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Health and social woodland benefits and non-wood forest product opportunities: Literature Review

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Health and social woodland benefits and non-wood forest product opportunities: Literature Review

Author: Meghan Duffin

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For further information please contact:

Climate and Environment Research Team

Social Research and Information Division

Welsh Government

Cathays Park

Cardiff

CF10 3NQ

Email: ClimateAndEnvironmentResearch@gov.wales

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Glossary

Broadleaf Woodlands

These woodlands are characterised by trees which are broad and vary in shape. Most are deciduous meaning they lose and gain leaves (Woodland Trust, 2019). Common examples include English oak, ash and downy birch.

Bioeconomy

This refers to industries that use biological resources, such as agriculture, food, fisheries, forestry, and biotechnology (European Commission, 2012).

Coniferous Woodlands

Coniferous woodlands are forests primarily made up of conifer trees, which produce cones and have needle-like or scale-like leaves (The Wildlife Trusts). Common examples include pines, spruces, firs, and cedars.

FSC (Forest Stewardship Council)

FSC is a non-profit organisation, which verifies the responsible sourcing of forest products.

Non-Wood Forest Products (NWFP)

NWFPs are biological goods and services from forests, excluding wood (FAO, 1995),

Value chains

Refers to the sequence of processes involved in transforming forest resources into goods and services that deliver economic, social, and environmental value.

Acronyms

FAO

Food and Agriculture Organization

NWFPs

Non-Wood Forest Products

ONS

Office for National Statistics

1. Introduction

1.1. Introduction/background

The Welsh Government's Woodlands for Wales Strategy sets out the Welsh Government's broader vision for woodland, trees and forests (Welsh Government, 2018). The strategy is built around four strategic themes, one of these themes, "Woodlands for people" has the following outcomes:

- more communities are involved with, and benefit from their local woodlands and trees
- more people benefit from education and learning opportunities provided in, and by, woodlands and trees
- more people live healthier lives as a result of using, enjoying, and living in proximity to, woodlands and trees
- more people benefit from woodland-related enterprises and associated employment opportunities.

These outcomes align with Welsh Government's commitments to create a National Forest across Wales and explore how the National Forest can support the development of a sustainable timber industry. This is outlined in the Programme for Government – Update (Welsh Government, 2021, page 6) which pledges to "Harness the economic, cultural, and recreational potential of the National Forest as part of progress towards a sustainable timber industry." This is part of a wider commitment to "Embed our response to the climate and nature emergency in everything we do."

The National Forest for Wales was first announced in 2020 (Welsh Government, 2020). Since then, various schemes have been introduced to support the addition of sites to the official National Forest for Wales network. Initial support mechanisms were funded in 2020 to test their potential in achieving the National Forest for Wales outcomes, and these were further evaluated in 2022 (Welsh Government, 2022)

Currently, the Welsh Government is conducting a mid-term evaluation of the National Forest for Wales to assess the effectiveness of various delivery mechanisms, including staff funded to provide guidance and advice to landowners on funding opportunities and applying for National Forest status and funding support. The evaluation will also explore how to measure future impacts, including for outcomes such as woodlands accessible to people and community involvement in woodlands (Parkinson and others, 2025).

Evidence on ways to support the timber industry and encourage timber use for high-value products can be found in the 'Strategies and interventions to support the timber industry: literature review' (Welsh Government, 2025). This identified available evidence on international examples of interventions and plans to encourage sustainable forest management, use of timber for high-value products and the associated social benefits.

The Trees and Forestry branch commissioned the Climate and Environment Research Team in the Welsh Government's Knowledge and Analytical Services to undertake a literature review to explore woodland benefits and opportunities. This was focused on two research areas:

- economic benefits, opportunities and challenges of profiting from forest products and services
- health and social benefits of being in woodlands and barriers preventing engagement.

1.2. Aims and objectives

The aim of this review is to review and synthesise secondary evidence to support policy decision-making and identify the main gaps in the existing research that could be addressed through new primary research. The research identified will form part of the evidence base to inform how the economic, cultural and recreational potential of the National Forest for Wales can be harnessed.

The literature searches were carried out by the Welsh Government Library Services and the Climate and Environment Research Team.

This literature review sought to answer the following six research questions:

1. How have businesses capitalised on forest products and services to support the economic growth of their business?
2. What economic opportunities have forest products and services provided to businesses?
3. What barriers have businesses faced in capitalising on forest products and services?
4. What psychological and physiological health benefits are associated with woodlands?
5. What non-health related social benefits are associated with woodlands?
6. What barriers exist that prevent engagement in woodlands?

2. Methodology

2.1. Approach

This report is based on literature searches undertaken by the Welsh Government Library Services and the Climate and Environment Research team. Searches were completed between 26 September 2024 and 27 February 2025.

Through scoping discussions with the Forestry branch, six specific research questions were developed - see section 1.2 Aims and Objectives. The research questions covered two broad topic areas:

- the ways businesses make use of forest products and services to support profits for their business and the opportunities and challenges associated with this
- health and social benefits of being in woodlands, including psychological and physiological health benefits, non-health related social benefits, and the barriers that prevent engagement in woodlands.

These broad areas guided two subsequent literature searches. One was undertaken by Library services and focused on examples of how businesses have capitalised on forest products and services to support their economic growth. This search also looked at the challenges that these businesses faced when trying to capitalise on woodland products and services.

The other search was undertaken by the Climate and Environment Research team. This focused on the health and social benefits of woodlands, the diverse ways individuals engage with woodlands as well as barriers to this. Health and social benefits of woodlands overlap with how woodlands and trees contribute to the improvement of people's well-being, which is the objective of the 'Woodlands for People' theme of the Woodlands for Wales strategy. Given this overlap, the search looked to explore evidence relevant to the Woodland for Wales Strategy indicators (Welsh Government, 2019) under this theme where possible:

- local benefits of woodlands
- community involvement
- recreation
- accessibility
- local Enterprises.

The results of these two literature searches were combined into this report.

2.2. Scoping

Library Services and the Climate and Environment Research team collected research from the following types of sources: journal articles, literature reviews, theses, and biomedical reports. Only evidence that met social research standards and was publicly available (including available on request) was included. The search initially focused on the UK

however international papers were also reviewed due to the limited number of UK results, particularly from countries with similar climates to the UK including areas of Europe and North America. Therefore, this evidence may be transferable to Wales but care should be taken when applying these findings, as different countries have varying social and political contexts which may influence policies relating to businesses, woodlands and woodland use more generally. The search criteria included literature published within the last 10 years (2014 to 2024), and any literature not readily accessible in English was excluded. This may have introduced language, cultural, and publication bias.

However, some research published before 2014 that was deemed relevant and discovered through more recent sources has been included. This is because it was felt to contribute to the review and explain concepts well, given that much of the evidence base, particularly around theory, is older.

It's important to note, after discussions with the Forestry branch, it was decided the available evidence on the economic opportunities in relation to wood products was well-established through sources such as Forest Research and in order to keep the scope of this work contained, this review has explored evidence in relation to non-wood products in more detail to build on the existing evidence. This influenced search terms, which included searching using the term 'woodland-based products' more broadly rather than specifying whether products were made of wood or other materials.

2.3. Search strategies

Through discussions with the Forestry branch, research questions were developed, and the corresponding search terms were created (see annex A for search terms) covering the two broad topic areas outlined in section 2.1. The approach to the two searches are outlined below.

2.3.1. Uses and opportunities of forest products and services for local businesses, and challenges to this

A search was conducted by Library services between 03/12/2024 and 19/12/2024. This was requested by the Climate and Environment Research team regarding the following research questions:

1. How have businesses capitalised on forest products and services to support the economic growth of their business?
2. What economic opportunities have forest products and services provided to businesses?
3. What barriers have businesses faced in capitalising on forest products and services?

The search strategies used in this search are set out in Annex A.

In addition to these search strategies, where the Library Services identified relevant databases, these were browsed for any publications that may include evidence useful for inclusion within this literature review. Library Services also used AI tools to ask for further

resources in response to the research questions. This was to identify if any literature had been missed. See annex A for further details.

Library services initially identified 41 sources using the search strategies. Of the results provided, 27 had a Welsh or UK focus. The Climate and Environment research team then further reviewed these sources against the research aims and identified that 36 included relevant findings. Sources were identified as irrelevant to this work for the following reasons:

- in the research focused on countries with climates that were not comparable
- the articles were not on open access portals.

In addition to this library search, evaluation reports from 3 relevant projects in Wales delivered by Llais y Goedwig were also reviewed and findings included in this report. These project evaluations are available on request directly from Llais y Goedwig.

2.3.2. Health and social benefits of being in woodlands, and barriers to this

A literature search was undertaken by the Climate and Environment research team between November 2024 and February 2025, related to the following three research questions:

1. What psychological and physiological health benefits are associated with woodlands?
2. What non-health related social benefits are associated with woodlands?
3. What barriers exist that prevent engagement in woodlands?

This search was conducted using Microsoft Bing search engine, Google search engine, and Google Scholar search engine. The search strategies used are also outlined in Annex A.

The Climate and Environment Research team met with Forest Research in February 2025 due to their experience with undertaking and reviewing research in this area. The purpose of this meeting was to check the relevance of search terms identified, share what literature had come out of the search already and check whether any main data sources were missing. The search terms for this topic area were then further supplemented by this advice.

The literature review methodology had some limitations which should be considered when reviewing the findings. These are set out below.

2.4. Limitations

The literature identified in this review was limited by the search strategies used. The sources and literature found may not represent all existing literature on this topic but were those identified using the specific search terms including searching for specific non-wood products. Different search terms might have yielded different sources. Furthermore, access was limited to the databases available, and this extends to the AI tools, where only the “free” versions of the AI tools were used. This also applies to the gaps identified; these gaps may not exist in the broader literature but were present in the literature identified through these search strategies.

When examining the health, social, and economic opportunities of woodlands, it is important to note that much of the evidence refers to nature and greenspaces more broadly rather than exclusively to woodlands or forests. This distinction matters because there are substantially more high-quality publications analysing the effects of greenspace compared to those focusing solely on forests or woodlands. These high-quality studies are typically characterised by larger sample sizes and by methodologies that ensure the sample is demographically and geographically representative of the general population. Such design features enhance the reliability of findings and increase confidence in their applicability to other contexts, including Wales. Therefore, to strengthen the evidence base specific to forests and woodlands, literature encompassing broader greenspace or nature-based environments was included, as these often contain wooded areas, small woodlands, and forests within their scope. Additionally, the literature often did not specify whether the services were taking place in woodlands, forests, or nature more generally. Where necessary, broader evidence has been included, with clear signposting in the review to indicate when the context extends beyond woodlands.

A final limitation of this review was few evaluations and empirical studies were identified within this literature review on how businesses in Wales used forest products and services to support the economic growth of their business. The available literature largely described instances of businesses in Wales who offered services in woodlands or sold woodland products. These sources didn’t assess the effectiveness of these activities in supporting business profits. Therefore, much of this section is supplemented with evidence from international sources. This limited the ability to evaluate the economic opportunities, and challenges local businesses in Wales face at the time this literature review was undertaken.

These limitations should be taken into account when reading and interpreting the findings of this literature review below

3. Findings – use, opportunities and challenges of non-wood forest products and services for businesses

This section explores forest products, with a particular focus on Non-Wood Forest Products (NWFPs), examining their use across Europe and Wales, their economic importance, and the challenges that hinder their development. It then explores forestry-related services and the outdoor tourism sector, highlighting the barriers these industries face. The discussion includes case studies of initiatives in Wales, assessing their outcomes and the lessons learned. Finally, the section examines literature on the growth potential of forest products and services, considering opportunities for future development.

3.1. Non-Wood Forest Products (NWFPs)

There is widely accepted evidence on the contribution of forest and woodlands to both the local and national economy of Wales (Beauchamp and others., 2020: Report 31. National Forest Evidence Review). They generate revenue and create jobs through various activities, such as timber and wood fuel production, as well as NWFP harvesting. They also support recreation activities and contribute to the tourism and hospitality sectors.

According to FAO (1995), NWFPs are biological goods and services from forests, excluding wood. These products can be collected from the wild or cultivated in forests, other wooded land and trees outside forests (Sheppard and others, 2020).

Various terms like by-products of forests, non-timber forest products (NTFP), wild forest products, and minor, secondary, or specialty forest products are used interchangeably to describe NWFPs, each focusing on different aspects and species (Ćosović, 2015; Sheppard and others, 2020). In this review, the term NWFP is used, except when it doesn't fit the appropriate context.

Examples of NWFPs include berries, mushrooms, cork, pine kernels, acorns, medicinal herbs, essential oils, chestnuts, and resin (Lovrić and others, 2020). Other forest-derived products such as Christmas trees, firewood, wild meat, and honey are also considered within the broader scope of this review (Sheppard and others, 2020). NWFPs can be classified into categories such as famine foods, dietary supplements, marketable goods, and livestock fodder. Saraev and others (2020) suggested in an evidence synthesis that incorporating these products into landscapes like food forests can enhance economic, health, and biodiversity benefits.

3.1.1. Utilisation of NWFPs in Europe

In 2005, the three most commercialised NWFPs in the UK were: Christmas trees, Foliage and moss, and Venison, according to the Forestry Commission UK (Ćosović, 2015). Collier and others. (2004) found that demand for certain forest products like willow, blackthorn, and hazel foliage had increased in the UK market.

Research suggests NWFPs can be used for food, medicine, arts and crafts, and cultural purposes (Sheppard and others. 2020). In Europe, empirical evidence showed the collection

of NWFPs is deeply embedded in cultural heritage (Seeland and Staniszewski, 2007) and is closely associated with the recreational use of forests (de Aragón and others, 2011).

The StarTree project (more information in section 3.5.1) commissioned a household survey in 2016 of around 15,000 respondents from 28 European countries, including the UK, and found that 25% of European households collected or used NWFPs (StarTree, n.d. [footnote 1]). The level of participation in picking NWFPs varied considerably between regions, ranging from just 4.6% in the Netherlands and 7.8% in the UK to as high as 67.6% in Latvia. According to Lovric and others (2021) this is can be attributed to NWFPs uneven distribution, with higher levels of collection in forest-rich areas.

Research also identified regional differences in the role and importance of NWFPs (Lovrić and others, 2020; Forest Europe, 2022) highlighting that NWFPs are especially important in the Mediterranean region. The vast diversity of NWFPs, combined with the low profitability of wood, means that NWFPs make up a considerable portion of the total value of forest production (Wolfslehner and others, 2016a). In Eastern Europe, NWFPs were found to greatly contribute to people's livelihoods, whereas in Western Europe, they were more associated with recreation.

3.1.2. Utilisation of NWFPs in Wales

Available evidence suggests that the amount of NWFPs available in Wales may be more limited than in other countries, however, there is some interest by the general public in Wales to gather these products.

Woodlands cover 15% of Wales' land area (Forest Research, 2024a). Compared to other European countries, this is a low proportion of afforested land, which can limit the availability of NWFPs (European Forest Institute, 2019). Research shows that the collection of berries, nuts, and similar items is typically done on a smaller scale and casually, while fungus collection is generally reserved for those with specific knowledge.

According to the 2025 UK Public Opinion of Forestry Survey, 68% of people in Wales visited woodlands in recent years (Forest Research, 2025). Among those who visited in the past 12 months, 47% gathered products, mainly decorative, floral, and craft items (24%), and food and drink items (21%). This could demonstrate the desire by the public for cultural interaction with woodlands (Wolfslehner and others, 2019).

The European Forest Institute (2019) have also highlighted that NWFPs are not widely recognised or understood in Wales. The source believes that there is considerable potential for their development within local communities although does not expand on this further.

3.1.3. NWFP benefits

Researchers have suggested that NWFPs can play a crucial role in providing new business opportunities and creating jobs in rural areas (Bernasconi, 2008; CORDIS, 2017), as well as enhancing the profitability of numerous small and medium-sized forest-based enterprises

Footnotes

[1] Unpublished. Report available on request from Llais y Goedwig: info@llaisygoedwig.org.uk

(Pettenella and others, 2007). Sources suggest NWFPs can have great potential to diversify livelihoods, support rural development, and boost the incomes of landowners and rural businesses, who often have fewer wage labour opportunities (Christie and others, 2006; Niskanen and others, 2007; Wolfslehner and others, 2016a; Forest Europe, 2022).

Lovrić and others (2020) contend that the limited attention given to NWFPs in policy discussions is evident in the insufficient understanding of how their production interacts with other forest ecosystem services. There is some limited evidence suggesting that the combined production of wood and non-wood products can be complementary. For instance, the influence of forestry on promoting growth, reproduction and chemical composition of Bilberry in Norway (Nybakken and others, 2012) and the production of timber and wild mushrooms in Finland and Spain were found to co-occur without causing disruption (Miina and others., 2019). According to Miina and others (2019), this co-production would offer forest owners an additional source of income through the sustainable harvesting of wild mushrooms.

In summary, the evidence in this sub-section suggests there are opportunities that NWFPs can offer to businesses and the eco-system that could be realised through increased understanding of their uses and benefits.

3.2. Economic value of NWFPs

The 2015 "State of Europe's Forests" report estimated the value of Non-Wood Forest Products (NWFPs) in Europe to be €2.27 billion, with 73% accounted for by marketed plant products such as berries. This represents around 10% of the value of timber products supplies in log form (roundwood) (Wolfslehner and others, 2016b). In 2020, the total value of plant-product NWFPs was projected at around €2.802 billion, with Central-West, South-West, and North Europe contributing the most (Forest Europe, 2020). For the same year, animal products such as wild meat and honey, were valued at €1.201 billion, with Central-West and North Europe leading. South-East and Central-East Europe had the lowest shares for both categories, but it's important to note that data coverage in these regions was very low.

Lovrić and others (2020) estimated that collected NWFPs have an annual economic value of €23.3 billion in Europe. This notably higher figure is attributed to the inclusion of self-consumed NWFPs. However, the authors noted key limitations of the study: it covered most but not all NWFPs collected in Europe; results are more reliable for frequently collected products and larger countries due to higher response rates; and NWFP yield and collection can vary annually.

Despite the increasing quantity and market value of non-wood goods, they remain far below the market value of wood production (Forest Europe, 2020). Forest Europe (2022) attributes much of this rise to changes in assessment methods and states that while import and consumption trends are quite clear, the data does not show a definitive trend for NWFP production.

In summary, NWFPs contribute meaningfully to Europe's forest economy, though they remain secondary to timber. Data limitations and gaps in understanding make it difficult to track clear trends in production and value.

3.3. Barriers to understanding the use and realised value of NWFPs

The forest-based sector has primarily focused on wood products due to their economic value and well-organised, competitive value chains (Wolfslehner and others, 2016a). Value chains refer to the sequence of processes involved in transforming forest resources into goods and services that deliver economic, social, and environmental value.

Firstly, research has demonstrated that there is limited data for and recognition of NWFPs. Despite the potential of non-wood forest products (NWFPs), they are often overlooked due to limited reliable data. Sills and others (2011) argue that this lack of information leads to underestimation of their value. Lovrić and others (2020) found that the economic importance of NWFPs in Europe is perceived as low, largely because reported values fluctuate due to the quality and availability of data rather than actual trends. As a result, NWFPs are not fully recognised in forest-based bioeconomy forecasts (Hurmekoski and others, 2019).

Research has found that measuring production and trade of NWFPs can be challenging. Official reporting is often inconsistent due to unclear systems and poorly understood value chains (Sheppard and others, 2020). People frequently use non-standard units like baskets or handfuls to estimate quantities (Lovrić and others., 2020). Additionally, high levels of personal use and informal trade make it difficult to track NWFPs through formal channels (Wolfslehner and others, 2016a).

The NWFP sector can also be viewed as harder to define because products vary widely and pass-through diverse markets and transformations (Wolfslehner and others, 2016a; Forest Europe, 2020). While a single classification system could help with comparisons, it may also reduce clarity about individual products (Wolfslehner and others, 2016a). Furthermore, integrating NWFPs into national forest surveys is difficult, as many are site-specific and only locally important (Forest Europe, 2022).

Moreover, commercialising NWFPs is more complex than other businesses. Success depends on the species, product type, value chain structure, and market conditions, according to Meinhold & Darr (2019). It requires a long-term, multidisciplinary approach, including natural resource management and market knowledge (Belcher & Schreckenberg, 2007). Further, NWFPs are often excluded from rural development and land-use planning policies, despite their potential role in the bioeconomy (Lovrić and others, 2020).

Lastly, the review did not identify any literature specifically addressing the barriers to the supply of NWFPs in Wales.

Overall, these barriers ranging from data gaps and measurement issues to commercial and policy challenges highlight why NWFPs remain underutilised. Addressing them could support opportunities for their recognition and inclusion in sustainable forest management and the bioeconomy.

3.4. Value of services

Nature-based recreation facilities, such as mountain bike centres, high ropes courses, and outdoor play parks, can attract many visitors annually (Saraev and others, 2020). These facilities generate income from car parking, onsite cafes, restaurants, retail opportunities, and entry fees for organised activities. Forest and woodland sites also offer economic opportunities for nearby tourism and hospitality businesses through hotels, campsites, catering services, and retail shops.

To demonstrate the potential added value of new woodlands in support of the National Forest for Wales, Saraev and others. (2020) used the Outdoor Recreation Valuation Tool (ORVal) to model patterns of recreational use across the natural environment in England and Wales. The tool estimated that people in Wales make around 158 million visits to the natural environment each year, with a total recreational value of £570 million, based on travel cost data. Of these, over 98 million visits (valued at £321 million) are to places that include woodland habitats, showing the important role woodlands play in outdoor recreation.

In 2024, the Office for National Statistics (ONS) published the Woodland Natural Capital Accounts (ONS, 2024). Natural capital refers to the UK's stock of natural resources and ecosystems that provide vital services, such as clean air, water, and recreation, while also demonstrating the value of the environment to our health, economy, and well-being (Ward, 2018). For Wales, the estimated health benefits from woodland-related recreation were valued at £53 million, whilst recreation and tourism expenditure amounted to £49 million (both in 2023 prices) (ONS, 2024).

Wales attracts a high number of tourists, especially to rural and coastal areas (Miller and others, 2024). More recent publications have examined the economic value of outdoor activity tourism in Wales, including activities such as trekking, bushcraft, horse trekking, mountain biking, and orienteering. According to Miller and others (2024), there has been strong growth in the outdoor activity tourism sector in the last 10 years, despite setbacks from the Covid-19 pandemic. Outdoor activity tourism businesses in Wales generated an income of £114.98 million in 2023. The net economic impact was £272.87 million annually, with £205 million retained in Wales. Although this publication focuses on outdoor activities in general, these findings include outdoor activities in woodlands and suggest increasing opportunities for woodlands to make a profit from outdoor activity tourism.

Forest Research highlighted that tourism uses of woodlands can also generate revenue for forestry owners, tourism businesses, organisations, and enterprises (Martin, 2007). The success of this is influenced by the type of activity. This evidence has been included despite being outside of the literature search parameter, as it remains one of the few detailed studies examining how tourism providers value and use forests and woodlands in the UK. The study examined how tourism providers value and use forests and woodlands in three case study areas in the UK, including the Dyfi Valley in Wales. According to planners and managers involved in forestry policy and those representing tourism enterprises, forests and woodlands are versatile and resilient spaces for tourism development. These stakeholders highlighted several advantages of using forests as spaces for tourists:

- forests can absorb large numbers of visitors without a huge impact
- forests can support a wide range of activities from quiet nature walks to more disruptive uses, particularly in coniferous woodlands
- forests can promote year-round tourism, offering attractions in all seasons regardless of weather conditions.
- forests can attract people to visit
- forests can extend the duration of visitors stay in local tourism areas
- forests can lengthen the tourist season.

A report by Forest Research, identified the following factors which can influence the realisation of these benefits: the appealing imagery, ambience, and aesthetics of woodlands, their accessibility, including flora and fauna, and man-made facilities like visitor centres, trails, and interpretive services such as translation (Martin, 2007).

To explore factors which may influence the potential recreational value of newly created woodlands, Saraev and others (2020) modelled hypothetical sites near Swansea. Two locations were considered: one on the edge of the city and another 10 miles to the north with variations in site size and habitat type (woodland versus mixed habitats). The findings indicated that proximity to urban areas increased recreational value per hectare, with sites closer to Swansea generating more visits and higher overall value. While larger sites attracted more visitors, the value per hectare decreased, suggesting diminishing marginal returns as site size increases. Additionally, sites with mixed habitats (including woodland, grassland, and moorland) attracted slightly more visitors and had a marginally higher value per visit. However, the authors note that this result should be interpreted with caution, as the presence of existing accessible woodlands nearby may reduce the perceived additional value of new woodland. Overall, the study highlighted the importance of location and habitat diversity in maximising the recreational benefits of woodland creation, particularly in the context of developing a National Forest.

3.4.1. Barriers that forest services face

Forest Research identified key barriers to tourism in the UK forestry sector through interviews with forestry planners, managers, and tourism enterprises across regions including the Dyfi Valley in Wales, Suffolk Coasts and Heaths in the East of England and the Great Glen in the Scottish Highlands (Martin, 2007). A major challenge was the limited collaboration between woodland enterprises and land managers, which restricts effective planning, marketing, and management of woodlands for tourism. The study highlighted the need to raise awareness among both woodland managers and tourism stakeholders about the potential of forest resources. Stronger partnerships were seen as important for improving the accessibility, diversity, and depth of visitor experiences. For example, an enterprise in the Dyfi Valley emphasised that closer ties with the tourism sector could lead to a wider range of products and services available to visitors, more meaningful tourist engagement, and improved access to services. Key areas for partnerships included product development, marketing, information sharing, and training in land management for tourism.

In a more recent summary, Forest Research (2022) highlighted that similar issues still remain. The source also expands on this to highlight how there are limited resources and

systems to support business innovation and entrepreneurship, Additionally, the source suggested a lack of clear and effective information on the values of and good practice in woodland tourism, including how to promote the role of woodlands in supporting the social, environmental and economic sustainability of the tourism sector.

The summary also recommended a strategic and inclusive landscape-scale approach to woodland tourism provision. It suggested that a more holistic approach should be taken by facilitating interactions between stakeholders' resources. For example, by developing processes for sharing knowledge and skills between local communities, businesses and land managers.

3.4.2. Barriers for forest businesses and owners

More general barriers identified in the literature that forest businesses and owners may face when looking to capitalise on NWFPs or services in their woodlands include:

- tourism exerts large pressure on forests ecosystems (Forest Europe, 2019) from increased traffic and visitor numbers
- survey evidence showed mixed opinions on using wood and wood-based products, with some concerned about forest overuse (Pichlerová and others, 2023).
- Forest Europe (2019) suggest that a future challenge may be to balance traditional forest goods and services with new ones.

Addressing these barriers requires consideration of the broader policy context and the principles guiding natural resource use in Wales. The Welsh Government's Natural Resources Policy is underpinned by the principle of Sustainable Management of Natural Resources (SMNR), which seeks to ensure that ecosystems are managed in a way that maintains their resilience and productivity for future generations (Welsh Government, 2017). This approach is particularly relevant when developing opportunities around NWFPs, as it emphasises the need to harvest only what nature can regenerate. Therefore, any future use of these resources in Wales must align with SMNR principles to protect biodiversity, support long-term economic viability, and ensure that forest ecosystems continue to deliver benefits year after year.

3.5. Examples of initiatives in Wales

The following sections provide examples of projects that have supported or affected Welsh businesses highlighted by Ćosović (2015) as well as initiatives funded by the European Union, where unpublished sources are available on request from Llais y Goedwig.

3.5.1. StarTree

The StarTree project, launched in 2012 under the EU's Seventh Framework Programme (FP7), was a four-year research initiative coordinated by European Forest Institute (StarTree, 2019). It aimed to boost rural development and the European bioeconomy by focusing on wild NWFPs, as well as multi-purpose trees. Rather than presenting specific findings, this section outlines the project's scope and activities as this was what was available at the time of writing.

The project sought to improve the management, marketability, and profitability of NWFPs by performing a full value chain analysis from resource to consumer (European Forest Institute, 2019). It involved research in 14 case study regions across Europe with a diverse range of actors, networks, habitats and markets. In West Wales and the Valleys, the project looked at four areas with potential for development:

- useful fungi and lichens
- trees for bees
- native bluebells
- woodland inventory toolkit

Further research on StarTree is identified in section 3.6.

3.5.2. Dewis Gwyllt

The Dewis Gwyllt (Wild Choice) project was a three-year initiative launched to explore the potential of NTFPs in Wales (Dewis Gwyllt, 2024). Funded by the Welsh Government and the EU under the Rural Development Programme for Wales 2014-2020, the project was led by Llais y Goedwig (LlyG), a grassroots network aiming to promote and support community woodland groups (CWGs) across Wales.

3.5.2.1. Project Initiatives

The primary aim was to assess whether a fully certifiable supply chain for woodland products could be developed and operated by a social enterprise, while also supporting economic, environmental, and social sustainability (Jones, 2022 [footnote 2]).

The project focused on a range of forest products including birch sap, wild garlic, elderflower, essential oils, and tree seeds (Jones, 2022). It sought to empower community groups and private landowners to sustainably harvest and market these resources, thereby creating new economic opportunities and encouraging better woodland management practices.

Despite substantial disruption caused by the COVID-19 pandemic, the project achieved many of its objectives and generated valuable insights into the opportunities and challenges associated with forest-based enterprises (Jones, 2022).

3.5.2.2. Project Outcomes

According to the project evaluation report, the Dewis Gwyllt project provided a valuable platform for businesses to explore the potential of forest products in developing innovative, locally sourced goods (Jones, 2022). Notable examples include Portmeirion Restaurant, which incorporated Welsh Birch Syrup into its menu, and Red Boat Ice Cream, which experimented with a new flavour using the same ingredient. The authors reported that though not all products reached commercial scale, these trials demonstrated the potential

Footnotes

[2] Unpublished. Report available on request from Llais y Goedwig: info@llaisygoedwig.org.uk

for innovation and market differentiation through the use of local, sustainably sourced ingredients.

The authors found that a key strength of the project was the marketing value of the local origin and story behind the products, as well as community involvement (Jones, 2022). Businesses appreciated the ethical and artisanal qualities of the products, which aligned with growing consumer interest in sustainability and local sourcing. This added value allowed some products to charge premium prices and enhanced the brand identity of participating businesses.

Moreover, the report found that the groundwork laid by Dewis Gwyllt encouraged several businesses to express interest in future collaborations (Jones, 2022). Many indicated that they would be open to continuing partnerships if issues around supply consistency and regulatory compliance could be addressed.

The project report also demonstrated that forest products can offer meaningful economic opportunities for small-scale producers (Jones, 2022). Four community woodland groups generated income through the sale of birch syrup and tree seeds. In addition, the authors noted a demand for products such as elderflower and birch syrup, with businesses like Mydflower showing interest in purchasing if the supply could be scaled appropriately.

Lastly, the project invested in capacity building by training over 50 individuals and organisations in harvesting, processing, and marketing forest products (Jones, 2022). According to the report, this increased the resilience of community woodland groups and laid a strong foundation for future economic activity in the sector.

3.5.2.3. Challenges and Lessons from the Evaluation of Dewis Gwyllt

Several barriers hindered the full commercialisation of forest products, according to the project report (Jones, 2022). One of the most considerable challenges recorded was the inconsistency and limited volume of supply. Many community groups lacked the capacity to harvest at scale, and the seasonal nature of the products further constrained availability. The pandemic further exacerbated these issues by disrupting harvests and delaying engagement with both producers and buyers.

Regulatory and accreditation requirements were also found to pose challenges (Jones, 2022). For example, food safety standards such as the SALSA accreditation were necessary for commercial sales but were beyond the ability of most groups. Additionally, logistical challenges related to storage, transport, and quality control created further obstacles.

Moreover, the authors found that volunteer fatigue and limited interest in commercialisation among some community groups emerged as barriers (Jones, 2022). Many participants viewed their involvement as a hobby rather than a business venture, and some were restricted by lease agreements that banned commercial activity.

In summary, the report concluded that factors such as supply chain coordination, accreditation, and group capacity had limited the scalability of the Dewis Gwyllt project. It

highlighted the need for centralised support and infrastructure to ensure the future viability of similar models. Despite the substantial challenges posed by the pandemic, the project was found to have successfully demonstrated in proving the concept. Additionally, the authors noted that the project contributed to a better understanding of the economic potential of forest products in Wales, showing that businesses can develop innovative, sustainable products that support local economies

3.5.3. Good From the Woods

In 2022, LlyG launched the Goods From The Woods project, funded through the Welsh Government and EU Rural Development Programme's Co-operation and Supply Chain Development Scheme (CSCDS) (Jones and Wild, 2023 [footnote 3]). This project aimed to address gaps in support for CWGs and woodland-based businesses, as identified in a previous initiative, Dewis Gwyllt.

3.5.3.1. Project Initiatives and Outcomes

Goods From The Woods undertook two key initiatives during the project: the development of CoedNet and participation in a pilot for an FSC (Forest Stewardship Council) group accreditation scheme (Jones and Wild, 2023). FSC is a non-profit organisation, which verifies the responsible sourcing of forest products. However, the group accreditation scheme was still in its early stages by the end of the project timeline, making it difficult to assess its overall impact.

A key achievement of the project was the creation of CoedNet, a cooperative online platform (Jones and Wild, 2023). Originally conceived as an e-commerce site for woodland products, the platform was restructured into a directory due to project delays and a condensed delivery schedule. CoedNet now functions as a live, map-based directory featuring 36 woodland enterprises. It offers links to websites, social media profiles, and contact information, connecting customers with community woodland groups and businesses.

As part of the evaluation of Goods From The Woods, researchers conducted a survey of CoedNet participants in 2023, alongside a series of semi-structured interviews with key stakeholders (Jones and Wild, 2023). These included four CWGs, eight woodland businesses, three project officers, one commissioner, and one additional stakeholder.

Researchers found that over 40 woodland enterprises, including at least 12 CWGs and 28 businesses, had joined CoedNet within the first month of its launch (Jones and Wild, 2023). This early uptake was interpreted as evidence of strong engagement and proof of concept for a unified online platform to market Welsh woodland products. The diversity of participants and the involvement of private sector businesses were seen as indicators of the platform's broad appeal and potential sustainability.

Footnotes

[3] Unpublished. Report available on request from Llais y Goedwig: info@llaisygoedwig.org.uk

It was reported that feedback from stakeholders was overwhelmingly positive (Jones and Wild, 2023). Participants praised the platform's design, usability, and especially the interactive map feature, which was highlighted as a valuable tool for connecting woodland enterprises across Wales. Despite some underrepresentation in mid-east Wales, the geographical spread of users was considered by interviewees as impressive. Several noted that the platform could facilitate networking and collaboration, with interest expressed in both online forums and in-person events.

The evaluation also identified a number of benefits (Jones and Wild, 2023). For example, users reported that CoedNet enabled new supply relationships, such as wood turners connecting with sawmills or CWGs finding tree surgeons. These connections were seen as enhancing the resilience and integration of the woodland sector. Additionally, the platform supported the dissemination of training and information, including links to initiatives like Plant Healthy, which are expected to contribute to more sustainable woodland management practices.

Interviewees from both CWGs and businesses believed that CoedNet had the potential to increase footfall, sales, volunteering, and public engagement (Jones and Wild, 2023). They also highlighted the legacy value of the education and skill-sharing components of the project. There was a shared appetite for the formation of new networks, which could either evolve into future projects or be integrated into LlyG's ongoing activities. Furthermore, several training sessions were recorded and made available online, extending the project's reach and impact.

Overall, the evaluation concluded that CoedNet has successfully demonstrated the viability of a national platform for woodland enterprises in Wales. It has fostered collaboration, supported sustainable practices, and laid the groundwork for future community-building and sector development.

3.5.3.2. Challenges and Lessons from the Evaluation of Goods From The Woods

Researchers evaluating the Goods From The Woods project identified several challenges that impacted the implementation and outcomes of the CoedNet platform (Jones and Wild, 2023). One key issue was the lower than expected engagement from CWGs. Although approximately one-third of CWGs with goods or services for sale joined the platform, overall participation fell short of initial targets. The evaluation was unable to determine definitive reasons for this, but researchers suggested that the volunteer-led nature of most CWGs, and their preference for practical, outdoor activities, may have contributed to the limited uptake.

In contrast, private woodland businesses showed greater-than-anticipated interest, which helped balance the overall engagement and ensured that key project outputs were met (Jones and Wild, 2023).

Some users raised concerns about accessibility and clarity of the CoedNet platform (Jones and Wild, 2023). For instance, a few beneficiaries noted that the Welsh language option on the platform was not easily visible, and others felt that the platform's design did not clearly

communicate its Welsh identity. These insights may inform future development under LlyG's stewardship.

The evaluation also highlighted several elements from the original funding proposal that were not realised (Jones and Wild, 2023). These included the absence of a stakeholder steering group, the non-establishment of produce hubs, and the fact that CoedNet functioned as a directory rather than a transactional marketplace. Researchers noted that the compressed project timeline, reduced from 18 to 10 months due to delayed funding and recruitment, was a constraint. This limited the ability to implement and evaluate key components, such as the proposed group accreditation scheme, which could have provided valuable insights into the relationship between accreditation and market access.

In conclusion, researchers found that while the project successfully demonstrated early engagement from woodland businesses and delivered a functional, well-received platform, it faced challenges related to CWG participation, project scope, and time constraints. According to the report, the findings underscore the importance of adequate planning, stakeholder engagement, and sustained investment in marketing and governance for future initiatives. Although it is too early to assess long-term impacts, the lessons learned provide valuable guidance for the development of similar woodland enterprise networks in Wales.

3.5.4. LEADER

LEADER was a European Union initiative, launched in 1990, aimed at supporting rural areas with low GDP (Roncevic and others, 2020). A form of community-led local development, LEADER centred on developing and implementing local development strategies to foster economic and social cohesion, often focusing on adding value to local products (Ćosović, 2015). These strategies were executed by local action groups. Over the years, LEADER evolved through several stages and became a cornerstone of the EU's rural development policy. For the Programming period 2014-2020, LEADER was funded by the European Agricultural Fund for Rural Development (EAFRD), and strove to promote entrepreneurship, growth, employment, and environmental sustainability in rural regions. The remit of LEADER funding meant that it could support businesses to explore how they can profit from NWFPs and services. Two examples of Welsh projects funded through LEADER were Fine Pluck and Out to Learn Willow which are discussed further below.

Fine Pluck offers locally grown tea packets blended from various plants, a foraging poster with information on picking Welsh herbs, and courses on foraging, tea growing, processing, and blending (Ćosović, 2015).

Out to Learn Willow offers a variety of workshops and courses, including traditional willow crafts, dried willow weaving, and planting living willow structures (Ćosović, 2015). Their target groups include primary and secondary schools, community groups, youth services, and other voluntary and statutory agencies.

Sub-sections 3.5.5.1 to 3.5.5.5 highlight factors that support the success of activities promoting NWFPs and services from the wider literature and supported by evaluations findings from LEADER and its relevant initiatives.

3.5.5. The role of knowledge, institutional support and cross-sectoral cooperation

Researchers suggest that knowledge, skills, and physical and monetary resources are crucial for successful innovation in NWFPs and Non-Wood Forest Services (NWFSs) (Niskanen and others, 2007).

3.5.5.1. Role of education and knowledge

Ćosović (2015) found that education is vital for innovative businesses, equipping stakeholders with essential knowledge for production, marketing, legal compliance, and creativity. For example, in an interview, Fine Pluck's owner stated how they leveraged their educational background to manage the project independently, saving time and money. Similarly, Out to Learn Willow talked of their expertise in marketing, social networking, graphic design, and willow planting.

Moreover, Out to Learn Willow valued both traditional and contemporary knowledge in their business, which Schreckenberg and others (2006) expresses is vital for understanding community needs and successfully commercialising NWFPs. The business emphasised traditional willow weaving skills in their courses and workshops, creating baskets, coffins, and other crafts (Ćosović, 2015). Additionally, they incorporated contemporary knowledge in making willow sculptures and advertising their company. Ćosović (2015) stated that continuous learning and improvement of this knowledge is necessary for success in innovative NWFP businesses.

3.5.5.2. Role of institutional support

According to Wolfslehner and others (2016a) realising the potential of forest and woodland businesses depends on overcoming obstacles faced by enterprises and receiving adequate support from public administration and private bodies.

The LEADER policy tool supported NWFP projects by offering financial aid, advice, network building, and educational resources (Ćosović, 2015). The owners of Fine Pluck highlighted that support from LEADER was vital for starting and developing their business, providing approximately £3000 in funding, including £1500 for a water filtration system. They also stated that they received valuable information and guidelines from the European Herbal Infusions Association (EHIA) and advice from local food safety authorities. Moreover, the LEADER grant boosted Out to Learn Willow's business development by funding essential equipment and tables, while also expanding their network. The business also collaborated with the local council on cultural heritage initiatives, hosting free workshops.

Ćosović (2015) highlighted that government support, while important, is complemented by the business owners' knowledge and efforts. A certain level of knowledge is essential to secure and apply for financial support.

3.5.5.3. Features of institutional support

Wolfslehner and others (2016a) published a study on the state of NWFPs in Europe, based on StarTree research and sector mapping. The report observed the following common features of support to promote the use of NWFPs for business purposes.

1. Rural Development Plans: These plans, including the LEADER+ programme, supported rural economic growth and innovation by funding NWFP enterprises.
2. Regional Policies: Many regions implemented specific policies to support small businesses in developing and marketing NWFPs, with a focus on products such as mushrooms, pine nuts, cork, chestnuts, and honey.
3. Research and Innovation: National and regional research and innovation policies advanced use of NWFPs through targeted scientific research and specific programs, such as those for mycology, chestnut tree health, and renewable resources.
4. Local Economic Support: Regional policies often aimed to support local economies and job security, fostering research and development activities that broadly linked to NWFPs. For example, in West Wales and The Valleys, regional policies focused on job security by developing the local food sector through grant schemes.

3.5.5.4. Role of cross-sectoral cooperation

Forest Europe (2019) contend that cross-sectoral cooperation among various stakeholders, such as tourism associations, insurance companies, NGOs, and sporting associations, is essential for enhancing regional development. Ćosović (2015) also highlighted that the engagement of many actors from different sectors was crucial for the success of the business, especially for the Welsh willow weaving company for the exchange of knowledge and experience. Fine Pluck also engaged with many sectors such as food technology, culinary, trade, and the hospitality and education sector.

3.6. Opportunities for woodland products

More recent evaluations such as the StarTree project found that there is an opportunity to better connect NWFPs with growing trends in organic goods and nature-based solutions (Wolfslehner and others, 2016b). Traditional products could be well-positioned for revival and innovation within the bioeconomy, while also supporting the preservation of traditional lifestyles and subsistence-based economies. A subsidence-based economy is one in which people produce goods mainly for their own use rather than for profit (Cambridge Dictionary, n.d.). Balancing these could help create sustainable, multifunctional forests for the future. Furthermore, Forest Europe (2019) stated that a future challenge may be to combining traditional forest goods and services into new appealing packages.

Looking at Wales, StarTree found that interest in fungus foraging and farmers' markets was growing, with local jams and preserves gaining popularity (European Forest Institute, 2019). Events like apple days promoting Welsh apple branding for cider and outdoor activities such as horse riding, mountain biking, and bushcraft were observed as being popular in some areas. This indicates there is a potentially growing market for products made from NWFPs and involvement in activities happening in woodlands.

3.7. Opportunities for woodland services

Forest Research listed some tourism uses of woodlands with development potential (Martin, 2007). While this source is outside of the literature search parameter, it was the most detailed material that could be identified in the search, therefore there may be activities already happening or have happened that are realising these opportunities. The opportunities for development are as follows:

- overnight stays in woodland accommodation
- cultural and heritage activities based on local woodland
- activities focused on woodland ecology
- sports and adventure activities
- health and well-being activities
- purchasing woodland materials and products.

Forest Research also highlighted the added value businesses can benefit from through diversifying the services they provide. For example, accommodation providers have added value by offering guided tours, activities, evening meals, and local products. This diversification creates a broad range of services and activities that make up the overall tourism product.

Moreover, research found that the demand for NWFPs has increased due to higher living standards and a preference for natural, safe, and healthy items, especially among European consumers (Rovira and others, 2022). The authors suggest that the tourism sector can capitalise on this preference for natural items by offering wild and traditional products and activities in rural areas which in turn can make these destinations more attractive to visit. As a result, this could boost the consumption of NWFPs and woodland experiences. Local providers of forest activities can generate revenue by offering a range of services, such as guided excursions, educational or therapeutic programmes, workshops, and seminars, as well as diverse forest-based packages like overnight accommodations (Forest Europe, 2019). These services cater to the growing interest in nature-based experiences and contribute to the economic development of rural areas.

The delivery of woodland services or encouraging the use of NWFPs by the public and tourists could benefit from specific job roles to implement this. Research has shown that new career opportunities have emerged for forest guides, forest educators, and healthcare professionals, particularly in countries like the United Kingdom (Forest Europe, 2019). Women have shown high interest in these roles, which could challenge the traditionally male-dominated sector and promote gender balance. This shift not only opens up new job prospects but also supports the development of inclusive and diverse services in the forest-based tourism industry.

In summary, NWFPs and services provide opportunities to develop tourism services through diversifying offerings to include experiences specific to the local area, capitalising on the

demand for NWFPs, generating revenue through forest activities, and creating new career opportunities that promote gender balance and inclusivity.

3.8. Conclusion

3.8.1. How have businesses capitalised on forest products and services to support the economic growth of their business?

Available evidence suggests that the amount of NWFPs available in Wales may be more limited than in other countries. Evidence identified through this literature review suggest this may be because of the low proportion of afforested land in Wales compared with other countries which limits the availability of NWFPs.

For Wales specifically, the evidence identified in this literature review was limited regarding the potential barriers to capitalising on NWFPs. There have been some examples of initiatives in Wales that have aimed to develop the management, marketability and profitability of NWFPs such as the StarTree project, Dewis Gwyllt and Good for Woods. Evaluations of the latter two projects identified the meaningful economic opportunities NWFPs can offer small-scale businesses and the importance of building networks to support selling products and sharing information amongst woodland businesses. There appeared to be less interest from community woodland groups to commercialise NWFPs and engage with these initiatives compared with small businesses.

Additional projects in Wales were highlighted through the LEADER programme which identified the importance of educating businesses with the knowledge they need to produce and market their products and the role of institutional support through government funding. Cross-sector engagement was also highlighted as key to the success of projects, important collaborations included with tourism associations, insurance companies, food technology and trade sectors.

In general, the literature review highlighted few examples on how businesses in Wales have capitalised on NWFPs and services. The evidence base would benefit from more research and evaluations of business activities in this space.

3.8.2. What economic opportunities have forest products and services provided to local businesses?

Available evidence suggests that NWFPs can support opportunities for job creation, boost the incomes of landowners and rural businesses which in turn can boost rural development. The evidence identified in this literature review highlighted that NWFPs can provide considerable economic value in Europe. Although their value is less than the market value of wood products and will vary by product type.

Research suggests opportunities for NWFPs are well-positioned to take advantage of the growing trends in organic goods and nature-based solutions. Specifically in Wales, evidence has found increased interest in products made from NWFPs and therefore a potential market that could be harnessed.

Multiple sources of evidence have been identified through this literature review on the opportunities to economically benefit from offering services such as outdoor recreation activities in woodlands and the revenue that can be generated through tourism. Research has highlighted the importance of woodland location and habitat diversity in maximising the recreational benefits of woodlands.

Opportunities to take advantage of tourism uses of woodlands identified in the literature include overnight stays, cultural and heritage activities, sport activities and health and well-being activities. There is a growing interest in nature-based experiences which woodland businesses can take advantage of and in turn contribute to the economic development of their local area through the visitors and tourists they attract.

3.8.3. What barriers have local businesses faced in capitalising on forest products and services?

Generally, barriers to capitalising on products fall into one of two categories:

- issues with data quality and coverage
- challenges in commercialising NWFPs compared to other business products

Issues with limitations in the data include:

- inconsistency of official reporting through inconsistent units of measurement and the diversity of NWFPs and their site-specific nature which further complicate classification and integration into national forest surveys.
- issues related to limited available information in some areas - some researchers say this may skew findings and lead to an underestimation in their economic value

NWFPs can be more difficult to commercialise than other business products. Research suggests that success can vary by factors like product type and market conditions and requires a long-term approach including good knowledge of the market as well as good management of natural resources.

Barriers identified in the evidence to capitalise on woodland services include:

- barriers to tourism in the forestry sector including insufficient or underestimated resources to support tourism
- marketing challenges
- the need for better collaboration between forest and tourism stakeholders

Barriers for woodlands specifically including pressures on forest eco-systems and balancing the offering of traditional forest good and services with new ones.

4. Findings – health and social benefits of woodlands and trees

This section is structured to move from a broad overview of global mental health challenges to a focused examination of how forests support psychological health and wellbeing. It introduces key theories and conceptual models, and explores three primary pathways known as mitigation, restoration, and capacity building, through which forests are understood to provide mental health benefits. The discussion then shifts to the physiological health impacts of forest exposure and highlights the interconnectedness between mental and physical health. Following this, this findings section examines the influence of cultural and social values, as well as the structural and contextual factors that shape the health and social benefits derived from forests. Finally, the section concludes by exploring the motivations behind forest visits.

4.1. Psychological health

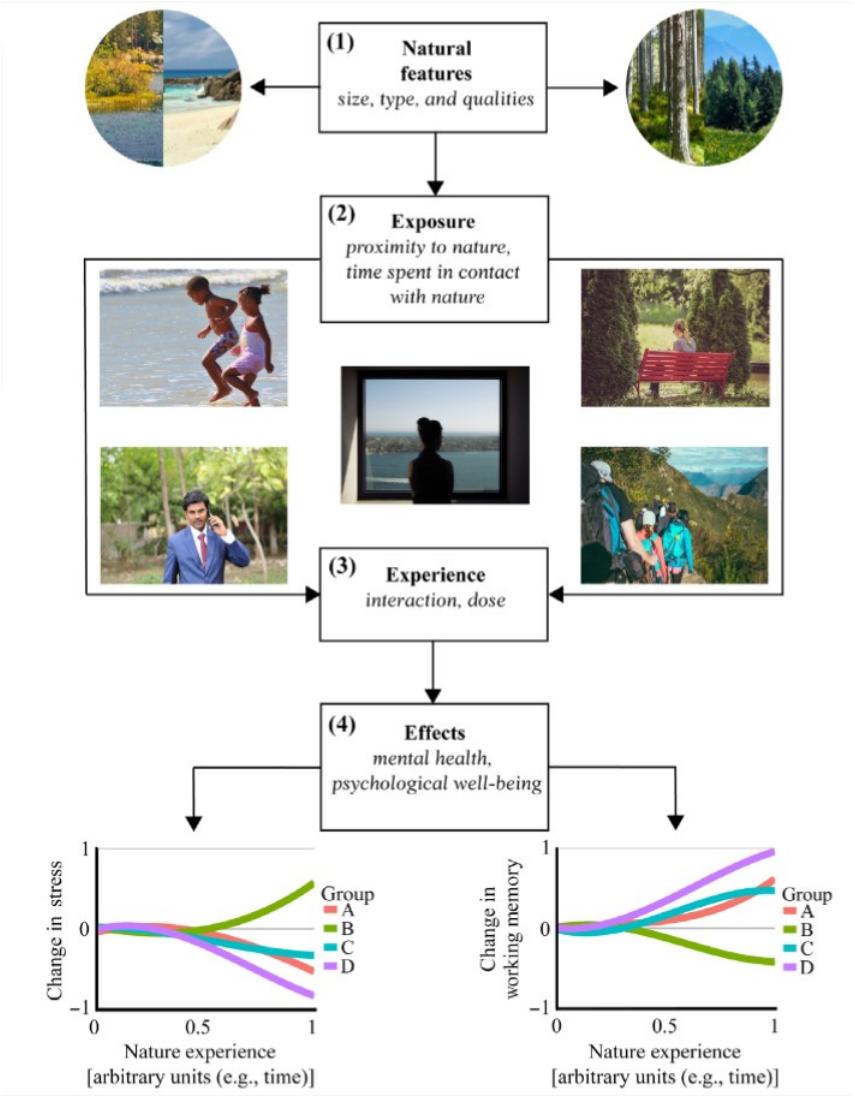
Existing research studies identified a range of factors that have contributed to a global rise in mental health conditions such as stress and anxiety including increasing urbanisation, sedentary lifestyles, virtualisation of social relationships, insecure employment, climate change, and conditions like the COVID-19 lockdown have led to a rise in mental health conditions (Doimo and others, 2020). Stress is considered a major contributor to noncommunicable diseases. These are defined as illnesses that are not transmitted from person to person but caused by lifestyle factors (WHO, 2024). Examples include cardiovascular, metabolic, immunological, oncological, and psychiatric disorders. Therefore, research suggests measures for stress recovery and the promotion of healthy lifestyles have become crucial for the health of the population (Doimo and others, 2020).

In this section psychological health includes both mental health conditions and broader emotional, psychological and social well-being in line with World Health Organisation definitions (WHO, 2022). Psychological well-being includes various affective and cognitive components such as happiness, self-actualisation, resilience and healthy relationships (Bratman and others, 2019).

The number and variety of forest-based initiatives for health and wellbeing have grown worldwide. Examples include: Shinrin-Yoku (forest bathing), forest trails, forest therapy, forest schools and more (Forest Europe, 2019; Doimo and others, 2020).

According to Beute and others (2023), to understand why and how different green spaces provide psychological health benefits, studies need to examine specific and measurable features of these spaces. Bratman and others (2019) proposed a conceptual model for the mental health effects derived from nature experience that included the features of the space as depicted in figure 4.1. The model has three components: the natural environment (e.g. parks, forests), the amount of exposure, and the type of exposure (direct or indirect) with this factor being the most important. Exposure refers to the amount of contact that an individual or population has with nature. Later models also include the experience of nature, and sensory experiences and engagement with green spaces (Beute and others, 2023).

Figure 4.1 Bratman and others (2019) conceptual model for mental health as an ecosystem service

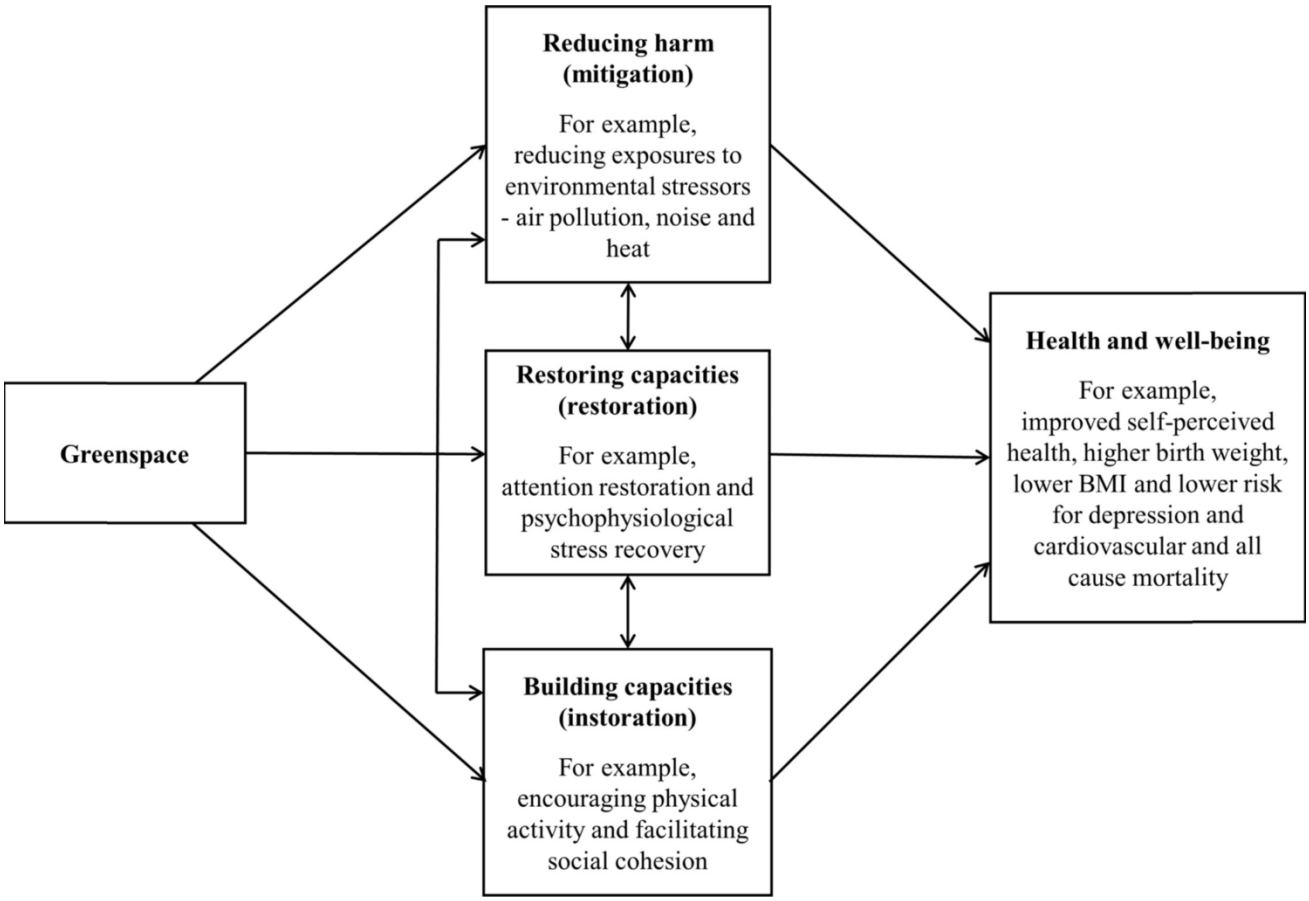


Source: Bratman and others (2019)

Description of figure 4.1: The model begins with natural features (like size, type, and quality of nature), which affect a person's exposure (proximity and time spent in contact with nature). This leads to experience (interaction and dose), which ultimately impacts mental health outcomes, such as reduced stress and improved working memory.

Markevych and others (2017) also identified three pathways through which green spaces benefit health in both the short and long term: mitigation, restoration, and building capacities. The following sections are organised to describe these pathways in further detail – the conceptual model is shown in figure 4.2.

Figure 4.2 Markevych and others (2017) conceptual model for the three domains of pathways linking greenspace to positive health outcomes.



Source: Markevych and others (2017)

Description of figure 4.2: The model shows the three pathways in which greenspace can impact health and well-being. It reduces harm by reducing exposure to environmental stressors like air pollution and noise (known as mitigation), restores mental and physical capacities through stress recovery and attention restoration (known as restoration), and builds capacities by encouraging physical activity and social connection (known as instoration). These combined effects lead to better health outcomes, including improved self-rated health, lower depression risk, and reduced mortality.

4.2. Mitigation

The mitigation pathway suggests that exposure to green spaces may support better mental health by reducing harmful environmental exposures, such as air pollution. However, the evidence for this pathway remains mixed (Beute and others, 2023). For instance, air pollution has been linked to poor mental health outcomes (Klompmaker and others, 2019). Green spaces often have lower levels of air pollution due to the absence of major emission sources like traffic (Markevych and others, 2017), and vegetation can help remove pollutants such as ozone and particulate matter (Tyrväinen and others, 2005).

However, the relationship between vegetation and air quality is complex. Vegetation type plays a critical role as some species act as pollutant sinks, while others emit biogenic volatile organic compounds (BVOCs), which can contribute to the formation of secondary pollutants like ozone and particulate matter under certain conditions (Pacifico and others, 2009; Su and others, 2011; Cao and others, 2020). Additionally, vegetation can influence air dispersion: dense or poorly placed vegetation may create barriers or 'urban canyons' that trap pollutants, potentially increasing local concentrations (Deshmukh and others, 2018). Factors such as emission height, vegetation density, and distance to human receptors also affect pollutant dispersion and exposure levels (Nowak and others, 1998).

Conversely, BVOCs can also offer health benefits. In a review, Kuo (2015) found that natural environments are large sources of BVOCs, which can lead to various health advantages for instance:

- many plants release phytoncides, which reduce blood pressure and boost immune function
- forested and mountainous areas have high concentrations of negative air ions, which can reduce depression
- and increased exposure to microbial biodiversity in these environments can improve immune system functioning.

These findings show mixed evidence on how vegetation characteristics and urban design influence both air quality and health outcomes. Overall these findings are mainly relevant to forests and greenspaces within urban areas, so findings should not necessarily be translated to forests more generally. Generally, the evidence above suggests that woodlands can mitigate against harms such as air pollution but this mitigation pathway may be more complex within urban environments.

4.3. Restoration

Restoration in this context refers to the psychological recovery process that occurs in natural environments (Probst and others, 2024). This section explores various theories and empirical studies that highlight the restorative benefits of nature.

Theoretical frameworks are relevant as they provide a foundational understanding of how nature facilitates psychological restoration and wellbeing. Multiple studies (Sonntag-Öström, and others, 2014; Forest Europe, 2019; Výbošťok and others, 2024) have outlined how the restorative capacity of natural environments can be explained by theories such as attention restoration theory (Kaplan, and Kaplan, 1989) and stress reduction theory (Ulrich, 1983). Both theories agree that natural green environments are beneficial for restoration of depleted cognitive and emotional resources (Forest Europe, 2019). Attention restoration theory suggests that these environments can improve performance in cognitive tasks due restoration of attention that has depleted as a result of completing everyday tasks (Forest Europe, 2019). Similarly, stress reduction theory suggests that natural environments, such as forests, cause positive emotional and physiological responses. It suggests that exposure to nature triggers a shift towards a more positive state of wellbeing, enhancing attention and conscious processing (Výbošťok and others, 2024). Research suggests that attention

restoration has the potential to decrease accidents resulting from mental fatigue as well as enhance impulse control which can mitigate risky health behaviours such as smoking, overeating, and substance abuse (Wagner and Heatherton, 2010 cited in Kuo, 2015). A more recent theory, the Calm and Connection Theory (Grahn and others, 2021), states natural environments can support cognitive and emotional recovery processes by inducing feelings of security.

Several studies have compared the restorative effects of natural and forest settings with those of urban environments. These comparisons are crucial as they can illustrate the restorative benefits of natural environments to enhance psychological wellbeing, compared with urban settings. For example, a systematic review conducted by Bowler and others (2010) compared studies on measurements of health or well-being in natural (such as woodland and forests) and synthetic environments (such as indoor and outdoor built environments). It found that short visits to parks, urban woodlands, and forests reduced negative emotions like anger and sadness and enhanced psychological stress recovery. A Japanese study by Lee and others (2014) found that forest environments compared with urban settings enhanced the psychological benefits of physical activity. After walking in forests, participants experienced less tension, anxiety, anger, fatigue, and confusion. They also felt more comfortable, calm, and refreshed compared to after walking in an urban setting. It's important to note that this study had a small sample size (48 participants) with only male participants, which presents limitations when generalising the findings.

Using a similar sized sample (51 participants) of female participants, Stigsdotter and others (2017) compared urban and forest environments in Denmark, indicating that walking in a forest had more restorative qualities than in an urban environment. This was shown through improved self-reported mood and higher perceived restorativeness, measured through the Profile of Mood State (POMS) questionnaire and the Perceived Restorativeness Scale (PRS) (Forest Europe, 2019).

Empirical studies have explored various ways to measure restoration. For instance, using a nationally representative survey of the English population, White and others (2017) explored the relationships between three types of exposure to natural environments and four components of subjective wellbeing (SWB). SWB involves how people evaluate their overall life satisfaction, the sense of meaning and purpose they place on activities, and the emotions they frequently experience. This encompasses both positive feelings, such as happiness, and negative feelings, such as anxiety. The study found that visiting nature the previous day was linked to higher levels of happiness, and more frequent visits were associated with increased feelings of life being worthwhile. This was in comparison to individuals who spent no time or very little time in natural environments. However, there were limitations, such as the use of cross-sectional data, which limits causal conclusions, and the reliance on self-reported data, which may introduce bias. The quality and type of natural environments visited were also not explored.

Case studies in this area have also been able to highlight the practical application of restorative activities in natural settings. For instance, case studies of a small-scale yoga and forest bathing retreat as well as wellbeing walk were conducted as part of the Active Forests Programme in England (Forest research, 2024b; Forest research, 2024c). The programme,

launched in 2014 by Forestry England and Sport England, promotes physical activity in forest environments. Initially, a three-year pilot focused on five large public forest sites managed by Forestry Commission England, attracting both local residents and visitors. Coordinators at each site collaborated with local sports clubs and communities to develop activities such as fun runs, bushcraft, cycling, orienteering, yoga and archery. Participants who were interviewed identified how they felt the activities improved mental wellbeing, social interaction, and physical health. Participants also noted that they felt peaceful and relaxed and expressed a willingness to continue the activities independently.

Furthermore, external factors can influence the perception and utilisation of natural environments for restoration. Pichlerová and others (2023) analysed the impact of the COVID-19 pandemic in Slovakia on the restorative effects of forests. Using a nationwide survey following the first pandemic wave, the authors demonstrated that the COVID-19 pandemic enhanced the perception of forests as high-quality restorative environments.

Research suggests there is a relationship between feeling connected to nature and experiencing psychological restoration. A study by Wyles and others (2017) used data from a large survey (4,515 responses) in England to investigate how different environmental settings (rural green and coastal environments compared to urban green) and their quality impacted on psychological wellbeing. People felt more connected to nature in environments they found restorative, and they also reported feeling more restored in places where they experienced a stronger sense of connection to nature. 'Connectedness' refers to an individual's emotional and cognitive bond with nature. Therefore, the authors concluded that connectedness and psychological restoration have a mutual (bidirectional) relationship where they both enhance each other.

In summary, a growing body of research shows that natural environments like forests, support psychological restoration by reducing stress, improving mood, and enhancing wellbeing. Theories like attention restoration theory and stress reduction theory explain how nature helps replenish cognitive and emotional resources. Empirical studies and programmes, such as Active Forests, demonstrate that both the quality of the environment and individuals' sense of connection to nature play key roles in these restorative effects.

4.4. Building capacities (instoration)

From the literature identified, building capacity relates to enhancing individuals' abilities to engage in activities that promote health and wellbeing. Examples of this concept include forests and woodlands encouraging physical activity and facilitating social cohesion (Markevych and others, 2017).

Research suggests that frequent visits to natural environments or green spaces can enhance mental health. An important factor contributing to this improvement is the increase in physical activity that can take place in green spaces (Saraev and others, 2021; Ward and others, 2023). Extensive research has demonstrated that exercise can boost mental well-being and help alleviate symptoms of anxiety, depression, and stress (Mikkelsen and others, 2017). This research indicated health benefits can be provided without direct intervention by making woodlands and forests accessible for recreational use and physical

activities. This can involve organised events like walking, cycling, and running or encouraging self-led activities that people can enjoy alone or in groups (Forest Europe, 2019).

As outlined by Forest Europe (2019), most research into physical activity primarily examine the duration and intensity of the activity, rather than the setting in which it occurs. However, they suggest nature areas can provide added value as they can offer a safe and appealing environment for physical activity, and regular exercise in these settings is linked to improved emotional well-being compared with built environments. However, not all green spaces are suitable for physical activity because of factors like size, available facilities, and the surrounding environment. More information on structural and demographic barriers to accessing green spaces can be found in section 4.8.5.

The Active Forests programme is an example of a programme aiming to promote activity in forest environments. Research including surveys, observations and interviews with individuals engaged with the programme (O'Brien & Forster, 2020) suggested that the programme successfully linked physical activity with benefits like improved mental wellbeing, social interaction, and enjoyment of nature. Evaluations highlighted the value of forest landscapes in motivating participants to stay active. For example, participants reported greater wellbeing benefits from being active in forests, including mental wellbeing and social interaction. Moreover, attractive site infrastructure, such as paths and facilities, were felt to further encourage physical activity. Due to the programme's success, it expanded to 14 forest sites in 2018, and 20 sites from 2023 to 2026 for phase three.

Woodlands and forests can also encourage social cohesion. O'Brien and Morris (2013) identify three categories where social connections during forest visits can benefit health and wellbeing: strengthening social relationships, developing new social relationships, and participation and community capacity building. These are important as loneliness can impact both physical and mental health (Forest Europe, 2019).

Examples of initiatives which support the development of social connections include Forest schools, which have been shown to improve social behaviours in children through outdoor play (O'Brien, 2009). Research suggests these initiatives foster community building, teamwork, and improve social skills, contributing to overall wellbeing. Furthermore, findings from Weinstein and others (2015) indicated that local nature was linked to lower crime both directly and indirectly through its effects on community cohesion. This could suggest that social connections fostered by natural environments can enhance community wellbeing and safety.

Forest Europe (2019) concluded that most studies in their review indicated that forest areas are positively linked to social benefits. However, the authors note the complexity of this relationship as these benefits may not be experienced equally by all social groups.

4.5. Physiological health

Forest Europe (2019) suggested that there is evidence that shows that when physical activity was controlled, forest visits can lower blood pressure, pulse rate, and cortisol levels, and suppress sympathetic nervous activity (definition in 4.5.1). However much of this

evidence base had small sample sizes and mainly compared popular recreational forests in Asia with urban environments. The authors note that cultural differences and variations in forest types between Asia and Europe may affect the health outcomes observed. Therefore, similar studies should be conducted in Europe. Research also shows that short visits to green environments also may improve cardiovascular risk factors through stress recovery.

Lee and others (2014) identified that forest-related activities may benefit health by restoring homeostasis after acute and chronic stress. The authors found forest stimuli can help relax central and autonomic nervous activities, reducing the secretion of stress hormones (cortisol, adrenaline, and noradrenaline) and improving immune function. These physiological responses to natural environments can interact, leading to positive health outcomes.

4.5.1. Heart rate variability (HRV)

One method for measuring the health benefits of spending time in forests is through HRV, a non-invasive measure of the influence of the parasympathetic nervous system (PNS) (which controls the 'rest and digest' functions of the body) and the sympathetic nervous system (SNS) (which drives the 'fight or flight' response) on the heart (de Brito and others, 2020; Latham, 2021).

Research found differences in measured levels of HRV in male and female participants. Stigsdotter and others (2017) compared the physiological impacts of urban and forest environments using HRV in female participants in Denmark. The study found no difference in HRV before and after walks in either environment. Lee and others (2014) found that walking in forests in Japan promotes cardiovascular relaxation for male participants by enhancing the parasympathetic nervous system, suppressing the sympathetic nervous system, and lowering heart rate. According to Stigsdotter and others (2017), the differing results could be due to variations in the chosen urban environments as well as possible gender difference in the response to green space.

While the previous research focused on urban and forest environments, broader green environments have also been studied. A longer-term study found that repeated walks in green environments in America elicited greater beneficial HRV responses for female participants compared to a suburban environment (de Brito and others, 2020).

Studies using HRV to measure the health effects of forest exposure show mixed results, with differences observed between genders and environments, suggesting that both context and individual factors influence physiological responses to green spaces.

4.5.2. Psychological and physiological Health

Research suggests an interconnection between psychological and physiological health. These effects often occurred together during direct contact with forests (Doimo and others, 2020). For instance, visiting a forest was found to positively influence psychological responses through the senses, reduce perceived stress, depression, anxiety, and negative emotions, while increasing vigour, recovery, and positive feelings. Physiologically, forest visits were shown to enhance parasympathetic nervous system activity, indicated by a

decrease in heart rate, and reduce stress hormones like cortisol, adrenaline, and noradrenaline (Doimo and others, 2020).

Another study summarised how chronic depression, anxiety, and work-related stress have been associated with a higher risk of cardiovascular disease (Gan and others, 2014). Given that forests can reduce stress, depression, and anxiety, it is plausible that these mental health benefits also contribute to lowering the risk of cardiovascular disease, thereby supporting overall physiological health.

4.5.2.1. Limitations of research on psychological and physiological health impacts of forests

Bach Pagès and others (2020) conducted a systematic international review of the available evidence on forest-based preventive and therapeutic interventions. The authors concluded that many systematic reviews failed to meet acceptable quality standards. The study designs, control groups, and populations in the included studies were often unsuitable for the research questions, which substantially limited their contribution to the evidence in the field.

Multiple studies have cited the lack of longitudinal research on how mental health is improved by regular visits to nature and whether short term benefits translate into longer term effects (Saraev and others, 2021; Beute and others, 2023). O'Brien and Forster (2020) also highlight that there is currently less emphasis on research on the impacts of forests on physical activity compared to mental health.

Additionally, a systematic review conducted by Bowler and others (2010) found that evidence on natural environments is diverse, often low quality, and inconclusive. These authors suggest this may be explained by earlier studies' simplistic view of natural environments, where they are combined as 'greenspace' without considering the type or quality. Similarly, Beute and others (2023) concluded that future studies should adopt a unified terminology for categorising various types of green space. This was also felt with studies referencing forest-based interventions. Bach Pagès and others (2020) stressed that there is no uniform use of the terms forest bathing (Shinrin-Yoku), forest therapy, and forest medicine. Therefore, future studies need to define and precisely describe these terms to support comparability of sites.

4.6. Social and cultural values

According to O'Brien and others (2024), cultural values are tied to the beliefs and practices that a society considers important, often expressed through oral traditions, identity, connections to places, spirituality, and symbolism. Social values, which can overlap with cultural values, are shared by communities and relate to environmental aspects like landscape aesthetics, nature connections, recreation, and biodiversity. These values are largely theoretical and are considered more difficult to quantify (Oh and others., 2017; O'Brien, and others. 2024).

Spiritual, symbolic, and sensory values of forests are important to many different people (O'Brien and others., 2024). Cloke and Jones (2002) highlighted that trees carry rich cultural

importance. Trees feature prominently in folklore and myth and our responses to trees are shaped by cultural practices and beliefs at local, national, and international levels. Often, motivations for being recreationally active in woodlands focus on the beauty and variety of the forest landscape (Forest Research, 2024b).

In the Welsh language, a notable example of the cultural magnitude of forests is found in the phrase “dod yn ôl at fy nghoed”, which literally translates to “to return to my trees.” (Hemmings, 2013). Although commonly used to describe a return to a calm or balanced state of mind, its literal meaning could point to the longstanding association between trees and psychological well-being in Welsh society.

4.7. Factors affecting health and social benefits

Research recognises there are inequalities in accessing or using greenspaces such as forests and therefore in the ability for some groups to receive these benefits (Pearson and others, 2023). The following subsection identifies literature that examines the conditions influencing health and social effects of forests.

4.8. Forest features and their impact on wellbeing

The importance of different features of forests and woodlands on the health and social benefits has become increasingly important. Many studies agree that there is a need to study relationships between specific forest features, types of activity and health to maximise benefits from forest-based initiatives. (Doimo and others, 2020; O’Brien and Forster, 2020; Bach Pagès and others, 2020; Beute and others, 2023; Clark and others, 2023; Výbošťok and others, 2024).

While limited, some research has specifically examined forest characteristics. Wheeler and others (2015) found a positive association between good health and the density of broadleaf woodlands, alongside other natural environments in the UK such as ‘improved grassland’. In contrast, coniferous woodlands were linked to both positive and negative health outcomes, but this association was only observed in town and fringe areas. Similarly, Forest Research found tourism enterprises perceived there to be distinction between ‘forests’ and ‘woodlands’ (Martin, 2007). Forests were more likely to be seen as coniferous plantations that were threatening, monotonous, lacking in wildlife and inaccessible. Whereas woodlands were pictured as being made up of broadleaved and native species, being open and accessible, supporting more wildlife and adding beauty and diversity to the landscape. These findings suggest that the health benefits of natural environments may vary depending on how individuals perceive wooded areas (i.e. as either forests or woodlands) which may be influenced by how accessible they’re viewed to be and the type of vegetation.

4.8.1. Preferences for wilderness and natural aesthetics

A study in Slovakia found specific links between subjective wellbeing and stress reduction after forest visits, and people's preferences for certain forest features and sensory experiences (Výbošťok and others, 2024). These preferences focused on the varied ages of trees and the smell of the forest. These forest features and recreational activities explained up to 20% of the increase in SWB and 12% of the variability in stress reduction.

Numerous studies have shown that people favour perceived wilderness, as evidenced by the higher aesthetic values participants assigned to areas viewed as wild or unmanaged (Ranacher and others, 2017; Derks and others, 2023)

In Vienna, a pilot study showed that study breaks in green spaces played a role in the improvement of the wellbeing and cognitive performance of adolescents. (Wallner and others, 2018). Larger green spaces, such as parks or forests, had stronger positive impacts on these measures than small parks. The results support both the stress reduction theory and the attention restoration theory. However, the authors note that the findings were influenced by the method used, as stress reduction was assessed through self-rating questions. Other forms of assessment, such as physiological measures, may have given different results.

4.8.2. Proximity and quality of forests

The proximity of forests and woodlands to people's homes is often seen as a key factor influencing visiting patterns. A study by Dallimer and others (2014) attribute more importance to the availability and closeness of forests and woodlands to visitors' homes when planning forest visits rather than specific forest characteristics. The Welsh Government has acknowledged the link between ecosystems and wellbeing in its Wellbeing of Wales indicators, specifically under 'Areas of healthy ecosystems in Wales', which recognises the importance of accessible, high-quality natural environments in supporting public health and well-being.

However, some researchers have highlighted that the relationship between proximity and well-being is more complex. For example, simply living near green space may not be enough to realise these benefits. White and others (2017) found that living in greener neighbourhoods was not associated with higher life satisfaction.

Beute and others (2023) argued that just measuring how close an individual lives to green spaces is not enough to understand their actual exposure and the consequent benefits. The authors suggest that it's unclear whether people spend time in these spaces on purpose or by chance, and how often. They found that using proximity can be misleading as if one type of green space isn't nearby, people may use a different one, like choosing a forest instead of a park.

Importantly, some individuals may not access any green space at all, even when it is close to home. Participants in several studies reported avoiding nearby green spaces due to poor quality and safety, cultural discomfort or the presence of anti-social behaviours in their local green spaces (Nordland, 2022 [footnote 4]; Ward and others, 2023). This suggests that proximity alone does not ensure access or use, particularly when local spaces are perceived as unsafe or inadequate.

Footnotes

[4] Weblink unavailable, full reference: Nordland S (2022), 'Barriers and facilitators to accessing greenspace environments as sites for health amongst marginalised groups – A systematic review', MSc Dissertation paper – systematic review, UWE.

Moreover, the evidence base identified in the review offer differing perspectives on whether health benefits from forests and other green spaces require active use. Some studies suggest that passive exposure such as simply viewing greenery can still offer psychological benefits, including reduced stress (Jiang and others, 2016). However, other research suggests that passive interactions alone may not be sufficient, and that active engagement in green spaces such as walking, is more strongly linked to improved well-being (Shanahan and others, 2016). The evidence related to this is discussed further in section 4.8.3.

Therefore, while proximity to forests and green spaces can support well-being, it does not guarantee access or use. Some evidence sources suggest that factors such as safety, quality, and active and passive engagement with these spaces play a crucial role in determining whether individuals benefit from nearby nature. Overall, the available evidence suggests that the relationship between proximity of woodlands, active use (i.e. whether it is required or not) and wellbeing benefits of woodlands is complicated.

4.8.3. Activities and interactions in forests

The type of interactions and activities with forests and woodlands can impact the health and social benefits (Výbošťok and others, 2024). Some studies have suggested that the forest environment itself, rather than the activities performed within it, encourage intense positive moods, which are important components of stress reduction theory and attention restoration theory (Výbošťok and others, 2024).

This idea stems from literature outside the search parameter, suggesting that no specific activity or type of forest is necessary to achieve psychological benefits. For example, Morita and others (2007) studied the psychological effects of forest bathing with a large sample of participants over four days. They found that moods, including hostility, depression, and liveliness, improved on the day participants visited the forest compared to a control day without a forest visit. According to the researchers. these improvements were not solely due to exercise or engaging in favourite activities but were attributed to the forest environment itself. Additionally, the beneficial effects were consistent across different types of forests and were linked to visual factors, such as simply seeing the green environment.

However, there is evidence that certain forest-based activities impact health benefits. Research by Wyles and others (2017) used data from a large survey (4,515 responses) in England to investigate how different activities impacted on psychological wellbeing. Walking, the most popular activity, was found to foster higher levels of connectedness to nature compared to 19 other activities, such as exercise, playing, food-related activities, and visiting attractions. Wyles and others (2017) suggested this aligns with Wolsko and Lindberg's (2013) category of appreciative outdoor recreation, which proposes that activities like walking immerse individuals more deeply in the natural world, leading to greater connectedness scores. The study also indicated that people felt more connected to nature during visits longer than 30 minutes. According to Wyles and others (2017), this finding mirrors a similar trend in psychological restoration, where spending an optimal amount of time in nature provides the most benefits. International evidence shows a similar trend: more frequent visits to nature are linked to lower levels of mental distress (e.g. stress and loneliness) (Saraev, and others, 2021).

One important area identified through research was green social prescribing (GSP). This is an approach that connects individuals to nature-based activities such as gardening or walking, to support mental and physical health. According to NHS England (2021), there is growing evidence that these interventions can reduce anxiety, depression, and loneliness, while also improving emotional well-being and physical outcomes like blood pressure (Coventry and others, 2021).

A recent evaluation of the NHS England Green Social Prescribing Test and Learn programme in Humber and North Yorkshire found that nature-based activities can lead to short-term improvements in mental health and well-being among adults with common mental health conditions (Darcy and others, 2025). The study showed that longer engagement, particularly over nine to twelve weeks, was linked to greater benefits in both happiness and life satisfaction. Horticultural and care farming activities were noted as especially effective. Additionally, the authors highlighted the risk that social prescribing could unintentionally widen health inequalities, particularly if groups such as people with impairments, ethnic minorities, or younger individuals are underrepresented (de Bell and others, 2024).

Therefore, available evidence suggests that the picture is mixed with some sources suggesting that the forest environment by itself can lead to positive wellbeing outcomes, whilst others suggest outcomes may be stronger when participants are more deeply connected to nature through certain activities such as walking or through longer visits. Lastly, growing evidence supports the role green social prescribing in promoting mental health, but it must be implemented inclusively to avoid reinforcing health inequalities.

4.8.4. Structural barriers to participation

Friends of the Earth (2020 cited by Ward and others, 2023) have shown that structural barriers exist which limit the possible health and social benefits, such as a limited access to green spaces due to a lack of nearby accessible areas, poor quality of existing green spaces, and the costs of traveling, parking, and necessary equipment (Pearson and others, 2023). These barriers were shown to particularly impact low-income individuals and ethnic minority groups, who are often concentrated in areas without well-maintained and safe green space (Ward and others, 2023). Similarly, limited public transport and high parking costs were identified as obstacles to continued participation in the Active Forest Programme in England (O'Brien & Forster, 2020).

Further notable work has focused on this topic such as Bell's (2023) recent project, Sensing Nature. This was developed through a two-year research project and provided insights into how landscape decision-making can become more inclusive by recognising the diverse ways people experience and engage with nature. The project explored everyday interactions with natural environments and challenged dominant sighted perspectives by embracing disability as a natural and valued part of human diversity. In collaboration with national and international partners, it promoted accessible nature experiences through creative methods and produced a range of outputs to support inclusive engagement.

The project identified three key themes in how participants with sight impairments experience nature: freedom, skill, and connection (Bell, 2023). Nature gave people a sense of freedom by helping them escape negative attitudes, move around safely, and explore new places with confidence. Participants also described nature as a "skillscape" where they developed personal strategies and sensory awareness to engage with their surroundings. The author contends that this highlights the importance of moving beyond a disability-focused view of access and recognising individuals' diverse interests and contributions. Finally, nature helped people feel less isolated and more connected to the world around them, offering comfort and companionship.

In summary, structural and social barriers limit equitable access to nature, particularly for low-income and marginalised groups. Projects like Sensing Nature highlight the importance of inclusive design and recognising diverse experiences, showing how nature engagement can foster freedom, skill, and connection when accessibility is prioritised.

4.8.5. Demographic influences on forest-based health and wellbeing

There is a growing body of research examining how demographic characteristics influence the extent to which individuals experience the health and social benefits of woodlands and forests. Age, for instance, has been shown to play an important role. White and others, (2013) found that feelings of restoration following a nature visit were lowest among those aged 16–24. However, earlier research by Thompson, and others, (2008) suggested that young adults may come to find nature more restorative as they grow older, particularly if they had positive experiences in natural settings during childhood. Supporting this, McMahan and Estes (2015) observed that older adults tend to report more positive moods in natural environments compared to their younger counterparts.

Access to green spaces is also shaped by social and cultural factors. Ward and others. (2023) highlighted that experiences and perceptions of racism and hate crimes can act as barriers, preventing individuals from visiting green spaces and, consequently, from benefiting from them. Minority ethnic groups were also found to face cultural barriers and often felt underrepresented in these environments. Similar feelings of exclusion were reported among working-class communities, who expressed a sense of not belonging in such spaces.

Social cohesion within green spaces can be challenged by differing cultural practices, motivations, and perceptions. These differences may lead to tensions over how green spaces are used and understood, sometimes resulting in the exclusion of certain groups (Ward and others, 2023).

Gender is another important factor. Wyles and others. (2017), drawing on survey data from approximately 4,500 respondents in England, found that women and older adults reported greater feelings of restoration and connectedness to nature than men and younger individuals. However, women were generally less likely to access woodlands due to safety concerns, particularly fears related to poor visibility in wooded areas (Boyd and others, 2018; Pearson and others, 2023).

Notably, the review did not identify any literature specifically addressing the experiences of individuals who identify as LGBTQIA+ in relation to woodland access or benefits.

Demographic and health-related factors often intersect. For example, older women from ethnic minority backgrounds who are in poor health are less likely to use green spaces, including woodlands. This is often due to living in more deprived areas with limited access to local green space (Boyd and others, 2018).

Moreover, access to green spaces for physical activity remains limited for groups such as wheelchair users and older adults due to barriers like uneven terrain, inadequate facilities, and poor information provision (Burns, 2008; Morris and others, 2011). Overprotective or dismissive attitudes from woodland service providers were believed to further restrict opportunities (Burns, 2008). Research in Central Europe found that wheelchair users prefer hard surfaces like asphalt or concrete for woodland trails (Janeczko and others, 2016). Despite growing awareness, large gaps remain in research on woodland accessibility for disabled people (Pearson and others, 2023). For older adults, factors such as limited mobility, poor public transport, and safety concerns, particularly among women, were found to deter use of parks and woodlands (Jorgensen & Anthopoulou, 2007).

Ward and others (2023) also emphasised the importance of inclusive green infrastructure. Interview participants reported difficulties accessing local green spaces due to disabilities, health conditions, or caring responsibilities for young children. These challenges were frequently linked to a lack of accessible features such as wheelchair-friendly paths, benches, and clear signage. The absence of basic amenities such as toilets, cafés, and information boards was also noted as a barrier. These structural issues, when combined with social inequalities, can substantially limit access and perpetuate disparities in who benefits from forests and green spaces more generally.

4.9. Motivations for forest visits

Motivations for visiting forests can vary considerably. Jorgensen and Anthopoulou (2007) found age played an important role. Through interviews, they identified that although meanings such as 'relaxation' and 'peacefulness' were commonly appreciated across age groups, older adults particularly valued urban woodlands for their connection to the past and the opportunity to immerse in the natural world.

O'Brien (2019) reported many studies on why people visit forests focus on individual motivations for physical activity. However, through the concept of 'social practice', it can be demonstrated that it is important to focus beyond the individual in interventions that encourage physical activity behaviours. The social practices perspective views individual behaviours as part of larger social patterns. These behaviours show shared meanings, as well as materials and skills used.

This social practice perspective was incorporated during research on the Active Forests Programme in England, where participants' motivations were linked to 'socially shared meanings', such as staying active, maintaining mobility and health, life transitions providing more time for personal needs, and seeking challenges (O'Brien, 2019). Participants enjoyed physical activities for mental health, social engagement, and the welcoming atmosphere of

forest sites, which women found non-judgmental compared to gyms. Other reasons for involvement included: learning effective exercise and recovery techniques, gaining knowledge and finding new activities, which links to the social practices concept of ‘competence’.

Unprecedented circumstances can also impact motivations for forest visits. An explorative study conducted in Germany on visit patterns and visitor attitudes in a peri-urban forest revealed that new motivations for visiting the forest emerged (Derks and others, 2023). It found that people used the forest as space for encounters and various social activities due to lockdown restrictions.

4.10. Conclusion

4.10.1. What psychological and physiological health benefits are associated with woodlands?

Evidence indicates that woodlands offer numerous psychological and physiological health benefits. For instance, forest environments may support physiological health by reducing stress-related indicators such as heart rate and cortisol levels. However, findings are mixed and often based on small, non-European studies, limiting their application. While some benefits appear linked to both psychological and physiological responses, further high-quality, long-term research is needed to establish these effects across different populations and settings.

Overall, forests may contribute to psychological health by reducing stress and supporting emotional well-being, particularly through direct exposure and sensory experiences. Theories such as attention restoration theory and stress reduction theory offer useful frameworks for understanding these effects, and initiatives like Active Forests suggest potential benefits linked to physical activity and social connection. However, the evidence remains mixed and varies depending on context, population, and study design. Further research is needed to clarify these relationships and ensure that forest-based interventions are inclusive and effective for diverse groups.

4.10.2. What non-health related social benefits are associated with woodlands?

In summary, the available evidence suggests that forests hold a range of social and cultural values that are meaningful to many people, though these values can be difficult to quantify. Cultural values are often expressed through identity, oral traditions, and symbolic connections to place, while social values relate to shared experiences such as recreation and aesthetic appreciation. For different communities, forest hold spiritual and symbolic importance. For example, the cultural importance of trees in folklore and myth. The Welsh phrase “dod yn ôl at fy nghoed” also could illustrate how language can reflect a perceived link between nature and psychological well-being. While more research is needed to fully understand these relationships, the evidence points to the relevance of cultural and social values in how people experience and benefit from forested environments.

4.10.3. What barriers exist that prevent engagement in woodlands?

In conclusion, current research suggests that a variety of factors may influence the extent to which individuals experience health and social benefits from forests and woodlands. These include demographic and social inequalities, the physical characteristics of forest environments, and the types of activities people engage in. While some studies indicate that being in a forest setting can support aspects of wellbeing, others argue the potential added value of specific features such as sensory experiences and activities like walking or spending long periods of time in nature. However, findings are not always consistent, and the relationships between forest exposure and wellbeing are complex. Further research is needed to better understand how these factors interact.

Furthermore, the evidence reviewed highlights that access to the health and social benefits of forests and green spaces is not evenly distributed. Structural barriers such as limited availability of nearby green spaces, poor quality environments, and the costs associated with travel and equipment can restrict access, particularly for low-income and ethnic minority communities. These challenges are compounded by demographic factors, including age, gender, and health status, which can influence both the likelihood of visiting forests and the benefits derived from such visits. Cultural and social dynamics also play a role, with some groups feeling excluded or underrepresented in green spaces.

While motivations for visiting forests are shaped by individual and social factors, including physical activity, mental health, and social engagement, broader systemic issues such as infrastructure and inclusivity remain important considerations. Overall, the evidence suggests that while forests can offer meaningful benefits, these are not equally accessible to all and addressing structural and social barriers is essential to ensure more equitable outcomes.

5. Recommendations

The following recommendations for further research can be made:

5.1. Recommendation 1:

The review highlighted limited Wales-specific evidence on how businesses capitalise on forest services and NWFPs, any barriers and the economic impacts of these services and products. To fill this evidence gap, the Welsh Government should consider commissioning targeted research to explore the economic impacts of forest-based services and NWFPs, as well as the challenges businesses face in commercialising them.

5.2. Recommendation 2:

To better understand the value of NWFPs in Wales, the Welsh Government should consider piloting new data collection methods in national forest surveys and explore ways to improve how informal NWFP gathering and use is captured. Current reporting is inconsistent and often overlooks informal use, making it difficult to assess the sector's true scale.

5.3. Recommendation 3:

The review highlighted that research is needed to develop and test standardised approaches for classifying NWFPs in ways that reflect their diversity and local context. When classifying NWFPs in Wales, the Welsh Government should consider existing classification approaches and how these can align to support classification.

5.4. Recommendation 4:

To understand the health benefits of forest-based activities over the long term, the Welsh Government should consider funding research that can examine their sustained impacts as current evidence identified in this review is limited, typically short-term, and rarely designed to track outcomes over time.

5.5. Recommendation 5:

Research has shown that social and cultural connections with nature play an important role in promoting inclusive relationships with nature and the experience of wellbeing benefits and that a person's ability to connect or engage in nature may differ depending on a range of demographic considerations. The Welsh Government should consider commissioning research into how different communities in Wales experience and value forests and woodlands, particularly the perspectives of groups who face barriers to accessing forests, such as those in marginalised or low-income communities or disabled people.

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7. Annex A

7.1. Research question:

- How have local businesses capitalised on forest products and services to support the economic growth of their business?
- What economic opportunities have wood and non-wood forest products provided to local businesses?
- What barriers have local businesses faced in capitalising on forest products and services?

7.2. Search terms

- Source: Web of Science:
    - ‘economic growth’ and ‘local businesses’ or ‘small businessess’ and ‘forest-based activities’ or ‘nature based activities’: 0 results
    - ‘economic growth’ and ‘local businesses’ or ‘small businessess’ and ‘holiday parks’ or ‘holiday camps’: 0 results
    - ‘foraging’ or ‘wild forag*’ and ‘econom*’ and ‘impact’ or ‘benefit’: 495 results, range reduction to 144 excluding non UK or Europe countries, nothing relevant
    - ‘local comm*’ or ‘local business*’ or ‘small business*’ or ‘local econ*’ and ‘impact’ or ‘benefit’ or ‘growth’ and ‘forest yoga’ or ‘bushcraft’ or ‘woodland tourism’ or ‘forest tourism’ or ‘rural craft’ or ‘nature craft’: 2 results
    - ‘local comm*’ or ‘local business*’ or ‘small business*’ or ‘local econ*’ and ‘impact’ or ‘benefit’ or ‘growth’ and ‘glamping’ or ‘animal sanctuar*’ or ‘wildlife monitoring’ or ‘nature walks’): 2 results, nothing relevant
    - ‘forest based activities’ or ‘forest based services’ or ‘woodland based services’ or ‘woodland based products’ and ‘local comm*’ or ‘local business*’ or ‘small business*’ or ‘local econ*’ or ‘economy’: 6 results
    - ‘forest yoga’ or ‘forest bathing’ or ‘nature craft’ or ‘rural craft’ and ‘economy’ or ‘business’: 15 results
    - ‘glamping’ or ‘woodland camping’ and ‘economy’ or ‘business’ or ‘local community’ or ‘economic growth’: 1 result
    - ‘glamping’ or ‘camping’ and ‘forest’ or ‘wood’: 72 results
    - ‘nature based tourism’ or ‘nature-based tourism’ or ‘ecotourism’ or ‘wildlife tourism’ or ‘woodland tourism’ or ‘forest based tourism’ and ‘local business’ or ‘local community’ or ‘local economy’: 309 results

- ‘mountain biking’ or ‘outdoor activit*’ or ‘foraging’ or ‘paintballing’ and ‘economic growth’ or ‘economic benefit’ or ‘ local economy’ or ‘economy’ and ‘wood*’ or ‘forest*’: 50 results
- ‘woodland owners’ or ‘landowners’ or ‘private business’ or ‘local business’ and ‘forest products’ or ‘forest services’ or ‘wood products’ or ‘woodland services’

- Source: Science Direct:
  - ‘forest based products’ or ‘forest based services’: 2014 to 2024, 233 results
  - ‘woodland’ or ‘forest’ and ‘economy’ or ‘growth’ and ‘non-timber’ or ‘non-wood’: 119 results
  - ‘foraging’ or ‘glamping’ or ‘activity centre’ or ‘activity park’ and ‘woodland’ or forest’: last 10 years, 1070 results
  - ‘foraging’ or ‘glamping’ or ‘activity centre’ or ‘activity park’ and ‘woodland’ or ‘forest’ and ‘impact’ or ‘benefit’ or ‘economic growth’: 368 results
  - ‘woodland’ or ‘forest’ and ‘economic activity’ or ‘economic benefit’ and ‘trail’ or ‘ecotourism’ or ‘sanctuary’ or ‘spotting’ or ‘outdoor activities’: 16 results
  - ‘forest yoga’ or ‘forest bathing’ or ‘nature craft’ or ‘rural craft’ and ‘economy’ or ‘business’: 3 results
  - ‘glamping’ or ‘woodland camping’ and ‘economy’ or ‘business’ or ‘local community’ or ‘economic growth’: 2 results
  - ‘glamping’ or ‘camping’ and ‘forest’ or ‘wood’: 107 results
  - ‘nature based tourism’ or ‘nature-based tourism’ or ‘ecotourism’ or ‘wildlife tourism’ or ‘woodland tourism’ or ‘forest based tourism’ and ‘local business’ or ‘local community’ or ‘local economy’: 119 results, last 10 years
  - ‘woodland owners’ or ‘landowners’ or ‘private business’ or ‘local business’ and ‘forest products’ or ‘forest services’ or ‘wood products’ or ‘woodland services’

- Source: ProQuest:
  - ‘forest based products’ or ‘forest based services’ or ‘woodland products’ or ‘woodland services’ and ‘econom*’: 13 results, nothing
  - ‘non-timber forest products’ or ‘non wood forest products’ and ‘econom*’ or ‘divers*’: 632 results. Last 10 years, 293 results. Regional area reduced to 134 results. Many of the results all focus on the developing world – at least with regards to NTFP or NWFP labels.
  - ‘econom*’ and ‘forag*’ or ‘nature tourism’ or ‘animal tourism’ or ‘bird spotting’ or ‘hiking’ or ‘trails’ or ‘mountain biking’, 4000+, last 10 years 2500+

- ‘forag*’ or ‘nature tourism’ or ‘animal tourism’ or ‘bird spotting’ or ‘hiking’ or ‘trails’ or ‘mountain biking’ and ‘economic impact’ or ‘economic benefit’ or ‘economic growth’ and ‘local community’ or ‘local business*’ or ‘local companies’ or ‘small business’: 9 results
- ‘agritourism’ or ‘agri-tourism’ or ‘rural tourism’ and ‘benefit’ or ‘impact’ or ‘economic’ or ‘advantages’: 1000+, regional filters down to 64, not sufficiently relevant
- forest yoga’ or ‘forest bathing’ or ‘nature craft’ or ‘rural craft’ and ‘economy’ or ‘business’: 9 results
- ‘glamping’ or ‘woodland camping’ and ‘economy’ or ‘business’ or ‘local community’ or ‘economic growth’: 4 results
- ‘glamping’ or ‘camping’ and ‘forest’ or ‘wood’
- ‘nature based tourism’ or ‘nature-based tourism’ or ‘ecotourism’ or ‘wildlife tourism’ or ‘woodland tourism’ or ‘forest based tourism’ and ‘economic growth’ or ‘economic benefit’ or ‘local economy’ or ‘economy’ and ‘impact’ or ‘benefit’ or ‘capitalise’ or ‘capitalize’: last 10 year, 224 results, too broad, nothing of use
- ‘mountain biking’ or ‘outdoor activit*’ or ‘foraging’ or ‘paintballing’ and ‘economic growth’ or ‘economic benefit’ or ‘local economy’ or ‘economy’ and ‘wood*’ or ‘forest*’: 34 results
- ‘woodland owners’ or ‘landowners’ or ‘private business’ or ‘local business’ and ‘forest products’ or ‘forest services’ or ‘wood products’ or ‘woodland services’: 286 results, last 10 years 122 results

- Source: AI Perplexity; Elicit; You.com:
  - inserted research questions and requested a Welsh / UK focus

7.3. Research question

- What psychological and physiological health benefits are associated with woodlands?

7.4. Search terms

- Source: Google Scholar; Scopus; PubMed; Science Direct
  - ‘health’ or ‘psychological’ or ‘physiological’ or ‘stress reduc*’ or ‘physical fitness’ or ‘emotional wellbeing’ or ‘wellbeing’ or ‘mindful*’ or ‘restor*’ or ‘physical health’ or ‘mental health’ or ‘forest bathing’ and ‘wood*’ or ‘forest’ or ‘green space’ or ‘tree*’
- Source: Forest Research
  - browsed publications