR Aim 3: Wales has Healthy Places for People, Protected from Environmental Risks. Natural Resources Wales p. 16 Accessed here:

https://cdn.cyfoethnaturiol.cymru/media/693612/165960736 8330461 1785381.pdf

⁵¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Air Quality. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693285/sonarr2020-theme-air-quality.pdf</u>

⁵¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Air Quality. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693285/sonarr2020-theme-air-quality.pdf</u>

⁵¹Third Climate Change Risk Assessment Technical Report: Summary for Wales (Dr. Alan Netherwood, 2021) <u>https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-Final.pdf</u>

⁵¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Woodlands. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693279/sonarr2020-ecosystem-woodlands.pdf</u>

⁵¹ Data can be accessed via the Wales Environmental Portal, <u>https://naturalresources.wales/evidence-and-data/accessing-our-data/beta-environmental-data/?lang=en</u>

⁵¹ The maps are downloadable from the Welsh Government <u>Lle Data Portal</u> NRW has produced a handbook on the use of the Habitat Network Maps (Latham J and Rothwell J. 2019. A handbook on habitat networks. Practical application for improving connectivity and building ecosystem resilience. NRW Evidence Report No. 275. NRW. Bangor).

⁵¹ Wales Environment Information Portal Accessed here: <u>https://smnr-</u>

nrw.hub.arcgis.com/apps/036c04ccb85948d2abe7312de75ad318/explore

⁵¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Woodlands. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693279/sonarr2020-ecosystem-woodlands.pdf</u>

⁵¹ South East Area Statement Landscape profiles unpublished, available from NRW on request.

⁵¹ Jones S M, Karran A, Bosanquet S, Barter G, Garrett H and Hancocks E. 2021. Greater Gwent State of Nature. Produced by the Resilient Greater Gwent Partnership. Accessed here: <u>https://www.blaenau-gwent.gov.uk/en/resident/countryside/resilient-greater-gwent/</u>

⁵¹ The maps are downloadable from the Welsh Government <u>Lle Data Portal</u> NRW has produced a handbook on the use of the Habitat Network Maps (Latham J and Rothwell J. 2019. A handbook on habitat networks. Practical application for improving connectivity and building ecosystem resilience. NRW Evidence Report No. 275. NRW. Bangor).

⁵¹ South East Area Statement Landscape profiles unpublished, available from NRW on request.

⁵¹ Baseline data can be accessed via the NRW website here: <u>https://naturalresources.wales/evidence-and-data/research-and-reports/protected-sites-baseline-assessment-2020/?lang=en</u>

⁵¹ Jones S M, Karran A, Bosanquet S, Barter G, Garrett H and Hancocks E. 2021. Greater Gwent State of Nature. Produced by the Resilient Greater Gwent Partnership. Accessed here: <u>https://www.blaenau-gwent.gov.uk/en/resident/countryside/resilient-greater-gwent/</u>

⁵¹ Data on INNS can be accessed via the Wales Environment Portal here: <u>https://smnr-</u>nrw.hub.arcgis.com/apps/3ad6560d23d243c29f4fabd99a42eaa9/explore

⁵¹ South East Area Statement Landscape profiles unpublished, available from NRW on request.

⁵¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the

achievement of sustainable management of natural resources. Woodlands. Natural Resources Wales. Accessed here: https://cdn.cyfoethnaturiol.cymru/media/693279/sonarr2020-ecosystem-woodlands.pdf

⁵¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Woodlands. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693279/sonarr2020-ecosystem-woodlands.pdf</u>

⁵¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Woodlands. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693279/sonarr2020-ecosystem-woodlands.pdf</u>

⁵¹ CCRA-Evidence-Report-Wales-Summary-Final.pdf (ukclimaterisk.org)

⁵¹ Forest Research. 2019c. Public opinion of forestry 2019. Wales. Accessed here:

https://www.forestresearch.gov.uk/tools-and-resources/statistics/statistics-by-topic/public-opinion-offorestry/

⁵¹ Woodland Trust. 2017. A Space for people - Targeting action for woodland access. Accessed here: <u>https://www.woodlandtrust.org.uk/publications/2017/06/space-for-people-woodland-access</u>

⁵¹Third Climate Change Risk Assessment Technical Report: Summary for Wales (Dr. Alan Netherwood, 2021) <u>https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-Final.pdf</u>

⁵¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Semi-natural Grasslands. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693298/sonarr2020-ecosystem-semi-natural-grasslands.pdf</u>

⁵¹ Data can be accessed via the Wales Environment Portal:

https://app.powerbi.com/view?r=eyJrIjoiZmUyYzI1YTItZThkNy00MDJjLWEyZmEtYmY4NDFmOTE3YzU4IiwidCl6 Jjg4NjVlZjBmLWFjZGUtNDg3Yy1iZjE3LTVjYjUwMzc1ZDc1NyIsImMiOjh9&pageName=ReportSection1fb964ee46 46f4cbcb4e

⁵¹ South East Area Statement Landscape profiles unpublished, available from NRW on request.

⁵¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Semi-natural Grasslands. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693298/sonarr2020-ecosystem-semi-natural-grasslands.pdf</u>

⁵¹ Jones S M, Karran A, Bosanquet S, Barter G, Garrett H and Hancocks E. 2021. Greater Gwent State of Nature. Produced by the Resilient Greater Gwent Partnership. Accessed here: <u>https://www.blaenau-gwent.gov.uk/en/resident/countryside/resilient-greater-gwent/</u>

⁵¹ The maps are downloadable from the Welsh Government <u>Lie Data Portal</u> NRW has produced a handbook on the use of the Habitat Network Maps (Latham J and Rothwell J. 2019. A handbook on habitat networks. Practical application for improving connectivity and building ecosystem resilience. NRW Evidence Report No. 275. NRW. Bangor).

⁵¹ South East Area Statement Landscape profiles unpublished, available from NRW on request.

⁵¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Semi-natural Grasslands. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693298/sonarr2020-ecosystem-semi-natural-grasslands.pdf</u>

⁵¹ Baseline data can be accessed via the NRW website here: <u>https://naturalresources.wales/evidence-and-data/research-and-reports/protected-sites-baseline-assessment-2020/?lang=en</u>

⁵¹ Government Office for Science (GO-Science) Trend Deck, N14 Accessed here:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/994400/ GO-Science_Trend_Deck_-_Natural_Resources_section_-_Spring_2021.pdf

⁵¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Semi-natural Grasslands. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693298/sonarr2020-ecosystem-semi-natural-grasslands.pdf</u>

⁵¹ Stevens CJ, Dise NB, Mountford JO, Gowing DJ. 2004. Impact of nitrogen deposition on the species richness of grasslands. Science 303, 1876-1879., Stevens CJ, Duprè C, Dorland E, Gaunik C, Gowing DJG, Bleeker A, Diiekmann M, Alard D, Bobbink R, Fowler D, Corcket E, Mountford JO, Vandvik V, Aarrestad PA, Muller S, Dise NB. 2010b. Nitrogen deposition threatens species richness of grasslands across Europe. Environmental Pollution 158, 2940-2945., Van den Berg LJL, Vergeer P, Rich TCG, Smart SM, Guest D, Ashmore MR. 2011. Direct and indirect effects of nitrogen deposition on species composition change in calcareous grassland. Global Change Biology 17, 1871-1883

⁵¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Semi-natural Grasslands. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693298/sonarr2020-ecosystem-semi-natural-grasslands.pdf</u>

⁵¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Semi-natural Grasslands. Natural Resources Wales. Accessed here: https://cdn.cyfoethnaturiol.cymru/media/693298/sonarr2020-ecosystem-semi-natural-grasslands.pdf

⁵¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Semi-natural Grasslands. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693298/sonarr2020-ecosystem-semi-natural-grasslands.pdf</u>

⁵¹ Data on INNS can be accessed via the Wales Environment Portal here: <u>https://smnr-nrw.hub.arcgis.com/apps/3ad6560d23d243c29f4fabd99a42eaa9/explore</u>

⁵¹ Stroh PA, Walker KJ, Smith SLN, Jefferson RG, Pinches C, Blackstock TH. 2019. Grassland plants of the British and Irish lowlands: ecology, threats and management. Botanical Society of Britain and Ireland, Hertfordshire.
 ⁵¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Semi-natural Grasslands. Natural Resources

Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693298/sonarr2020-ecosystem-semi-natural-grasslands.pdf</u>

⁵¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Semi-natural Grasslands. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693298/sonarr2020-ecosystem-semi-natural-grasslands.pdf</u>

⁵¹ Welsh Government. 2017b. The Environmental Impact Assessment (Agriculture) (Wales) Regulations 2017. ⁵¹ UKCCC. 2020. UK Committee on Climate Change. Land use: Policies for a Net Zero UK. Available from: https://www.theccc.org.uk/publication/land-use-policies-for-a-netzero-uk/

⁵¹ UKCCC. 2020. UK Committee on Climate Change. Land use: Policies for a Net Zero UK. Available from: <u>https://www.theccc.org.uk/publication/land-use-policies-for-a-netzero-uk/</u>

⁵¹Third Climate Change Risk Assessment Technical Report: Summary for Wales (Dr. Alan Netherwood, 2021) <u>https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-Final.pdf</u>

⁵¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Mountains, moorlands and heaths. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693306/sonarr2020-ecosystem-mountains-moorlands-and-heaths.pdf</u>

⁵¹ Data can be accessed via the Wales Environmental Portal, <u>https://naturalresources.wales/evidence-and-data/accessing-our-data/beta-environmental-data/?lang=en</u>

⁵¹ Jones S M, Karran A, Bosanquet S, Barter G, Garrett H and Hancocks E. 2021. Greater Gwent State of Nature. Produced by the Resilient Greater Gwent Partnership Accessed here: <u>https://www.blaenau-</u>

gwent.gov.uk/fileadmin/documents/Resident/Countryside/Nature_Report_files/GGSoN_1_Introduction_Eco systems_____Data.pdf

⁵¹ The maps are downloadable from the Welsh Government <u>Lle Data Portal</u> NRW has produced a handbook on the use of the Habitat Network Maps (Latham J and Rothwell J. 2019. A handbook on habitat networks. Practical application for improving connectivity and building ecosystem resilience. NRW Evidence Report No. 275. NRW. Bangor).

⁵¹ Baseline data can be accessed via the NRW website here: <u>https://naturalresources.wales/evidence-and-data/research-and-reports/protected-sites-baseline-assessment-2020/?lang=en</u>

⁵¹ Jones S M, Karran A, Bosanquet S, Barter G, Garrett H and Hancocks E. 2021. Greater Gwent State of Nature. Produced by the Resilient Greater Gwent Partnership. Accessed here: <u>https://www.blaenau-gwent.gov.uk/en/resident/countryside/resilient-greater-gwent/</u>

⁵¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Mountains, moorlands and heaths. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693306/sonarr2020-ecosystem-mountains-moorlands-and-heaths.pdf</u>

⁵¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Mountains, moorlands and heaths. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693306/sonarr2020-ecosystem-mountains-moorlands-and-heaths.pdf</u>

⁵¹ Third Climate Change Risk Assessment Technical Report: Summary for Wales (Dr. Alan Netherwood, 2021) <u>https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-Final.pdf</u>

⁵¹Third Climate Change Risk Assessment Technical Report: Summary for Wales (Dr. Alan Netherwood, 2021) <u>https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-Final.pdf</u>

⁵¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Freshwater. Natural Resources Wales. <u>https://cdn.cyfoethnaturiol.cymru/media/693312/sonarr2020-ecosystem-freshwater.pdf</u>

⁵¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Freshwater. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693312/sonarr2020-ecosystem-freshwater.pdf</u>

⁵¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Freshwater. Natural Resources Wales. <u>https://cdn.cyfoethnaturiol.cymru/media/693312/sonarr2020-ecosystem-freshwater.pdf</u>

⁵¹ Natural Resources Wales (2020) A Plan of Action for Salmon and Sea Trout in Wales – Tackling the Salmonid Emergency. Natural Resources Wales, Bangor Accessed here: <u>https://naturalresources.wales/about-</u>

us/strategies-and-plans/salmon-and-sea-trout-plan-of-action-2020/salmon-and-sea-trout-plan-of-action-forwales-2020-overview/?lang=en

⁵¹ Jones S M, Karran A, Bosanquet S, Barter G, Garrett H and Hancocks E. 2021. Greater Gwent State of Nature. Produced by the Resilient Greater Gwent Partnership Accessed here: <u>https://www.blaenau-</u>

gwent.gov.uk/fileadmin/documents/Resident/Countryside/Nature Report files/GGSoN 1 Introduction Eco systems Data.pdf

⁵¹ Baseline data can be accessed via the NRW website here: <u>https://naturalresources.wales/evidence-and-data/research-and-reports/protected-sites-baseline-assessment-2020/?lang=en</u>

⁵¹ Jones S M, Karran A, Bosanquet S, Barter G, Garrett H and Hancocks E. 2021. Greater Gwent State of Nature. Produced by the Resilient Greater Gwent Partnership Accessed here: <u>https://www.blaenau-</u>

gwent.gov.uk/fileadmin/documents/Resident/Countryside/Nature Report files/GGSoN 1 Introduction Eco systems Data.pdf

⁵¹ Jones S M, Karran A, Bosanquet S, Barter G, Garrett H and Hancocks E. 2021. Greater Gwent State of Nature. Produced by the Resilient Greater Gwent Partnership Accessed here: <u>https://www.blaenau-</u>

gwent.gov.uk/fileadmin/documents/Resident/Countryside/Nature_Report_files/GGSoN_1_Introduction_Eco systems____Data.pdf

⁵¹ Data can be accessed via the Wales Environmental Portal <u>https://naturalresources.wales/evidence-and-data/accessing-our-data/beta-environmental-data/?lang=en</u>

⁵¹ Hatton-Ellis TW, Jones TG. 2021. Compliance Assessment of Welsh River SACs against Phosphorus Targets. NRW Evidence Report No: 489, 96pp, Natural Resources Wales, Bangor Accessed here:

https://cdn.cyfoethnaturiol.cymru/media/693025/compliance-assessment-of-welsh-sacs-against-phosphorustargets-final-v10.pdf?mode=pad&rnd=132557227300000000

⁵¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Invasive Non-native Species. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693300/sonarr2020-theme-invasive-non-native-species.pdf</u>

⁵¹ Data can be accessed via the Wales Environmental Portal, <u>https://naturalresources.wales/evidence-and-data/accessing-our-data/beta-environmental-data/?lang=en</u>

⁵¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Freshwater. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693312/sonarr2020-ecosystem-freshwater.pdf</u>

⁵¹ Hatton-Ellis TW, Jones TG. 2021. Compliance Assessment of Welsh River SACs against Phosphorus Targets. NRW Evidence Report No: 489, 96pp, Natural Resources Wales, Bangor Accessed here:

https://cdn.cyfoethnaturiol.cymru/media/693025/compliance-assessment-of-welsh-sacs-against-phosphorustargets-final-v10.pdf?mode=pad&rnd=132557227300000000

⁵¹ Third Climate Change Risk Assessment Technical Report: Summary for Wales (Dr. Alan Netherwood, 2021) <u>https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-Final.pdf</u>

⁵¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Freshwater. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693312/sonarr2020-ecosystem-freshwater.pdf</u>

⁵¹ Third Climate Change Risk Assessment Technical Report: Summary for Wales (Dr. Alan Netherwood, 2021) <u>https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-Final.pdf</u>

⁵¹ Data can be accessed via the Wales Environment Portal

https://app.powerbi.com/view?r=eyJrIjoiZmUyYzI1YTItZThkNy00MDJjLWEyZmEtYmY4NDFmOTE3YzU4liwidCl6 Ijg4NjVlZjBmLWFjZGUtNDg3Yy1iZjE3LTVjYjUwMzc1ZDc1NyIsImMiOjh9&pageName=ReportSection1fb964ee46 46f4cbcb4e

⁵¹ Data can be accessed via the Wales Environmental Portal, <u>https://naturalresources.wales/evidence-and-data/accessing-our-data/beta-environmental-data/?lang=en</u>

⁵¹ NRW, 2018. Severn Estuary / Môr Hafren Special Area of Conservation: Indicative site level feature condition assessments 2018. NRW Evidence Report Series, Report No: 235, 41pp, NRW, Bangor Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/684391/severn-sac-ica-2018.pdf</u>

⁵¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Coastal Margins. Natural Resources Wales Accessed here: https://cdn.cyfoethnaturiol.cymru/media/693314/sonarr2020-ecosystem-coastal-margins.pdf

⁵¹ ASC. 2016. UK Climate Change Risk Assessment 2017 Evidence Report – Summary for Wales. London: Adaptation Sub-Committee of the Committee on Climate Change.

⁵¹ Ibrahim J. 2020. Public Service Boards in Wales: A review of marine and coastal priorities to improve wellbeing. NRW Evidence Report No. 433

⁵¹ Jones S M, Karran A, Bosanquet S, Barter G, Garrett H and Hancocks E. 2021. Greater Gwent State of Nature. Produced by the Resilient Greater Gwent Partnership Accessed here: <u>https://www.blaenau-</u>

gwent.gov.uk/fileadmin/documents/Resident/Countryside/Nature Report files/GGSoN 1 Introduction Eco systems Data.pdf

⁵¹ The term 'indicative condition assessment' describes the use of readily available evidence and expert judgement in an intensive, collective workshop process to provide an indication of feature condition at the site level

⁵¹ Use of UK Climate Projections 2018 (UKCP18) - Revision 1, November 2020 (onr.org.uk)

⁵¹ Rowe EC, Mitchell Z, Tomlinson S, Levy P, Banin L F, Sawicka K, Martín Hernandez C, Dore A. 2020. Trends Report 2020: Trends in critical load and critical level exceedances in the UK. Report to Defra under Contract AQ0843, CEH Project NEC05708.

⁵¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Coastal Margins. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693314/sonarr2020-ecosystem-coastal-margins.pdf</u> ⁵¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the

achievement of sustainable management of natural resources. Coastal Margins. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693314/sonarr2020-ecosystem-coastal-margins.pdf</u>

⁵¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Marine. Natural Resources Wales., <u>https://cdn.cyfoethnaturiol.cymru/media/693277/sonarr2020-ecosystem-marine.pdf</u>

⁵¹ Data can be accessed via the Wales Environmental Portal, <u>https://naturalresources.wales/evidence-and-data/accessing-our-data/beta-environmental-data/?lang=en</u>

⁵¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Invasive Non-native Species. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693300/sonarr2020-theme-invasive-non-native-species.pdf</u>

⁵¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Coastal Margins. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693314/sonarr2020-ecosystem-coastal-margins.pdf</u>

⁵¹ Environmental Audit Committee. 2016. Environmental impact of microplastics, HC 179, 2016-17.
 ⁵¹ Findings from the third UK Climate Change Risk Assessment (CCRA3) Evidence Report 2021

https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA3-Briefing-Marine.pdf

⁵¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Coastal Margins. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693314/sonarr2020-ecosystem-coastal-margins.pdf</u>

⁵¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Coastal Margins. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693314/sonarr2020-ecosystem-coastal-margins.pdf</u>
 ⁵¹ Third Climate Change Risk Assessment Technical Report: Summary for Wales (Dr. Alan Netherwood, 2021)

https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-Final.pdf

⁵¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Coastal Margins. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693314/sonarr2020-ecosystem-coastal-margins.pdf</u>
 ⁵¹ Chmura GL, Anisfeld SC, Cahoon DR, Lynch JC. 2003. Global carbon sequestration in tidal, saline wetland soils Global Biogeochemical Cycles 17 (4).

⁵¹ Ford H, Garbutt A, Duggan-Edwards M, Pagés JF, Harvey R, Ladd C, Skov MW. 2019. Large-scale predictions of salt-marsh carbon stock based on simple observations of plant community and soil type. Biogeosciences 16 (2), 425–436.

⁵¹ Armstrong S, Hull S, Pearson Z, Wilson R, Kay S. 2020. Estimating the Carbon Sink Potential of the Welsh Marine Environment. NRW Evidence Report No. 428, Cardiff.

⁵¹ Third Climate Change Risk Assessment Technical Report: Summary for Wales (Dr. Alan Netherwood, 2021) <u>https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-Final.pdf</u>

⁵¹ Third Climate Change Risk Assessment Technical Report: Summary for Wales (Dr. Alan Netherwood, 2021) https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-Final.pdf

⁵² Office for National Statistics (ONS), 2019. National population projections: 2018- based. Accessed here: <u>https://www.ons.gov.uk/releases/nationalpopulationprojections2018based</u>

⁵³ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Land use and soils. Natural Resources Wales p. 49 <u>https://cdn.cyfoethnaturiol.cymru/media/693310/sonarr2020-theme-land-use-and-soils.pdf</u>
 ⁵⁴UKCCC. 2020. UK Committee on Climate Change. Land use: Policies for a Net Zero UK. Available from:

https://www.theccc.org.uk/publication/land-use-policies-for-a-netzero-uk/

⁵⁵ IPBES, 2019: Summary for policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. S. Díaz, J. Settele, E. S. Brondízio, H. T. Ngo, M. Guèze, J. Agard, A. Arneth, P. Balvanera, K. A. Brauman, S. H. M. Butchart, K. M. A. Chan, L. A. Garibaldi, K. Ichii, J. Liu, S. M. Subramanian, G. F. Midgley, P. Miloslavich, Z. Molnár, D. Obura, A. Pfaff, S. Polasky, A. Purvis, J. Razzaque, B. Reyers, R. Roy Chowdhury, Y. J. Shin, I. J. Visseren-Hamakers, K. J. Willis, and C. N. Zayas (eds.). IPBES secretariat, Bonn, Germany Accessed here: https://zenodo.org/record/3553579#.YUse4hmSmUk

⁵⁶ Welsh Government, 2021, Future Trends Report 2021 Evidence Pack Accessed here: <u>https://gov.wales/sites/default/files/publications/2021-12/future-trends-report-wales-2021-evidence-pack.pdf</u>

⁵⁷ Gwent Well-being Assessment Engagement Group, 2021, outputs from Well-being Assessment engagement survey, full result available on request

⁵⁸ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Air Quality. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693285/sonarr2020-theme-air-quality.pdf</u>

⁵⁹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Air Quality. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693285/sonarr2020-theme-air-quality.pdf</u>

⁶⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Air Quality. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693285/sonarr2020-theme-air-quality.pdf</u>

⁶¹ Data can be accessed via the Torfaen Council Research tableau here:

https://public.tableau.com/app/profile/torfaen.council.research/viz/Wellbeinggraphs/ThematicMaps ⁶² Data can be accessed via the Torfaen Council Research tableau here:

https://public.tableau.com/app/profile/torfaen.council.research/viz/Wellbeinggraphs/ThematicMaps ⁶³ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the

achievement of sustainable management of natural resources. Air Quality. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693285/sonarr2020-theme-air-quality.pdf</u>

⁶⁴ Data can be accessed via the Torfaen Council Research tableau here:

https://public.tableau.com/app/profile/torfaen.council.research/viz/Wellbeinggraphs/ThematicMaps ⁶⁵ Data can be accessed via the Torfaen Council Research tableau here:

https://public.tableau.com/app/profile/torfaen.council.research/viz/Wellbeinggraphs/ThematicMaps ⁶⁶ Data can be accessed via the Torfaen Council Research tableau here:

https://public.tableau.com/app/profile/torfaen.council.research/viz/Wellbeinggraphs/ThematicMaps⁶⁷ Data can be accessed via the Torfaen Council Research tableau here:

https://public.tableau.com/app/profile/torfaen.council.research/viz/Wellbeinggraphs/ThematicMaps

⁶⁸ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Air Quality. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693285/sonarr2020-theme-air-quality.pdf</u>

⁶⁹ Air Quality Expert Group. 2020. Estimation of changes in air pollution emissions, concentrations and exposure during the COVID-19-19 outbreak in the UK. Rapid Evidence Review for DEFRA, SG, WG & Dept of Agriculture, Environment & Rural Affairs in Northern Ireland. Available from: https://uk.air.defra.gov.uk/library/reports.php?report_id=1005 ⁷⁰ Public Health Wales. 2016a. Estimating the Mortality burden of air pollution in Wales. in National Assembly for Wales. <u>https://senedd.wales/research%20documents/18-009/18-009-web-english.pdf</u>

⁷¹ Welsh Government Clean Air Advisory Panel, 2020, Impacts of the COVID-19-19 pandemic on air quality in Wales: March to October 2020 Accessed here:

https://airquality.gov.wales/sites/default/files/documents/2021-01/Clean Air Advisory Panel report-Impacts of the COVID-19-19 pandemic on air quality in Wales English.pdf

⁷² Wales Centre for Public Policy: Briefing on well-being and the impact of COVID-19-19 and Brexit June 2021 (unpublished)

⁷³ Natural Resources Wales. 2020. State of Natural Resources Report (SoNaRR): Assessment of the Achievement of SMNR Aim 3: Wales has Healthy Places for People, Protected from Environmental Risks. Natural Resources Wales p. 16 Accessed here:

https://cdn.cyfoethnaturiol.cymru/media/693612/165960736_8330461_1785381.pdf

⁷⁴ Natural Resources Wales. 2020. State of Natural Resources Report (SoNaRR): Assessment of the Achievement of SMNR Aim 3: Wales has Healthy Places for People, Protected from Environmental Risks. Natural Resources Wales p. 16 Accessed here:

https://cdn.cyfoethnaturiol.cymru/media/693612/165960736 8330461 1785381.pdf

⁷⁵ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Air Quality. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693285/sonarr2020-theme-air-quality.pdf</u>

⁷⁶ Public Health England, 2018, Heath Matters: Air Quality

https://www.gov.uk/government/publications/health-matters-air-pollution/health-matters-air-pollution ⁷⁷ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Air Quality. Natural Resources Wales Accessed here: https://cdn.cyfoethnaturiol.cymru/media/693285/sonarr2020-theme-air-quality.pdf

⁷⁸ Public Health England, 2018, Heath Matters: Air Quality

https://www.gov.uk/government/publications/health-matters-air-pollution/health-matters-air-pollution ⁷⁹ Welsh Government, 2021, Future Trends Report 2021 Evidence Pack Accessed here:

https://gov.wales/sites/default/files/publications/2021-12/future-trends-report-wales-2021-evidencepack.pdf

⁸⁰Third Climate Change Risk Assessment Technical Report: Summary for Wales (Dr. Alan Netherwood, 2021) <u>https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-</u> <u>Final.pdf</u>

⁸¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Woodlands. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693279/sonarr2020-ecosystem-woodlands.pdf</u>

⁸² Data can be accessed via the Wales Environmental Portal, <u>https://naturalresources.wales/evidence-and-data/accessing-our-data/beta-environmental-data/?lang=en</u>

⁸³ The maps are downloadable from the Welsh Government <u>Lle Data Portal</u> NRW has produced a handbook on the use of the Habitat Network Maps (Latham J and Rothwell J. 2019. A handbook on habitat networks. Practical application for improving connectivity and building ecosystem resilience. NRW Evidence Report No. 275. NRW. Bangor).

⁸⁴ Wales Environment Information Portal Accessed here: <u>https://smnr-</u>

nrw.hub.arcgis.com/apps/036c04ccb85948d2abe7312de75ad318/explore

⁸⁵ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Woodlands. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693279/sonarr2020-ecosystem-woodlands.pdf</u>

⁸⁶ South East Area Statement Landscape profiles unpublished, available from NRW on request.

⁸⁷ Jones S M, Karran A, Bosanquet S, Barter G, Garrett H and Hancocks E. 2021. Greater Gwent State of Nature. Produced by the Resilient Greater Gwent Partnership. Accessed here: <u>https://www.blaenau-gwent.gov.uk/en/resident/countryside/resilient-greater-gwent/</u>

⁸⁸ The maps are downloadable from the Welsh Government <u>Lle Data Portal</u> NRW has produced a handbook on the use of the Habitat Network Maps (Latham J and Rothwell J. 2019. A handbook on habitat networks. Practical application for improving connectivity and building ecosystem resilience. NRW Evidence Report No. 275. NRW. Bangor).

⁸⁹ South East Area Statement Landscape profiles unpublished, available from NRW on request.

⁹⁰ Baseline data can be accessed via the NRW website here: <u>https://naturalresources.wales/evidence-and-data/research-and-reports/protected-sites-baseline-assessment-2020/?lang=en</u>

⁹¹ Jones S M, Karran A, Bosanquet S, Barter G, Garrett H and Hancocks E. 2021. Greater Gwent State of Nature. Produced by the Resilient Greater Gwent Partnership. Accessed here: <u>https://www.blaenau-gwent.gov.uk/en/resident/countryside/resilient-greater-gwent/</u>

⁹² Data on INNS can be accessed via the Wales Environment Portal here: <u>https://smnr-nrw.hub.arcgis.com/apps/3ad6560d23d243c29f4fabd99a42eaa9/explore</u>

⁹³ South East Area Statement Landscape profiles unpublished, available from NRW on request.

⁹⁴ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Woodlands. Natural Resources Wales. Accessed here: https://cdn.cyfoethnaturiol.cymru/media/693279/sonarr2020-ecosystem-woodlands.pdf

⁹⁵ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Woodlands. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693279/sonarr2020-ecosystem-woodlands.pdf</u>

⁹⁶ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Woodlands. Natural Resources Wales. Accessed here: https://cdn.cyfoethnaturiol.cymru/media/693279/sonarr2020-ecosystem-woodlands.pdf
 ⁹⁷ CCRA-Evidence-Report-Wales-Summary-Final.pdf (ukclimaterisk.org)

⁹⁸ Forest Research. 2019c. Public opinion of forestry 2019. Wales. Accessed here:

https://www.forestresearch.gov.uk/tools-and-resources/statistics/statistics-by-topic/public-opinion-offorestry/

⁹⁹ Woodland Trust. 2017. A Space for people - Targeting action for woodland access. Accessed here: <u>https://www.woodlandtrust.org.uk/publications/2017/06/space-for-people-woodland-access</u>

¹⁰⁰Third Climate Change Risk Assessment Technical Report: Summary for Wales (Dr. Alan Netherwood, 2021) https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-Final.pdf

¹⁰¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Semi-natural Grasslands. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693298/sonarr2020-ecosystem-semi-natural-grasslands.pdf</u>

¹⁰² Data can be accessed via the Wales Environment Portal:

https://app.powerbi.com/view?r=eyJrIjoiZmUyYzI1YTItZThkNy00MDJjLWEyZmEtYmY4NDFmOTE3YzU4IiwidCl6 Ijg4NjVlZjBmLWFjZGUtNDg3Yy1iZjE3LTVjYjUwMzc1ZDc1NyIsImMiOjh9&pageName=ReportSection1fb964ee46 46f4cbcb4e

¹⁰³ South East Area Statement Landscape profiles unpublished, available from NRW on request.
 ¹⁰⁴ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Semi-natural Grasslands. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693298/sonarr2020-ecosystem-semi-natural-grasslands.pdf</u>

¹⁰⁵ Jones S M, Karran A, Bosanquet S, Barter G, Garrett H and Hancocks E. 2021. Greater Gwent State of Nature. Produced by the Resilient Greater Gwent Partnership. Accessed here: <u>https://www.blaenau-gwent.gov.uk/en/resident/countryside/resilient-greater-gwent/</u>

¹⁰⁶ The maps are downloadable from the Welsh Government <u>Lle Data Portal</u> NRW has produced a handbook on the use of the Habitat Network Maps (Latham J and Rothwell J. 2019. A handbook on habitat networks. Practical application for improving connectivity and building ecosystem resilience. NRW Evidence Report No. 275. NRW. Bangor).

¹⁰⁷ South East Area Statement Landscape profiles unpublished, available from NRW on request.

¹⁰⁸ South East Area Statement Landscape profiles unpublished, available from NRW on request.

¹⁰⁹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Semi-natural Grasslands. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693298/sonarr2020-ecosystem-semi-natural-grasslands.pdf</u>

¹¹⁰ Baseline data can be accessed via the NRW website here: <u>https://naturalresources.wales/evidence-and-data/research-and-reports/protected-sites-baseline-assessment-2020/?lang=en</u>

¹¹¹ Government Office for Science (GO-Science) Trend Deck, N14 Accessed here: <u>https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/994400/</u> GO-Science Trend Deck - Natural Resources section - Spring 2021.pdf

¹¹² Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Semi-natural Grasslands. Natural Resources

Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693298/sonarr2020-ecosystem-semi-natural-grasslands.pdf</u>

¹¹³ Stevens CJ, Dise NB, Mountford JO, Gowing DJ. 2004. Impact of nitrogen deposition on the species richness of grasslands. Science 303, 1876-1879., Stevens CJ, Duprè C, Dorland E, Gaunik C, Gowing DJG, Bleeker A, Diiekmann M, Alard D, Bobbink R, Fowler D, Corcket E, Mountford JO, Vandvik V, Aarrestad PA, Muller S, Dise NB. 2010b. Nitrogen deposition threatens species richness of grasslands across Europe. Environmental Pollution 158, 2940-2945., Van den Berg LJL, Vergeer P, Rich TCG, Smart SM, Guest D, Ashmore MR. 2011. Direct and indirect effects of nitrogen deposition on species composition change in calcareous grassland. Global Change Biology 17, 1871-1883

¹¹⁴ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Semi-natural Grasslands. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693298/sonarr2020-ecosystem-semi-natural-grasslands.pdf</u>

¹¹⁵ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Semi-natural Grasslands. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693298/sonarr2020-ecosystem-semi-natural-grasslands.pdf</u>

¹¹⁶ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Semi-natural Grasslands. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693298/sonarr2020-ecosystem-semi-natural-grasslands.pdf</u>

¹¹⁷ Data on INNS can be accessed via the Wales Environment Portal here: <u>https://smnr-nrw.hub.arcgis.com/apps/3ad6560d23d243c29f4fabd99a42eaa9/explore</u>

¹¹⁸ Stroh PA, Walker KJ, Smith SLN, Jefferson RG, Pinches C, Blackstock TH. 2019. Grassland plants of the British and Irish lowlands: ecology, threats and management. Botanical Society of Britain and Ireland, Hertfordshire. ¹¹⁹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Semi-natural Grasslands. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693298/sonarr2020-ecosystem-semi-naturalgrasslands.pdf</u>

¹²⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Semi-natural Grasslands. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693298/sonarr2020-ecosystem-semi-natural-grasslands.pdf</u>

 ¹²¹ Welsh Government. 2017b. The Environmental Impact Assessment (Agriculture) (Wales) Regulations 2017.
 ¹²² UKCCC. 2020. UK Committee on Climate Change. Land use: Policies for a Net Zero UK. Available from: https://www.theccc.org.uk/publication/land-use-policies-for-a-netzero-uk/

¹²³ UKCCC. 2020. UK Committee on Climate Change. Land use: Policies for a Net Zero UK. Available from: <u>https://www.theccc.org.uk/publication/land-use-policies-for-a-netzero-uk/</u>

¹²⁴Third Climate Change Risk Assessment Technical Report: Summary for Wales (Dr. Alan Netherwood, 2021) <u>https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-Final.pdf</u>

¹²⁵ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Mountains, moorlands and heaths. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693306/sonarr2020-ecosystem-mountains-moorlands-and-heaths.pdf</u>

¹²⁶ Data can be accessed via the Wales Environmental Portal, <u>https://naturalresources.wales/evidence-and-data/accessing-our-data/beta-environmental-data/?lang=en</u>

¹²⁷ Jones S M, Karran A, Bosanquet S, Barter G, Garrett H and Hancocks E. 2021. Greater Gwent State of Nature. Produced by the Resilient Greater Gwent Partnership Accessed here: <u>https://www.blaenau-gwent.gov.uk/fileadmin/documents/Resident/Countryside/Nature Report files/GGSoN 1 Introduction Eco systems Data.pdf</u>

¹²⁸ The maps are downloadable from the Welsh Government <u>Lle Data Portal</u> NRW has produced a handbook on the use of the Habitat Network Maps (Latham J and Rothwell J. 2019. A handbook on habitat networks. Practical application for improving connectivity and building ecosystem resilience. NRW Evidence Report No. 275. NRW. Bangor).

¹²⁹ South East Area Statement unpublished, available from NRW on request.

¹³⁰ Baseline data can be accessed via the NRW website here: <u>https://naturalresources.wales/evidence-and-data/research-and-reports/protected-sites-baseline-assessment-2020/?lang=en</u>

¹³¹ Jones S M, Karran A, Bosanquet S, Barter G, Garrett H and Hancocks E. 2021. Greater Gwent State of Nature. Produced by the Resilient Greater Gwent Partnership. Accessed here: <u>https://www.blaenau-gwent.gov.uk/en/resident/countryside/resilient-greater-gwent/</u>

¹³² Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Mountains, moorlands and heaths. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693306/sonarr2020-ecosystem-mountains-moorlands-and-heaths.pdf</u>

¹³³ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Mountains, moorlands and heaths. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693306/sonarr2020-ecosystem-mountains-moorlands-and-heaths.pdf</u>

¹³⁴ Third Climate Change Risk Assessment Technical Report: Summary for Wales (Dr. Alan Netherwood, 2021) <u>https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-Final.pdf</u>

¹³⁵Third Climate Change Risk Assessment Technical Report: Summary for Wales (Dr. Alan Netherwood, 2021) <u>https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-</u> Final.pdf

¹³⁶ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Freshwater. Natural Resources Wales. <u>https://cdn.cyfoethnaturiol.cymru/media/693312/sonarr2020-ecosystem-freshwater.pdf</u>

¹³⁷ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Freshwater. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693312/sonarr2020-ecosystem-freshwater.pdf</u>

¹³⁸ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Freshwater. Natural Resources Wales. <u>https://cdn.cyfoethnaturiol.cymru/media/693312/sonarr2020-ecosystem-freshwater.pdf</u>

¹³⁹ Natural Resources Wales (2020) A Plan of Action for Salmon and Sea Trout in Wales – Tackling the Salmonid Emergency. Natural Resources Wales, Bangor Accessed here: <u>https://naturalresources.wales/about-us/strategies-and-plans/salmon-and-sea-trout-plan-of-action-2020/salmon-and-sea-trout-plan-of-action-for-wales-2020-overview/?lang=en</u>

¹⁴¹ Baseline data can be accessed via the NRW website here: <u>https://naturalresources.wales/evidence-and-data/research-and-reports/protected-sites-baseline-assessment-2020/?lang=en</u>

¹⁴² Jones S M, Karran A, Bosanquet S, Barter G, Garrett H and Hancocks E. 2021. Greater Gwent State of Nature. Produced by the Resilient Greater Gwent Partnership Accessed here: <u>https://www.blaenau-gwent.gov.uk/fileadmin/documents/Resident/Countryside/Nature Report files/GGSoN 1 Introduction Eco systems_____Data.pdf</u>

¹⁴³ Jones S M, Karran A, Bosanquet S, Barter G, Garrett H and Hancocks E. 2021. Greater Gwent State of Nature. Produced by the Resilient Greater Gwent Partnership Accessed here: <u>https://www.blaenau-gwent.gov.uk/fileadmin/documents/Resident/Countryside/Nature_Report_files/GGSoN_1_Introduction__Eco_systems___Data.pdf</u>

¹⁴⁴ Data can be accessed via the Wales Environmental Portal <u>https://naturalresources.wales/evidence-and-</u> <u>data/accessing-our-data/beta-environmental-data/?lang=en</u>

¹⁴⁵ Hatton-Ellis TW, Jones TG. 2021. Compliance Assessment of Welsh River SACs against Phosphorus Targets. NRW Evidence Report No: 489, 96pp, Natural Resources Wales, Bangor Accessed here:

https://cdn.cyfoethnaturiol.cymru/media/693025/compliance-assessment-of-welsh-sacs-against-phosphorustargets-final-v10.pdf?mode=pad&rnd=132557227300000000

¹⁴⁶ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Invasive Non-native Species. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693300/sonarr2020-theme-invasive-non-native-species.pdf</u>

¹⁴⁷ Data can be accessed via the Wales Environmental Portal, <u>https://naturalresources.wales/evidence-and-data/accessing-our-data/beta-environmental-data/?lang=en</u>

¹⁴⁸ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Freshwater. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693312/sonarr2020-ecosystem-freshwater.pdf</u>

¹⁴⁹ Hatton-Ellis TW, Jones TG. 2021. Compliance Assessment of Welsh River SACs against Phosphorus Targets. NRW Evidence Report No: 489, 96pp, Natural Resources Wales, Bangor Accessed here:

https://cdn.cyfoethnaturiol.cymru/media/693025/compliance-assessment-of-welsh-sacs-against-phosphorustargets-final-v10.pdf?mode=pad&rnd=132557227300000000

¹⁵⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Freshwater. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693312/sonarr2020-ecosystem-freshwater.pdf</u>

¹⁵¹ Third Climate Change Risk Assessment Technical Report: Summary for Wales (Dr. Alan Netherwood, 2021) https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-Final.pdf

¹⁵² Data can be accessed via the Wales Environmental Portal, <u>https://naturalresources.wales/evidence-and-data/accessing-our-data/beta-environmental-data/?lang=en</u>

¹⁵³ Data can be accessed via the Wales Environmental Portal, <u>https://naturalresources.wales/evidence-and-</u> <u>data/accessing-our-data/beta-environmental-data/?lang=en</u>

¹⁵⁴ NRW, 2018. Severn Estuary / Môr Hafren Special Area of Conservation: Indicative site level feature condition assessments 2018. NRW Evidence Report Series, Report No: 235, 41pp, NRW, Bangor Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/684391/severn-sac-ica-2018.pdf</u>

¹⁵⁵ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Coastal Margins. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693314/sonarr2020-ecosystem-coastal-margins.pdf</u>
 ¹⁵⁶ ASC. 2016. UK Climate Change Risk Assessment 2017 Evidence Report – Summary for Wales. London:

Adaptation Sub-Committee of the Committee on Climate Change.

¹⁵⁷ Ibrahim J. 2020. Public Service Boards in Wales: A review of marine and coastal priorities to improve wellbeing. NRW Evidence Report No. 433

¹⁵⁸ Jones S M, Karran A, Bosanquet S, Barter G, Garrett H and Hancocks E. 2021. Greater Gwent State of Nature. Produced by the Resilient Greater Gwent Partnership Accessed here: <u>https://www.blaenau-gwent.gov.uk/fileadmin/documents/Resident/Countryside/Nature Report files/GGSoN 1 Introduction Ecosystems_____Data.pdf</u>

¹⁵⁹ The term 'indicative condition assessment' describes the use of readily available evidence and expert judgement in an intensive, collective workshop process to provide an indication of feature condition at the site level

¹⁶⁰ Use of UK Climate Projections 2018 (UKCP18) - Revision 1, November 2020 (onr.org.uk)

¹⁶¹ Rowe EC, Mitchell Z, Tomlinson S, Levy P, Banin L F, Sawicka K, Martín Hernandez C, Dore A. 2020. Trends Report 2020: Trends in critical load and critical level exceedances in the UK. Report to Defra under Contract AQ0843, CEH Project NEC05708.

¹⁶² Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Coastal Margins. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693314/sonarr2020-ecosystem-coastal-margins.pdf</u>
 ¹⁶³ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the

achievement of sustainable management of natural resources. Coastal Margins. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693314/sonarr2020-ecosystem-coastal-margins.pdf</u>

¹⁶⁴ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Marine. Natural Resources Wales., <u>https://cdn.cyfoethnaturiol.cymru/media/693277/sonarr2020-ecosystem-marine.pdf</u>

¹⁶⁵ Data can be accessed via the Wales Environmental Portal, <u>https://naturalresources.wales/evidence-and-data/accessing-our-data/beta-environmental-data/?lang=en</u>

¹⁶⁶ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Invasive Non-native Species. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693300/sonarr2020-theme-invasive-non-native-species.pdf</u>

¹⁶⁷ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Coastal Margins. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693314/sonarr2020-ecosystem-coastal-margins.pdf</u>
 ¹⁶⁸ Environmental Audit Committee. 2016. Environmental impact of microplastics, HC 179, 2016-17.
 ¹⁶⁹ Findings from the third UK Climate Change Risk Assessment (CCRA3) Evidence Report 2021
 <u>https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA3-Briefing-Marine.pdf</u>

¹⁷⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Coastal Margins. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693314/sonarr2020-ecosystem-coastal-margins.pdf</u>

¹⁷¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Coastal Margins. Natural Resources Wales
 Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693314/sonarr2020-ecosystem-coastal-margins.pdf</u>
 ¹⁷² Third Climate Change Risk Assessment Technical Report: Summary for Wales (Dr. Alan Netherwood, 2021)

https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-Final.pdf

¹⁷³ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Coastal Margins. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693314/sonarr2020-ecosystem-coastal-margins.pdf</u>
 ¹⁷⁴ Chmura GL, Anisfeld SC, Cahoon DR, Lynch JC. 2003. Global carbon sequestration in tidal, saline wetland soils Global Biogeochemical Cycles 17 (4).

¹⁷⁵ Ford H, Garbutt A, Duggan-Edwards M, Pagés JF, Harvey R, Ladd C, Skov MW. 2019. Large-scale predictions of salt-marsh carbon stock based on simple observations of plant community and soil type. Biogeosciences 16 (2), 425–436.

¹⁷⁶ Armstrong S, Hull S, Pearson Z, Wilson R, Kay S. 2020. Estimating the Carbon Sink Potential of the Welsh Marine Environment. NRW Evidence Report No. 428, Cardiff.

¹⁷⁷ Third Climate Change Risk Assessment Technical Report: Summary for Wales (Dr. Alan Netherwood, 2021) https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-Final.pdf

¹⁷⁸ Third Climate Change Risk Assessment Technical Report: Summary for Wales (Dr. Alan Netherwood, 2021) <u>https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-Final.pdf</u>

¹⁷⁹ UKCCC. 2020. Committee on Climate Change. Land Use: policies for a Net Zero UK. Available from: <u>https://www.theccc.org.uk/publication/land-use-policies-for-a-net-zero-uk/</u> [accessed February 2021]

¹⁸⁰ Future Generations Commissioner for Wales, 2020. The Future Generations Report 2020: Decarbonisation Accessed here: <u>https://www.futuregenerations.wales/wp-content/uploads/2020/05/FGC-Report-English.pdf</u>

¹⁸¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Climate Change. Natural Resources Wales Accessed here: https://cdn.cyfoethnaturiol.cymru/media/693282/sonarr2020-theme-climate-change.pdf

¹⁸² Evans C, Rawlins B, Grebby S, Scholefield P, Jones P. 2015. Glastir Monitoring & Evaluation Programme. Mapping the extent and condition of Welsh peat. Welsh Government (Contract reference: C147/2010/11). NERC/Centre for Ecology & Hydrology (CEH Project: NEC04780). Available from: <u>https://gmep.wales/resources</u> [accessed February 2021]

¹⁸³ Calculated using the International Union for Conservation of Nature (IUCN) carbon figures

¹⁸⁴ Calculated using the US Environmental Protection Agency (EPA) Greenhouse Gas Equivalencies Calculator

¹⁸⁵ Welsh Government. 2019. Prosperity for All: A Low Carbon Wales. Welsh Government. Cardiff. Available from: <u>https://gov.wales/prosperity-all-low-carbon-wales</u> [accessed February 2021]

¹⁸⁶ UKCCC. 2020b. Committee on Climate Change. Land Use: policies for a Net Zero UK. Available from: <u>https://www.theccc.org.uk/publication/land-use-policies-for-a-net-zero-uk/</u> [accessed February 2021]

¹⁸⁷ UKCCC. 2020b. Committee on Climate Change. Land Use: policies for a Net Zero UK. Available from: https://www.theccc.org.uk/publication/land-use-policies-for-a-netzero-uk/ [accessed February 2021]

¹⁸⁸ Maskell LC, Alison J, Smart SM. 2019. ERAMMP Year 1 Report 20: GMEP Outstanding Analysis Part 1 - Reanalysis of data for SoNaRR. Report to Welsh Government (Contract C210/2016/2017). Centre for Ecology & Hydrology Project NEC06297 Accessed here: <u>https://erammp.wales/sites/default/files/ERAMMP%20Rpt-</u> <u>30%20GMEP%20re-analysis%20for%20SoNaRR2020%20v1.0.pdf</u>

¹⁸⁹ In order to make the effects of different greenhouse gases comparable, the Intergovernmental Panel on Climate Change (IPCC) of the United Nations has defined the so-called "Global Warming Potential". This index expresses the warming effect of a certain amount of a greenhouse gas over a set period of time (usually 100 years) in comparison to CO₂. GHGs can be calculated as CO₂ equivalents. See full definition here: <u>https://www.myclimate.org/information/faq/faq-detail/what-are-co2-equivalents/</u>

¹⁹⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Climate Change. Natural Resources Wales.
 Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693282/sonarr2020-theme-climate-change.pdf</u>
 ¹⁹¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the

achievement of sustainable management of natural resources. Climate Change. Natural Resources Wales. Available from: <u>https://cdn.cyfoethnaturiol.cymru/media/693282/sonarr2020-theme-climate-change.pdf</u> ¹⁹² South East Area Statement Landscape profiles unpublished, available from NRW on request.

¹⁹³ Senedd Research. 2019. Blue Carbon Research Briefing. National Assembly for Wales. Available from: <u>https://research.senedd.wales/research-articles/blue-carbonand-its-role-in-combating-climate-change/</u> [accessed February 2021]

¹⁹⁴ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Marine. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693277/sonarr2020-ecosystem-marine.pdf</u>

¹⁹⁵ Armstrong S, Hull S, Pearson Z, Wilson R, Kay S. 2020. Estimating the Carbon Sink Potential of the Welsh Marine Environment. Natural Resources Wales Evidence Report No 428. NRW, Cardiff, 74p. Available from: <u>https://naturalresources.wales/evidence-and-data/research-and-reports/marine-eports/marine-and-coastal-evidence-reports/?lang=en</u> [accessed February 2021]

¹⁹⁶ Natural Resources Wales. 2019. GN030f Benthic habitat assessment guidance for marine developments and activities: A guide to characterising and monitoring seagrass beds. Natural Resources Wales, Bangor Accessed here: <u>https://cdn.naturalresources.wales/media/689360/gn030f-seagrass-final-24jun2019.pdf</u>

¹⁹⁷ Data can be accessed via the Wales Environmental Portal, <u>https://naturalresources.wales/evidence-and-data/accessing-our-data/beta-environmental-data/?lang=en</u>

 ¹⁹⁸ O'Sullivan OS, Holt AR, Warren PH, Evans KL. 2017. Optimising UK urban road verge contributions to biodiversity and ecosystem services with cost-effective management. Journal of Environmental Management 191, 162-171 Accessed here: <u>https://www.sciencedirect.com/science/article/pii/S0301479716310556</u>
 ¹⁹⁹ UKCCC. 2019. UK Committee on Climate Change. Net Zero The UK's contribution to stopping global warming. Available from: <u>https://www.theccc.org.uk/publication/net-zero-the-uks-contribution-to-</u> stoppingglobal-warming/ [accessed February 2021]

²⁰⁰ Vision for Climate Ready Natural Resources in Gwent as taken from the South East Area Statement Accessed here: <u>https://naturalresources.wales/about-us/area-statements/south-east-wales-area-</u> <u>statement/climate-ready-gwent/?lang=en</u>

²⁰¹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Land use and soils. Natural Resources Wales Accessed here: https://cdn.cyfoethnaturiol.cymru/media/693310/sonarr2020-theme-land-use-and-soils.pdf
 ²⁰² Third Climate Change Risk Assessment Technical Report: Summary for Wales (Dr. Alan Netherwood, 2021)
 Accessed here: https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-Final.pdf

²⁰³ Third Climate Change Risk Assessment Technical Report: Summary for Wales (Dr. Alan Netherwood, 2021) Accessed here: <u>https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-Final.pdf</u>

²⁰⁴ These values are taken from the UKCP18 probabilistic projections and represent a central (median) estimate of 30-year average change in each variable from a 1981-2000 baseline. Third Climate Change Risk Assessment Technical Report: Summary for Wales (Dr. Alan Netherwood, 2021)

https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-<u>Final.pdf</u>

²⁰⁵ These values are taken from the UKCP18 probabilistic projections and represent a central (median) estimate of 30-year average change in each variable from a 1981-2000 baseline. Third Climate Change Risk Assessment Technical Report: Summary for Wales (Dr. Alan Netherwood, 2021)

https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-Final.pdf

²⁰⁶ The full likely range of change (i.e. 10 - 90th percentile) in each average variable is not shown here but is available from the full UKCP18 database.

²⁰⁷ For an understanding of RCP pathways see <u>UKCP18 Guidance: Representative Concentration Pathways</u> (RCPs)

²⁰⁸ IPCC. 2018: Intergovernmental Panel on Climate Change. Summary for Policymakers. In: Global Warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. [Masson-Delmotte V, Zhai P, Pörtner H-O, Roberts D, Skea J, Shukla PR, Pirani A, Moufouma-Okia W, Péan C, Pidcock R, Connors S, Matthews JBR, Chen Y, Zhou X, Gomis MI, Lonnoy E, Maycock T, Tignor M, Waterfield T (editors)]. In Press. Available from: https://www.ipcc.ch/sr15/chapter/spm/ [Accessed February 2021]

²⁰⁹ IPCC, 2019: Summary for Policymakers. In: Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems [P.R. Shukla, J. Skea, E. Calvo Buendia, V. Masson-Delmotte, H.- O. Pörtner, D. C. Roberts, P. Zhai, R. Slade, S. Connors, R. van Diemen, M. Ferrat, E. Haughey, S. Luz, S. Neogi, M. Pathak, J. Petzold, J. Portugal Pereira, P. Vyas, E. Huntley, K. Kissick, M. Belkacemi, J. Malley, (eds.)]. In press. Accessed here: https://www.ipcc.ch/srccl/chapter/summary-for-policymakers/

²¹⁰ Note: These values should not be combined to give a total as some properties will be at risk from more than 1 flood source

²¹¹ Data taken from National Flood Risk Assessment data 2021 (as yet unpublished)

²¹² The English National Study for Flooding and Health: First year report. PHE Publications gateway number 2016575. CC 2017 Accessed here: <u>http://www.wales.nhs.uk/sitesplus/documents/888/PHW-Prosperity-for-all-report-%28Eng-web%29.pdf</u>

²¹³ Present and future flood vulnerability, risk and disadvantage: A UK assessment, Sayers, P., Penning-Rowsell, E., Horritt, M. (2017).

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/597846/ NSFH_briefing_for_policymakers_and_practitioners.pdf

²¹⁴ Mariana Dyakova, Mark A. Bellis, Sumina Azam, Kathryn Ashton, Anna Stielke, Elodie Besnier, 2019, Driving Prosperity for All through Investing for Health and Well-being, Public Health Wales NHS Trust Accessed here:
 ²¹⁵ Third Climate Change Risk Assessment Technical Report: Summary for Wales (Dr. Alan Netherwood, 2021)
 <u>https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-Final.pdf</u>

²¹⁶ South East Area Statement taken from the integrated vision <u>Natural Resources Wales / South East Wales</u> <u>Area Statement</u>

²¹⁷ Welsh Government, 2021, Future Trends Report 2021 Evidence Pack Accessed here:

https://gov.wales/sites/default/files/publications/2021-12/future-trends-report-wales-2021-evidencepack.pdf

²¹⁸ Adapting to Climate Change: Guidance for Flood and Coastal Erosion Risk Management Authorities in Wales, Welsh Government April 2021

²¹⁹ Third Climate Change Risk Assessment Technical Report: Summary for Wales (Dr. Alan Netherwood, 2021) <u>https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-Final.pdf</u>

²²⁰ South Wales Fire and Rescue Service (unpublished), available on request

²²¹ Data provided by SWFRS and Mid and West Fire and Rescue Service *Data may be subject to change pending completion/validation of records

²²² South Wales Fire and Rescue Service (unpublished), available on request

²²³ South Wales Fire and Rescue Service (unpublished), available on request

²²⁴ Met Office, 2018, Met Office Annual weather assessment 2018 Accessed here:

https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/uk-pastevents/summaries/uk_monthly_climate_summary_annual_2018.pdf

²²⁵ Costs are based on the following criteria: Where a pump has attended the scene; crewing cost of pump appliances only, each pump crewed by one Crew Manager (competent level) and four Fire Fighters (competent level). (Crew Manager (competent level) hourly rate = \pm 15.46. Fire Fighter (competent level) hourly rate = \pm 13.94)

²²⁶ Nunes, J.P., Doerr, S., Keesstra, S., Pulquério, M., et al. 2018. Policy brief: impacts of fires on water quality. Results from the Connecteur/PLACARD workshop on Fire impacts on water quality, 14–16 February 2018, Lisbon Accessed here: <u>https://www.placard-network.eu/wp-content/PDFs/wildfire-water-quality-briefingV3.pdf</u>

227 https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA3-Briefing-Wildfire.pdf

²²⁸ Public Health England, 2018, Heath Matters: Air Quality

https://www.gov.uk/government/publications/health-matters-air-pollution/health-matters-air-pollution

²²⁹ Third Climate Change Risk Assessment Technical Report: Summary for Wales (Dr. Alan Netherwood, 2021) https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-Final.pdf

²³⁰ Armstrong, A., Brockett, B., Eustice, T., Lorentzon, A., O'Brien, L., Williams, S, 2021, Why Society Needs Nature: Lessons from Research during COVID-19-19. Accessed here:

https://www.forestresearch.gov.uk/research/why-society-needs-nature/

²³¹ Lakey, J., Smith, N., Oskala, A. and McManus, S. (2017). Culture, sport and well-being: Findings from the Understanding Society adults survey Accessed here:

https://www.artscouncil.org.uk/sites/default/files/download-

file/Culture%20sport%20and%20wellbeing_adults.pdf

²³² Natural Resources Wales, 2020, State of Natural Resources Report (SoNaRR): Assessment of the Achievement of SMNR Aim 3: Wales has Healthy Places for People, Protected from Environmental Risks. Accessed here: <u>SoNaRR2020 Aim 3 assessment</u>

²³³ Wales Centre for Public Policy: Cultural well-being briefing June 2021 (unpublished)

²³⁴ Natural Resources Wales, 2020, State of Natural Resources Report (SoNaRR): Assessment of the Achievement of SMNR Aim 3: Wales has Healthy Places for People, Protected from Environmental Risks. Accessed here: SoNaRR2020 Aim 3 assessment

²³⁵ Armstrong, A., Brockett, B., Eustice, T., Lorentzon, A., O'Brien, L., Williams, S. (2021) Why Society Needs Nature: Lessons from Research during COVID-19-19. Accessed here:

https://www.forestresearch.gov.uk/research/why-society-needs-nature/

²³⁶ South East Area Statement Landscape profiles unpublished, available from NRW on request.

²³⁷ South East Area Statement Landscape profiles unpublished, available from NRW on request.

²³⁸ Sport Wales/Welsh Government, 2019, National Survey for Wales 2018-19: Sport and Active Lifestyles – State of the Nation Report Accessed here:

https://www.sport.wales/files/f16771b9041ecbd847704e346c9e15bc.pdf

²³⁹ Natural Resources Wales, 2021, Permits given for recreational activities across the Welsh Government's Woodland Estate in Gwent 2019-2021. Available from NRW on request.

²⁴⁰ Wales Tourism Alliance, 2016, Inquiry into the Future of Agricultural and Rural Development Policies in
 Wales: Evidence Paper from Wales Tourism Alliance. Accessed here: <u>AAB 12 Wales Tourism Alliance.pdf</u>
 ²⁴¹ Welsh Government, 2020, Welcome to Wales: Priorities for the Visitor Economy 2020-2025 Accessed here: <u>https://gov.wales/sites/default/files/publications/2020-01/welcome-to-wales-priorities-for-the-visitor-economy-2020-to-2025.pdf</u>

²⁴² Wales Tourism Alliance, 2016, Inquiry into the Future of Agricultural and Rural Development Policies in Wales: Evidence Paper from Wales Tourism Alliance. Accessed here: <u>AAB 12 Wales Tourism Alliance.pdf</u>
 ²⁴³ The Fishing Passport, 2019, Facts and Figures - The Fishing Passport Magazine 2019 (Summer) Accessed here: <u>https://wyes.foleon.com/passport/the-fishing-passport-magazine-2019-summer/facts-and-figures/</u>
 ²⁴⁴ Wales Centre for Public Policy: Cultural well-being briefing June 2021 (unpublished)

²⁴⁵ Natural England, 2010, 'Nature Nearby' Accessible Natural Greenspace Guidance Accessed here: http://www.ukmaburbanforum.co.uk/docunents/other/nature_nearby.pdf

²⁴⁶ Welsh Government, 2020, National Survey for Wales, 2019-20. Accessed here: <u>National Survey for Wales:</u> results viewer | GOV.WALES

²⁴⁷ Wales Centre for Public Policy, 2021, Cultural well-being briefing. Unpublished, currently in draft.
 ²⁴⁸ The Sensory Trust and Natural Resources Wales, 2017, By All Reasonable Means Accessed here:

https://cdn.cyfoethnaturiol.cymru/media/693695/ogn-045-by-all-reasonable-means-least-restrictive-accessto-the-outdoors -004.pdf?mode=pad&rnd=132665823850000000

²⁴⁹ Armstrong, A., Brockett, B., Eustice, T., Lorentzon, A., O'Brien, L., Williams, S, 2021, Why Society Needs Nature: Lessons from Research during COVID-19-19. Accessed here:

https://www.forestresearch.gov.uk/research/why-society-needs-nature/

²⁵⁰ Armstrong, A., Brockett, B., Eustice, T., Lorentzon, A., O'Brien, L., Williams, S, 2021, Why Society Needs Nature: Lessons from Research during COVID-19-19. Accessed here:

https://www.forestresearch.gov.uk/research/why-society-needs-nature/

²⁵¹ Natural Resources Wales, 2020, Forestry and NNR Visitor Data Report January to September 2020 - Issue 2. Prepared by Stuart France, Linetop Ltd. Unpublished, available from NRW on request. ²⁵² Natural Resources Wales, 2020, State of Natural Resources Report (SoNaRR): Assessment of the Achievement of SMNR Aim 3: Wales has Healthy Places for People, Protected from Environmental Risks Accessed here: <u>SoNaRR2020 Aim 3 assessment</u>

²⁵³ Wales Centre for Public Policy, 2021, COVID-19-19 and Brexit Briefing Paper. Unpublished, currently in draft.

²⁵⁴ Armstrong, A., Brockett, B., Eustice, T., Lorentzon, A., O'Brien, L., Williams, S, 2021, Why Society Needs Nature: Lessons from Research during COVID-19-19. Accessed here:

https://www.forestresearch.gov.uk/research/why-society-needs-nature/

²⁵⁵ Natural Resources Wales, 2020, State of Natural Resources Report (SoNaRR): Assessment of the Achievement of SMNR Aim 3: Wales has Healthy Places for People, Protected from Environmental Risks Accessed here: <u>SoNaRR2020 Aim 3 assessment</u>

²⁵⁶ Natural Resources Wales, 2021, Anti-Social Behaviour on NRW-Managed Land (South East). Unpublished, available from NRW on request.

²⁵⁷ Coed Lleol (Small Woods Wales), 2021, Investigating the Need and Opportunities for Social Prescribing, Outdoor Health and Actif Woods Well-being Activities in South-East Wales. Unpublished, available from NRW on request.

²⁵⁸ South East Area Statement unpublished, available from NRW on request.

²⁵⁹ Wales Centre for Public Policy, 2021, COVID-19-19 and Brexit Briefing Paper. Unpublished, currently in draft.

²⁶⁰ Natural Resources Wales, 2021, Anti-Social Behaviour on NRW-Managed Land (South East). Unpublished, available from NRW on request.

²⁶¹ Armstrong, A., Brockett, B., Eustice, T., Lorentzon, A., O'Brien, L., Williams, S. (2021) Why Society Needs Nature: Lessons from Research during COVID-19-19 Accessed here:

https://www.forestresearch.gov.uk/research/why-society-needs-nature/

²⁶² South East Area Statement taken from the integrated vision <u>Natural Resources Wales / South East Wales</u> <u>Area Statement</u>

²⁶³ Natural Resources Wales (South East People & Places team), 2020. Unpublished, available from NRW on request.

²⁶⁴ Coed Lleol (Small Woods Wales), 2021, Investigating the Need and Opportunities for Social Prescribing, Outdoor Health and Actif Woods Well-being Activities in South-East Wales. Unpublished, available from NRW on request.

²⁶⁵ Armstrong, A., Brockett, B., Eustice, T., Lorentzon, A., O'Brien, L., Williams, S, 2021, Why Society Needs Nature: Lessons from Research during COVID-19-19. Accessed here:

https://www.forestresearch.gov.uk/research/why-society-needs-nature/

²⁶⁶ South East Land Management Team, Natural Resources Wales, 2021. Unpublished, observational information.

²⁶⁷ Wales Centre for Public Policy, 2021, COVID-19-19 and Brexit Briefing Paper. Unpublished, currently in draft
 ²⁶⁸ Third Climate Change Risk Assessment Technical Report: Summary for Wales (Dr. Alan Netherwood, 2021)
 <u>https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-Final.pdf</u>

²⁶⁹ Source June Survey Agriculture in the UK 2019 Welsh Government press release Agriculture in Wales 2019 and Agriculture facts and figures.

²⁷⁰ Senedd Research, 2021. A new landscape for farmers and nature? Accessed here:

https://research.senedd.wales/research-articles/a-new-landscape-for-farmers-and-nature/

²⁷¹ Welsh Government. 2019b. Farming Facts & Figures Wales 2019. Available from: <u>https://gov.wales/farming-facts-and-figures-2019</u> [Accessed July 2020]

²⁷² Department for Environment Food and Rural Affairs (Defra). 2020. Agriculture in the United Kingdom 2019. Available from: <u>https://www.gov.uk/government/statistics/agriculture-in-the-united-kingdom-2019</u> [Accessed July 2020]

²⁷³ Hybu Cig Cymru (HCC). 2020a. Industry Statistics. Available from:

https://meatpromotion.wales/en/industry-statistics [Accessed July 2020]

²⁷⁴ Welsh Government. 2019e. Our ambition to further develop Wales' food and drink sector. Consultation. Available from: https://gov.wales/developing-wales-food-anddrink-sector [Accessed July 2020]

²⁷⁵ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Land use and soils. Natural Resources Wales p. 45 Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693310/sonarr2020-theme-land-use-and-soils.pdf</u>

²⁷⁶ Statistics for Wales & Welsh Government (2019), Agricultural Small Area Statistics (2002-2018), Welsh Government Accessed here: <u>https://gov.wales/agricultural-small-area-statistics-2002-2018</u>

²⁷⁷ Statistics for Wales & Welsh Government (2019), Agricultural Small Area Statistics (2002-2018), Welsh Government Accessed here: <u>https://gov.wales/agricultural-small-area-statistics-2002-2018</u>

²⁷⁸ Welsh Government (2019) Response to FOI request. Rural Payments Wales, Welsh Government unpublished

²⁷⁹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Enclosed Farmland. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693343/sonarr2020-ecosystem-enclosed-farmland.pdf</u>

²⁸⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Enclosed Farmland. Natural Resources Wales p. 42 Accessed here: https://cdn.cyfoethnaturiol.cymru/media/693343/sonarr2020-ecosystem-enclosed-farmland.pdf

²⁸¹ Food Sense Wales, Well-being Assessment briefing note (unpublished)

²⁸² Welsh Government, 2021, Future Trends Report 2021 Evidence Pack Accessed here: <u>https://gov.wales/sites/default/files/publications/2021-12/future-trends-report-wales-2021-evidence-</u>

pack.pdf

²⁸³ IPBES (2019): Global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. E. S. Brondizio, J. Settele, S. Díaz, and H. T. Ngo (editors). IPBES secretariat, Bonn, Germany Accessed here: <u>https://ipbes.net/global-assessment</u>

²⁸⁴ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Land use and soils. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693310/sonarr2020-theme-land-use-and-soils.pdf</u>

²⁸⁵ Fitzpatrick I, Young R, Perry M, Rose E. 2017. The Hidden Cost of UK Food. The Sustainable Food Trust
 ²⁸⁶ Statistics for Wales & Welsh Government (2019), June 2020 Survey of Agriculture and
 Horticulture: Results for Wales, Welsh Government Accessed here:

https://gov.wales/sites/default/files/statistics-and-research/2020-12/survey-agriculture-and-horticulture-june-2020-932.pdf

²⁸⁷ Blackstock KL, Ingram J, Burton R, Brown KM, Slee B. 2010. Understanding and influencing behaviour change by farmers to improve water quality. Science of the Total Environment 408 (23), 5631–5638. Welsh Government. 2019a. Survey of agriculture and horticulture, June 2019 [online]. Available from: https://gov.wales/survey-agriculture-and-horticulture [Accessed February 2021]

²⁸⁸ Hayhow DB, Eaton MA, Stanbury AJ, Burns F, Kirby WB, Bailey N, Beckmann B, Bedford J, Boersch-Supan PH, Coomber F, Dennis EB, Dolman SJ, Dunn E, Hall J, Harrower C, Hatfield JH, Hawley J, Haysom K, Hughes J, Johns DG, Mathews F, McQuatters-Gollop A, Noble DG, Outhwaite CL, Pearce-Higgins JW, Pescott OL, Powney GD and Symes N. 2019. State of Nature 2019. The State of Nature partnership. Available from: https://nbn.org.uk/stateofnature2019/ [accessed March 2021]

²⁸⁹ Data can be accessed via the Wales Environmental Portal, <u>https://naturalresources.wales/evidence-and-</u> <u>data/accessing-our-data/beta-environmental-data/?lang=en</u>

²⁹⁰ Hayhow DB, Eaton MA, Stanbury AJ, Burns F, Kirby WB, Bailey N, Beckmann B, Bedford J, Boersch-Supan PH, Coomber F, Dennis EB, Dolman SJ, Dunn E, Hall J, Harrower C, Hatfield JH, Hawley J, Haysom K, Hughes J, Johns DG, Mathews F, McQuatters-Gollop A, Noble DG, Outhwaite CL, Pearce-Higgins JW, Pescott OL, Powney GD and Symes N (2019) The State of Nature 2019. The State of Nature partnership Accessed here: <u>https://nbn.org.uk/wp-content/uploads/2019/09/State-of-Nature-2019-UK-full-report.pdf</u>

²⁹¹ Jones S M, Karran A, Bosanquet S, Barter G, Garrett H and Hancocks E. 2021. Greater Gwent State of Nature. Produced by the Resilient Greater Gwent Partnership Accessed here: <u>https://www.blaenau-gwent.gov.uk/en/resident/countryside/resilient-greater-gwent/</u>

²⁹² Welsh Government. 2019c. Prosperity for All: A Low Carbon Wales. Cardiff: Welsh Government.

²⁹³ NAEI. 2020a. (National Atmospheric Emissions Inventory) Smith H, Thistlethwaite G, Jones L, Richmond B, Hampshire K, May K, Garland L, Zhang H. Devolved Administration GHG Inventory: 1990-2018. National Atmospheric Emissions Inventory. Available from: <u>https://naei.beis.gov.uk/reports/reports?report_id=1000</u> [Accessed January 2021]

²⁹⁴ Scarborough, P., Appleby, P., Mizdrak, A., Briggs, A., Travis, R., Bradbury, K. and Key, T. (2014). Dietary greenhouse gas emissions of meat-eaters, fish-eaters, vegetarians and vegans in the UK. *Climatic Change*, 125(2), pp.179-192. DOI: 10.1007/s10584-014-1169-1 Accessed here: <u>https://rdcu.be/b13Ag</u>
²⁹⁵ Slide prepared by Manchester Metropolitan university for Climate Ready Gwent Carbon Literacy training. Source: Welsh data is from report above (LCA by Bangor University- based on 20 Welsh farms). For comparison lamb and beef data were abstracted from the database underpinning the Poore & Nemecek paper – which is provided here: <u>https://ora.ox.ac.uk/objects/uuid:a63fb28c-98f8-4313-add6-e9eca99320a5</u>

²⁹⁶ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Land use and soils. Natural Resources Wales p. 11 Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693310/sonarr2020-theme-land-use-andsoils.pdf</u>

²⁹⁷ South East Area Statement integrated vision for Gwent: <u>https://naturalresources.wales/about-us/area-statements/south-east-wales-area-statement/ways-of-working/?lang=en</u>

²⁹⁸ Campbell, Lucy (2021). Climate Change and Reaching Net Zero: Perceptions and Awareness in Wales. Cardiff: Welsh Government, GSR report number 49/2021. Accessed here:

https://gov.wales/sites/default/files/statistics-and-research/2021-07/climate-change-and-reaching-net-zero-perceptions-and-awareness-in-wales.pdf

²⁹⁹ Department for Environment, Food & Rural Affairs (DEFRA). 2020. Food Statistics in your pocket: Global and UK supply. Available from: https://www.gov.uk/government/statistics/food-statistics-pocketbook/food-statisticsin-your-pocket-global-and-uk-supply [Accessed March 2021]

³⁰⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Land use and soils. Natural Resources Wales p. 45 Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693310/sonarr2020-theme-land-use-and-soils.pdf</u>

³⁰¹ Welsh Government, 2021, Future Trends Report 2021 Evidence Pack Accessed here: <u>https://gov.wales/sites/default/files/publications/2021-12/future-trends-report-wales-2021-evidence-pack.pdf</u>

³⁰² Wales Centre for Public Policy: Briefing on well-being and the impact of COVID-19-19 and Brexit June 2021 (unpublished)

³⁰³ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the
achievement of sustainable management of natural resources. Land use and soils. Natural Resources Wales p.
64 Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693310/sonarr2020-theme-land-use-and-</u>
soils.pdf

³⁰⁴ Department for Environment, Food & Rural Affairs (DEFRA), 2019, Agriculture in the United Kingdom 2019 Accessed here <u>https://www.gov.uk/government/statistics/agriculture-in-the-united-kingdom-2019</u>

³⁰⁵ Senedd Research, 2021. A new landscape for farmers and nature? Accessed here: <u>https://research.senedd.wales/research-articles/a-new-landscape-for-farmers-and-nature/</u>

³⁰⁶ Welsh Government. 2019e. Our ambition to further develop Wales' food and drink sector. Consultation. Available from: <u>https://gov.wales/developing-wales-food-and-drink-sector</u> [Accessed July 2020]

³⁰⁷ UK Centre for Ecology and Hydrology, 2020, Environment and Rural Affairs Monitoring & Modelling Programme (ERAMMP) Accessed here: <u>https://erammp.wales/en/12</u>

³⁰⁸ Emmett B, Alexander M, Alison J, Anthony S, Ballinger R, Bell C, Bowgen K, Cooper D, Cosby J, Dickie I, Ditchburn B, Edwards F, Engledew M, Fitch A, Frost N, Garbutt RA, Gooday R, Hatfield J, Henrys P, Hull S, Jenkins T, Jones L, Kettel E, Logie M, Lyons H, Maclean K, Mant J, Maskell LC, Matthews R, Petr M, Powney GR, Read D, Robinson DA, Siriwardena G, Smart SM, Steadman C, Thomas A, Thomas D, Thomas T, Tye A, Vieno M, Williams B. and Wood C. 2019. Environment and Rural Affairs Monitoring & Modelling Programme – ERAMMP Year 1 Report 11: Year 1 Summary. Report to Welsh Government (Contract C210/2016/2017). Centre for SoNaRR2020 Theme: Land use and soils 86 Ecology & Hydrology Project NEC06297.Emmett, B.A., Reynolds, B., Chamberlain, P.M., Rowe, E., Spurgeon, D., Brittain, S.A., Frogbrook, Z., Hughes, S., Lawlor, A.J., Poskitt, J. and Potter, E., 2010. Countryside survey: soils report from 2007.

³⁰⁹ Government Office for Science (GO-Science) Trend Deck, E6 Accessed here:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/993914/ GO-Science Trend Deck - Economics section - Spring 2021.pdf

³¹⁰ IPCC, 2019: Summary for Policymakers. In: Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems [P.R. Shukla, J. Skea, E. Calvo Buendia, V. Masson-Delmotte, H.- O. Pörtner, D. C. Roberts, P. Zhai, R. Slade, S. Connors, R. van Diemen, M. Ferrat, E. Haughey, S. Luz, S. Neogi, M. Pathak, J. Petzold, J. Portugal Pereira, P. Vyas, E. Huntley, K. Kissick, M. Belkacemi, J. Malley, (eds.)]. In press. Accessed here: https://www.ipcc.ch/srccl/chapter/summary-for-policymakers/

³¹¹ For an understanding of RCP pathways see <u>UKCP18 Guidance: Representative Concentration Pathways</u> (RCPs)

³¹² Government Office for Science (GO-Science) Trend Deck, E6 Accessed here:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/993914/ GO-Science_Trend_Deck - Economics_section - Spring_2021.pdf

³¹³ Third Climate Change Risk Assessment Technical Report: Summary for Wales (Dr. Alan Netherwood, 2021) <u>https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-Final.pdf</u>

³¹⁴ Welsh Government, 2020, Capability, Suitability & Climate Programme Accessed here: <u>https://gov.wales/sites/default/files/publications/2020-11/capacity-suitability-climate-programme-2012-</u>

study-rerun.pdf

³¹⁵ Welsh Government, 2020, Capability, Suitability & Climate Programme Accessed here: <u>https://gov.wales/sites/default/files/publications/2020-11/capacity-suitability-climate-programme-2012-</u> study-rerun.pdf

³¹⁶ Data can be accessed via the Wales Environmental Portal, <u>https://naturalresources.wales/evidence-and-</u> <u>data/accessing-our-data/beta-environmental-data/?lang=en</u>

³¹⁷ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Woodlands. Natural Resources Wales. Accessed here: https://cdn.cyfoethnaturiol.cymru/media/693279/sonarr2020-ecosystem-woodlands.pdf
³¹⁸ Wood Knowledge Wales (unpublished)

³¹⁹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Woodlands. Natural Resources Wales. Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693279/sonarr2020-ecosystem-woodlands.pdf</u>

³²⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Woodlands. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693279/sonarr2020-ecosystem-woodlands.pdf</u>

³²¹ Third Climate Change Risk Assessment Technical Report: Summary for Wales (Dr. Alan Netherwood, 2021) <u>https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-</u> Final.pdf

³²² Natural Resources Wales, 2017, South East Valleys Abstraction Licensing Strategy, natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/683371/sev-licensing-strategy-final-nov-</u> <u>17.pdf?mode=pad&rnd=13159636949000000</u>

³²³ Natural Resources Wales, 2017, Usk Abstraction Licensing Strategy, natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/682209/river-usk-abstraction-licensing-strategy-july-</u> <u>2017.pdf?mode=pad&rnd=131631840530000000</u>

³²⁴ Monmouthshire Public Services Board, 2019, Monmouthshire Public Services Board Well-being Assessment Accessed here: <u>https://www.monmouthshire.gov.uk/app/uploads/2017/05/well-being-assessment-v3.0.pdf</u>

³²⁵ Source Natural Resources Wales (NRW) (unpublished, available on request

³²⁶ Source Natural Resources Wales (NRW) (unpublished, available on request

³²⁷ Third Climate Change Risk Assessment Technical Report: Summary for Wales (Dr. Alan Netherwood, 2021) <u>https://www.ukclimaterisk.org/wp-content/uploads/2021/06/CCRA-Evidence-Report-Wales-Summary-Final.pdf</u>

³²⁸ Stockholm Environment Institute (SEI) and GHD, 2015, Ecological and Carbon Footprints of Wales Update to 2011 Accessed here: <u>https://gov.wales/sites/default/files/publications/2019-04/ecological-and-carbon-footprint-of-wales-report.pdf</u>

³²⁹_Stockholm Environment Institute (SEI) and GHD, 2015, Ecological and Carbon Footprints of Wales Update to 2011 Accessed here: <u>https://gov.wales/sites/default/files/publications/2019-04/ecological-and-carbon-footprint-of-wales-report.pdf</u>

³³⁰ This consumption based footprint was calculated using the CoGo Carbon Footprint tracker developed by Prof. Mike Berners-Lee Accessed here: <u>https://cogo.co/our-carbon-footprint-tracker</u>

³³¹ Stockholm Environment Institute (SEI) and GHD, 2015, Ecological and Carbon Footprints of Wales Update to 2011 Accessed here: <u>https://gov.wales/sites/default/files/publications/2019-04/ecological-and-carbon-footprint-of-wales-report.pdf</u>

³³² Data can be accessed via the Torfaen Council Research tableau here:

https://public.tableau.com/app/profile/torfaen.council.research/viz/Wellbeinggraphs/ThematicMaps

³³³ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Waste. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693283/sonarr2020-theme-waste.pdf</u>

³³⁴ Department for the Environment Food and Rural Affairs (DEFRA). 2018. Landfill Aftercare Scoping Study [online]. Available from: Defra, UK - Science Search [Accessed 8th December 2020]

³³⁵ StatsWales. 2019. Local authority municipal waste management: April 2018 to March 2019 [online]. Available from: <u>https://gov.wales/local-authority-municipal-waste-management-april-2018-march-2019</u> [Accessed 8th December 2020]

³³⁶ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Waste. Natural Resources Wales Accessed here: https://cdn.cyfoethnaturiol.cymru/media/693283/sonarr2020-theme-waste.pdf
³³⁷ Data can be accessed via the Torfaen Council Research tableau here:

https://public.tableau.com/app/profile/torfaen.council.research/viz/Wellbeinggraphs/ThematicMaps

³³⁸ Welsh Government, 2021, Beyond Recycling: A strategy to make the circular economy in Wales a reality Accessed here: <u>https://gov.wales/sites/default/files/publications/2021-03/beyond-recycling-strategy-document.pdf</u>

³³⁹ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Waste. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693283/sonarr2020-theme-waste.pdf</u>

³⁴⁰ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Waste. Natural Resources Wales Accessed here: <u>https://cdn.cyfoethnaturiol.cymru/media/693283/sonarr2020-theme-waste.pdf</u>

³⁴¹ Data can be accessed via the Torfaen Council Research tableau here:

https://public.tableau.com/app/profile/torfaen.council.research/viz/Wellbeinggraphs/ThematicMaps ³⁴² Stockholm Environment Institute (E. Dawkins, A. Paul, J. Barrett, J. Minx and K. Scott), 2008, Wales' Ecological Footprint – Scenarios to 2020 Accessed here:

https://mediamanager.sei.org/documents/Publications/Future/wales_ecological_footprint_report_270508_fi nal.pdf

³⁴³ Welsh Government, 2019, Well-being of Wales 2018-19 Accessed here:

https://gov.wales/sites/default/files/statistics-and-research/2019-11/well-being-of-wales-2019.pdf ³⁴⁴ Data can be accessed via the Torfaen Council Research tableau here:

https://public.tableau.com/app/profile/torfaen.council.research/viz/Wellbeinggraphs/ThematicMaps ³⁴⁵ Stockholm Environment Institute (E. Dawkins, A. Paul, J. Barrett, J. Minx and K. Scott), 2008, Wales' Ecological Footprint – Scenarios to 2020 Accessed here:

https://mediamanager.sei.org/documents/Publications/Future/wales_ecological_footprint_report_270508_fi nal.pdf

³⁴⁶ Cardiff Capital Region press release 11 February 2021, <u>Cardiff Capital Region and Welsh Government</u> collaborate to create pioneering Energy Vision and Strategy Accessed here:

https://www.cardiffcapitalregion.wales/news-events/latest-news/car diff-capital-region-and-welsh-government-collaborate-to-create-pioneering-energy-vision-and-strategy/

³⁴⁷ Cardiff Capital Region Energy Strategy (item 8, appendix 2)

³⁴⁸ Air Quality Expert Group. 2020. Estimation of changes in air pollution emissions, concentrations and exposure during the COVID-19-19 outbreak in the UK. Rapid Evidence Review for DEFRA, SG, WG & Dept of Agriculture, Environment & Rural Affairs in Northern Ireland. Available from: <u>https://uk-air.defra.gov.uk/library/reports.php?report_id=1005</u> [Accessed 14 December 2020]

³⁴⁹ Public Health Wales. 2016a. Estimating the Mortality burden of air pollution in Wales. in National Assembly for Wales. <u>https://senedd.wales/research%20documents/18-009/18-009-web-english.pdf</u> [Accessed 2nd July 2020]

³⁵⁰ Welsh Government Clean Air Advisory Panel, 2020, Impacts of the COVID-19-19 pandemic on air quality in Wales: March to October 2020 Accessed here:

https://airquality.gov.wales/sites/default/files/documents/2021-01/Clean_Air_Advisory_Panel_report-Impacts of the COVID-19-19 pandemic on air quality in Wales English.pdf

³⁵¹ Wales Centre for Public Policy: Briefing on well-being and the impact of COVID-19-19 and Brexit June 2021 (unpublished)

³⁵² Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Waste. Natural Resources Wales. Available here: <u>https://cdn.cyfoethnaturiol.cymru/media/693283/sonarr2020-theme-waste.pdf</u>

³⁵⁴ Climate Just key messages: Which households emit the most carbon from energy use? Accessed here: https://www.climatejust.org.uk/messages/which-households-emit-most-carbon-energy-use
³⁵⁵ Ofgem Consumer Vulnerability Strategy 2025, available here:

file:///C:/Users/fen.turner/Downloads/consumer vulnerability strategy 2025.pdf

³⁵⁶ Natural Resources Wales. 2021. State of Natural Resources Report (SoNaRR): Assessment of the achievement of sustainable management of natural resources. Waste. Natural Resources Wales. Available here: <u>https://cdn.cyfoethnaturiol.cymru/media/693283/sonarr2020-theme-waste.pdf</u>

³⁵⁷ WRAP Cymru. 2018. Towards a Route Map for Plastic Recycling: Creating Circularity for Plastics in Wales [online]. Available from: Towards a Route Map for Plastic Recycling | WRAP (wrapcymru.org.uk) [Accessed 9th March 2021]

³⁵⁸ Eunomia. 2017. Natural Resources Wales - Waste Crime Review report Unpublished. Natural Resources Wales.

³⁵⁹ Progress report: reducing emissions in Wales, published 17 December 2020 available from: www.theccc.org.uk/publications

³⁶⁰ Blaenau Gwent County Borough Council Decarbonisation Plan 2020 to 2030, available from: <u>https://www.blaenau-</u>

gwent.gov.uk/fileadmin/documents/Council/Policies Strategies Plans/BGCBC Decarbonisation Plan 2030 Council Version .pdf

³⁶¹ Jones, A. 2018. Carbon Positive Project Technical Report: Calculating Natural Resources Wales' Net Carbon Status. NRW Evidence Report No: 303, 134pp, Natural Resources Wales, Bangor. Available from:

https://cdn.cyfoethnaturiol.cymru/media/687222/cym-evidence-report-303-carbon-positive-project-technicalreport-calculating-nrws-net-carbon-status.pdf

³⁶² Climate change and reaching net zero: perceptions and awareness in Wales (summary), available from: <u>https://gov.wales/sites/default/files/pdf-versions/2021/7/4/1626332413/climate-change-and-reaching-net-</u>zero-perceptions-and-awareness-wales-summary.pdf

³⁶³ Cynnal Cymru and the Electoral Reform Society Cymru, 2021, Blaenau Gwent Climate Assembly Report Accessed here: <u>https://www.blaenau-</u>

gwent.gov.uk/fileadmin/images/News/BG Climate Assembly Report ENG.pdf

³⁶⁴ NAEI. 2020. National Atmospheric Emissions Inventory Greenhouse Gas Inventories for England, Scotland, Wales & Northern Ireland: 1990-2018. Thistlethwaite G, Smith H, Brown P, MacCarthy J, Pang Y, Passant N, Richmond B, Wakeling D, Walker C, Hampshire K, King K, May K, Garland L, Zhang H, Jones L, Thomson A, Buys G, Clilverd H, Malcolm H, ZwagermanT, Henshall P, Matthews R, Cardenas L, Gilhespy S, Misselbrook T. Available from: https://naei.beis.gov.uk/reports/reports?report_id=1000 [Accessed February 2021]
³⁶⁵ Vivid Economics. 2020. A UK Investment Strategy: Building back a resilient and sustainable economy [online]. Available from: https://www.vivideconomics.com/casestudy/a-uk-investment-strategy-building-back-a-resilient-and-sustainable-economy [Accessed 14 December 2020]

³⁶⁶ Advice Report: The path to a Net Zero Wales Climate Change Committee December 2020 Presented to Welsh Ministers pursuant to Section 45(1) of the Environment (Wales) Act 2016. This report was published on 17 December 2020 and is available online at: www.theccc.org.uk/publications

³⁶⁷ Based on analysis provided by the Tyndall Centre for Climate Change Research – available here: <u>https://carbonbudget.manchester.ac.uk/reports/</u>. Slide created for Climate Ready Gwent carbon literacy training by Manchester Metropolitan University

³⁶⁸ Based on analysis provided by the Tyndall Centre for Climate Change Research – available here: <u>https://carbonbudget.manchester.ac.uk/reports/</u>. Slide created for Climate Ready Gwent carbon literacy training by Manchester Metropolitan University

³⁶⁹ Advice Report: The path to a Net Zero Wales Climate Change Committee December 2020 Presented to Welsh Ministers pursuant to Section 45(1) of the Environment (Wales) Act 2016. This report was published on 17 December 2020 and is available online at: <u>www.theccc.org.uk/publications</u>

³⁷⁰ Advice Report: The path to a Net Zero Wales Climate Change Committee December 2020 Presented to Welsh Ministers pursuant to Section 45(1) of the Environment (Wales) Act 2016. This report was published on 17 December 2020 and is available online at: www.thecccorg.uk/publications

³⁵³ Climate Just key messages: Which households emit the most carbon from energy use? Accessed here: <u>https://www.climatejust.org.uk/messages/which-households-emit-most-carbon-energy-use</u>

³⁷¹ Everyday Plastic. 2020. The Everyday Plastic Survey Lockdown Edition [online]. Available from: <u>https://www.everydayplastic.org/lockdown-1</u> [Accessed 9th December 2020]

³⁷² Citywire. 2020. Artemis: Food delivery is our big takeaway from COVID-19-19 article [online]. Available from: <u>https://citywire.co.uk/investment-trust-insider/news/artemis-food-delivery-is-our-big-takeaway-from-covid-19/a1384866</u> [Accessed 9th December 2020]

³⁷³ Advice Report: The path to a Net Zero Wales Climate Change Committee December 2020 Presented to Welsh Ministers pursuant to Section 45(1) of the Environment (Wales) Act 2016. This report was published on 17 December 2020 and is available online at: <u>www.theccc.org.uk/publications</u>

³⁷⁴ UK Government. 2015. Quality Protocols: converting waste into non-waste products [online]. Available from: <u>https://www.gov.uk/government/collections/quality-protocols-end-of-waste-frameworks-for-waste-derived-products</u> [Accessed 8th December 2020]

³⁷⁵ Advice Report: The path to a Net Zero Wales Climate Change Committee December 2020 Presented to Welsh Ministers pursuant to Section 45(1) of the Environment (Wales) Act 2016. This report was published on 17 December 2020 and is available online at: www.thecccorg.uk/publications