

Fix nature. Fix so much more.



The evidence that nature is necessary



Social and economic recovery starts here

Fix Nature.

Fix so much more

Foreword

Imagine a world where everything just works. A thriving economy, a population in good mental and physical health, emergency services that aren’t overstretched, lower household bills and a food system that’s fair and secure.

We hear so much talk of ‘fixing’ the nation. But what if the solution is in our soil, our air, our water and our wildlife?

When nature thrives, so do we. A healthy environment is necessary for our well-being, our physical health, even our economy. What food security can we hope for without healthy soil in which to grow crops? How can we manage pressures on our health service, or our economy, when too many of us are sick, or unable to work? And, in a fractured world, nature can be the glue to bring us together as communities: a common interest and common ground across generational and political divides.

And yet. Habitats and natural spaces continue to be destroyed and degraded. More than half of the UK’s wildlife species are in decline, their growing absence sending shock waves throughout the natural world, while climate breakdown is already taking its toll on our infrastructure, our health, and our wallets. Ecosystem collapse has even been cited the next security crisis: without addressing this, we become increasingly vulnerable as a nation.

Nature is not a ‘nice to have’, it’s the multi-tool we need. Each of us has this tool at our disposal. While intervention and resourcing from governments and business are key to making the long-term, large-scale changes urgently needed, we can all contribute through our own individual actions.

Much of the evidence in this compendium overlaps and intersects a range of issues – and that is precisely the point. We are part of nature. Nature oils the gears of so many aspects of our lives. We have an immense opportunity to fix nature, and in doing so, fix so much more. And here is the evidence to prove it.



Craig Bennett OBE
CEO, The Wildlife Trusts

Our Method

This compendium has been compiled by carrying out targeted online searches of peer-reviewed scientific journals, each tailored to a different theme. The searches were carried out during February 2026, using Google Scholar and a combination of keyword search terms adjusted to each theme. They included different combinations of:

- one or more **geographical terms** (such as “UK”, or “Scotland”, or “Scottish”, or “Wales”, or “Welsh”, or “England”, or “English”, or “Northern Ireland”, or “Northern Irish”, or “Ulster”, or “global”, or “international”, or “Europe”, or “European”, or “urban”, or “rural”);
- one or more **target population terms** (such as “people”, or “elderly”, or “older people”, or “children”, or “teenagers”, or “adolescents”, or “women”, or “disadvantaged communities”, or “students”, or “families”, or “businesses”);
- one or more **socio-economic challenge terms** (such as “property values” or “house prices” or “health” or “well-being”, or “non-communicable diseases”, or “mental health”, or “brain function”, or “flood risk”, or “air quality” or “pollution”, or “food” or “diet”, or “climate change”, or “global warming”, or “heatwave”, or “drought”, or “economic regeneration”, or “local economy”, or “resilient high streets”, or “local markets”, or “loneliness”, or “happiness”, or “childhood development”, or “community cohesion”); and
- one or more **natural solution terms** (such as “nature” or “natural” or “green” or “greenspace” or “wildlife” or “biodiversity” or “ecology” or “ecological”, or “trees”, or “forest”, or “park”, or “conservation volunteering” or “local environmental action”, or “wetland”, or “peatland restoration”, or “beaver”, or “garden”, or “gardening”).
- Typically, each search returned more than 1,000 records. After each search, results were sorted by relevance and the top 30 articles were examined in more detail to identify those providing the strongest and most recent relevant evidence, sifting first on the content of titles, then on the content of abstracts and finally on content of full articles (where these could be accessed).
- We prioritised articles published since 2016, but included older publications when searches failed to identify anything more relevant and/or higher quality that had been published more recently, or when an older

publication made a specific relevant point particularly clearly.

- We looked for at least two articles under each theme, prioritising systematic reviews and meta-analyses, then narrative reviews, studies with large sample sizes and robust experimental and sampling methods (such as randomised controlled trials), and finally, smaller (typically qualitative) studies with small sample sizes. Articles were also assessed for their UK-relevance.
- Where there was an abundance of relevant evidence, we looked to identify a mixture of articles that made strong, wide-ranging and clearly substantial contributions, and those that highlighted specific aspects and details, articulately illustrated particular points, or that had content particularly useful in identifying a context, situation or story relevant to the UK.

This process identified **203** articles that might usefully be included in the final compendium, 52 of which were rejected after being read in full on the grounds that they replicated content already included elsewhere, or added less useful or less scientifically robust material (occasionally in a less readily accessible format). Most of the remaining **151** articles were read in full, and are available in online accessible (often open access) formats. Those that aren’t available in full are available as abstracts, with abstracts and selected summary highlights that provide sufficient detail for their contribution to be helpful and judged to be reliable.

Additional material was then sourced from a variety of ‘grey literature’ published sources (**47** documents in total), such as reports from government agencies and significant non-governmental organisations (including The Wildlife Trusts). These were identified through online searches and recommendations by known experts with specialist knowledge in various relevant technical or policy areas. They were incorporated into the report to add substance, context and depth as appropriate, together with one referenced BBC News item.

Each area is summarised as well as detailed. Several sources included content relevant to more than one area of interest; these have been referenced multiple times accordingly.

This is what the evidence says...

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Introduction

Nature is necessary to everyone. Here's why.

We all need nature – more than most of us realise. Yes, nature means trees, flowers, rockpools and hedgehogs but nature also means air, water, food, shelter. But this must be clean air, safe water, and for humans it also should be productive employment, a thriving high street, stronger communities and good health. It has been calculated that a breakdown in the UK's natural environment could lead to a 12% loss of GDP by the 2030s – a hit larger than the 2008 financial crisis, an impact greater than Covid-19. Nature is the life-support system we all rely on, the hidden infrastructure working quietly in the background that keeps society functioning. And when nature is damaged, the systems and structures we depend on break down. If we repair it and keep it in good shape, it will repay us many times over.

It is crucial that we understand that to fix nature is to fix society too.

Now, The Wildlife Trusts have brought together a wide ranging and substantial body of evidence, demonstrating across multiple fields the power of nature to address some of the biggest challenges society faces. This provides proof that when nature is thriving, people benefit in direct and measurable ways.

A large body of evidence links access to green and blue spaces with better health outcomes at all stages of our lives. Contact with nature is associated with lower risk of chronic disease, improved mental well-being and better recovery from illness (Twohig-Bennett & Jones 2018; Nguyen et al. 2023; Lamont & Hinson 2024). Spending time in nature can reduce stress and anxiety (Geary et al. 2023). For children, nature supports cognitive development (Fyfe-Johnson et al. 2021). In older age, it can ease loneliness and support psychological well-being (Kolster et al. 2025; Pitkälä et al. 2026).

Meanwhile healthy soils, pollinators and diverse ecosystems are essential to food security and nutritious diets (Dasgupta 2021; Kopittke et al. 2024; Feliziani et al. 2025). Trees and other vegetation can reduce air pollution and cool our cities (Vashist et al. 2024; Taylor et al. 2024). Restored rivers, floodplains, woodlands and coastal habitats can reduce flood risk and protect homes and infrastructure, often delivering strong economic returns alongside wider public benefits (Sayers et al. 2025; Morris et al. 2024). Habitats such as peatlands, forests, saltmarshes and seabeds store carbon and help limit the severity of climate change

(Girardin et al. 2021; Burrows et al. 2024; Zhang et al. 2025).

Fixing nature will not only save wildlife: it will repair the systems all life depends on, while reducing pressure on overstretched services, strengthening local economies, lowering long-term costs and making everyday life more secure.

The evidence points to the need for action at every level: protecting and restoring habitats at scale; designing towns, cities and neighbourhoods around nature; supporting farming, water management and coastal management that work with natural processes; and ensuring everyone has access to nearby, high-quality natural spaces. **This means treating nature not as something that's 'nice to have' but considering it essential infrastructure, from the outset.**

Nature is necessary to everyone. Even if you don't consciously consider nature a big part of your life, the life you lead is shaped by the condition of the natural world around you. Its benefits are not confined to those who live in the countryside or work in conservation; they reach into every street, school, farm, workplace, warehouse and household. The evidence in this compendium isn't the whole picture; it's just a snapshot; I'm sure you will know of more (and possibly better) evidence that hasn't been included. We'd be delighted to hear it and add it into the mix. But even the limited evidence included here shows very clearly that fixing nature is not simply a nice idea – it is one of the smartest, fairest and most far-reaching ways to get our systems working better again and to build a healthier, safer and more hopeful future for everyone.



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Nature and Health

Summary

There is a large and growing body of published scientific evidence that supports the conclusion that nature is good for mental and physical health. Much of this was summarised in a reliable independent briefing paper (a POSTNote) by the Parliamentary Office for Science & Technology (POST), as long ago as 2016 (Parliamentary Office of Science & Technology 2016).

Spending time in and around parks, gardens, woodlands, the seashore, ponds, rivers and lakes is associated with better well-being, fewer health problems, and a lower risk of many chronic illnesses. Even living in a neighbourhood where there's a good, managed park is very likely to make you healthier (even if you only see it from a window).

A recent systematic review published in the Lancet (Phi-Yen, et al. 2023) succinctly summarises it as follows:

“Extensive evidence indicates contact with nature is associated with good social, mental, and physical health. These potential benefits include favourable pregnancy outcomes and improved mental health to reduced risks of cardiometabolic and neurodegenerative diseases in older adults.”

In short, if you want a long and healthy life, make nature part of it.



General health

Summary



There is now incontrovertible evidence that nature is good for our health and well-being in many ways, and that making it more central to everyone's lives would be hugely beneficial to people of all ages and backgrounds. And many of the people facing the biggest health challenges would likely benefit the most. Of course, there is still a lot to explore and learn about exactly how different aspects of the natural world influence our health and how those influences vary from place to place, time to time and person to person. Scientists are still working out exactly why experiencing and connecting to nature has the beneficial effects that it does, and precisely which aspects of the natural world and which ways of bringing them into people's lives will bring the biggest benefits. But the big picture is very clear. More nature and more exposure to it is good for us.

A technical 'Evidence Statement' published by the Department for Environment, Food & Rural Affairs (Defra) in 2019 brought together and reviewed 46 peer-reviewed papers dealing with the relationship between health and the marine and coastal environment. While there were several aspects of public health where the reviewing panel concluded available evidence of a link with coastal and marine nature was weak (and even occasionally non-existent), the review highlighted many positive connections. These included positive impacts on subjective well-being, the use of coastal environments for personal restoration and for therapy. People living within 5km of the coast were reported to have lower levels of mental distress than those living further away and children living in smaller towns and villages within 1km of the coast were less likely to be obese than those living elsewhere. Coastal climates were reported to provide more favourable conditions for vitamin D synthesis (including higher UV exposure), giving people living at the coast higher vitamin D levels than those living 50km inland (Shellock, Milner & Collins, 2019).

There is emerging robust evidence that the diversity of natural features people encounter when they're in a greenspace (trees, plants, birdlife) has a direct positive impact on their mental well-being. The quality of an outdoor nature-encounter makes a difference (Hammoud et al. 2024). And scientists are beginning to get to grips with the length of time spent in nature that might be considered a suitable 'dose' to maintain good mental health (White et al. 2019).

The Wildlife Trusts have contributed our own evidence to this growing collection, by commissioning and contributing to several research projects and evaluations of the impacts of our work on people's health and (in particular) mental well-being (for example: Bragg et al. 2015; Richardson et al. 2016; Rogerson et al. 2017; Richardson & McEwan 2018; Richardson et al. 2018; The Evaluator 2019; Warwickshire Wildlife Trust 2019;

Bagnall et al. 2019; Sheldrake et al. 2019; Cameron et al. 2020; The Wildlife Trusts 2020; Harvey et al. 2022; Sellars et al. 2024).

As with most scientific understanding, there are still many questions that scientists still cannot answer and there's constant discussion and debate as different studies and researchers contribute to the growing body of evidence, but progress is continuous and ongoing. A comprehensive review of the green exercise literature undertaken in 2019 identified many studies that reported positive impacts of outdoor and/or nature-related exercise. Even so, overall, the authors concluded at the time that exercising in outdoor or virtual green environments could not conclusively be judged to bring more health benefits than exercising indoors without exposure to nature. They also highlighted that this was likely to be at least in part because published research studies available at the time weren't structured or delivered well enough to reach reliable conclusions about the role of nature in delivering the health benefits reported, compared to the role of exercise without nature (Lahart et al. 2019).

Five years later, a very thorough and wide-ranging review of literature reviews, published by Natural England in 2024, set out the headlines that there is good evidence of nature's positive impact on public health across many aspects of psychological well-being and physical activity. It underlined conclusions reached by many other reviews and the original studies that contributed to them, and highlighted the strength of evidence that is now available. It also pointed to some areas where aspects of nature and spending time outdoors might bring challenges and threats to public health – particularly concerning exposure to pathogens and poor air quality. And it pointed to a number of ways in which the available evidence might usefully be extended and improved (Lamont & Hinson 2024).

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Physical Health



Nature helps prevent long-term health conditions

Many of the most challenging health issues facing people in the UK are related to an aging population

grappling with long-term health conditions and non-infectious diseases. Experiencing and engaging with nature and greenery in and around where we live can help to tackle these, and even speed up recovery.

A 2018 systematic review and meta-analysis including 143 different studies showed increased greenspace exposure was associated with decreased salivary cortisol (used to assess stress), heart rate, diastolic blood pressure, HDL cholesterol, low frequency heart rate variability (HRV), and increased high frequency HRV. It was also associated with decreased risk of preterm birth, type 2 diabetes, all-cause mortality, small size for gestational age, cardiovascular mortality, and an increased incidence of good self-reported health. Incidence of stroke, hypertension (high blood pressure), dyslipidaemia (unhealthy fat levels in the blood), asthma and coronary heart disease were also reduced. The authors concluded that despite limitations in the studies available at the time, their results were “indicative of a beneficial influence of greenspace on a wide range of health outcomes” (Twhig-Bennett & Jones 2018).

A large study using UK census data for 4.6 million adult London residents, linked to official records of deaths, looked at the relationship between people’s exposure to green spaces and the likelihood and cause of deaths over an 8½ year period. They were particularly looking for associations between the quantity and accessibility of green spaces, and deaths from non-communicable diseases (NCDs) such as cardiovascular disease, cancer, respiratory disease and type 2 diabetes. While most associations studied were inconclusive, all-cause mortality was significantly associated with the area of small, local green spaces (pocket parks). A single percentage point increase in pocket park coverage was associated with a 5.6% decrease in all-cause mortality risk. Similarly, an increase of ten pocket park access points per km² was associated with an 8.4% decrease in the risk of dying from a respiratory disease (Hajna et al. 2023).

In a longitudinal study (one that collects data over an extended period, looking at long-term impacts and trends) of nearly 280,000 UK residents, nearly 10,000 of those in the study developed obesity-related cancer within the time they were part of the study (typically about eight years). The study identified that an increase of 15.3% in the area of greenspace within a 100m of where someone lived was associated



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with a 5% decreased risk of obesity-related cancer of any type (including prostate, breast, colorectal, uterine, kidney, pancreatic, oesophageal, ovarian, stomach and liver cancers), and with a 14% reduced risk of specifically uterine cancer. The area of private gardens within 100m of a person’s home showed a similar, but in some ways stronger pattern. A 21.7% increase in garden area was linked to reduced obesity-related cancer risk of 8% overall and greater reductions in the risk of breast cancer (9%) and uterine cancer (20%) (Odebeatu *et al.* 2024).

In a study of children aged 5–7 years, longer time spent in public green spaces, living close to large green spaces and quantity of residential surrounding greenspace was linked to having longer, healthier lives. (Miri *et al.* 2020). This was due to developing longer leukocyte telomeres (the tips of chromosomes in white blood cells). Telomeres are necessary for cells to divide and they get shorter each time a division occurs... so longer telomeres are a sign of biological youth and short ones a sign of biological old age. Ultimately, when telomere tips get shorter than a critical length, the cell can no longer divide and it dies. Long telomeres lead to longer lives and less disease, so children with longer telomeres are likely to live longer, healthier lives. And if more access to nature and more time spent outdoors in green spaces lead to longer telomeres

(slower shortening), then that will likely lead to better health outcomes later in life, and potentially greater longevity.

Being active in nature reduces the risk of heart disease

Maintaining a healthy heart and circulation is vital to overall health; not doing so is a significant contributor to death and chronic illness – especially in older age. Regular physical exercise can help... and its benefits may be increased if it’s outdoors in a natural place.

A recent study tested a regular programme of outdoor exercise for people over the age of 60 and found that it significantly reduced their blood pressure compared to a control group (reducing systolic blood pressure – when the heart actively contracts to pump blood round the body – by 17.4 mmHg and diastolic blood pressure – when the heart relaxes between beats – by 9.2 mmHg). The paper’s authors noted that “the observed reductions in blood pressure substantially exceed established clinical thresholds, representing some of the most pronounced effects reported to date in the multidomain intervention literature” (García-Llorente *et al.* 2025).



A literature review published in 2021 included more than 100 studies which the review’s authors considered collectively to indicate that “nature and nature-based PA [physical activity] is associated with decreased heart rate, blood pressure, cholesterol, body mass index (BMI), and improved heart rate variability”. They went on to say with some certainty that consideration of the studies reviewed indicated that “exposure to nature is associated with reduced incidence of stroke, hypertension [high blood pressure], dyslipidemia [high blood fat content], asthma, and coronary heart disease as well as risk of obesity, diabetes, preterm birth, small size for gestational age, cardiovascular mortality, and all-cause mortality” (Christiana *et al.* 2021).

Of the 22 studies recently reviewed with the intention of identifying the impact of nature-based health interventions on heart diseases and metabolic diseases, 12 reported a decrease in systolic blood pressure (when the heart actively contracts to pump blood round the body) and 10 studies showed a decrease in diastolic blood pressure (when the heart is relaxed). The review demonstrated improvements in blood pressure and a range of other indicators of cardiovascular health: pulse rate, endothelin-1 and angiotensin II (which cause constriction of veins), brain natriuretic peptide (which indicates heart failure), cortisol (which may increase as a result of stress) and parasympathetic nervous system activity (which has a role in slowing heart rate and reducing blood pressure). Overall, the authors concluded that “nature-based interventions can have a positive impact on cardiovascular and cardiometabolic health by improving biomarkers such as blood pressure, parasympathetic nervous system activity, blood glucose, and many others” (Al Ghanim *et al.* 2025).



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Being in natural environments boosts the immune system

There is an increasing amount of evidence that natural environments may have a significant impact on our immune systems and the way they are regulated. Some of these benefits may relate to our need for exposure to a full range of naturally occurring microorganisms which help to shape how our immune systems function.

A Finnish study investigated the interaction between microbe communities, young children attending day-care centres and the function of their immune systems, by introducing soil and vegetation from natural forest and other natural materials into the outdoor spaces where the children played. The researchers then compared these day-care centres before and after the introduction of natural materials, with a sub-set of explicitly ‘nature-focused’ day-care centres. The introduction of these materials changed the composition and diversity of the bacterial communities present, those found on the children’s skin and those found in their guts. These changes were in turn associated with changes in the immune systems of the participating children. The authors concluded that “our study demonstrated that modifying the living environment of children with microbiologically diverse natural materials might provide a feasible approach for decreasing the risk of immune-mediated diseases in urban populations” (Roslund et al. 2020).

Airborne microorganisms end up on the skin, in the airways, and in the gut where they influence the immune system. The number and variety of microorganisms in nature is enormous and varies considerably from place to place and ecosystem to ecosystem, with literally millions of microorganisms per cubic metre in air over grassland or shrubs, and as many as 1,800 different bacterial types found in air samples from a single location. The picture is similar in soils and water. Interaction with these communities of microorganisms has shaped our immune systems for millennia; continuing our exposure to them – and sustaining a relationship with the microbial communities that are typical of natural environments – may be important in maintaining a healthy immune system (Rook, 2013).

A systematic review of research into the effects of nature-exposure on the immune system concluded that across 33 studies nature-exposure had a positive impact on the immune system. The authors concluded that exposure to nature, through activities such as ‘forest bathing’ (quiet, intentional immersion in the natural environment) can bring many benefits to the body’s immune system. Exposure to nature can be anti-inflammatory, anti-allergic and anti-asthmatic, and it can increase the activity of the immune system’s ‘natural killer’ cells (which help to fight off infections). All seven of the studies reviewed that looked at it concluded that forest bathing either

increased anti-inflammatory cytokine levels or reduced levels of its inflammatory counterpart, implying that asthma and other allergic conditions might benefit from exposure to forest environments (Andersen et al. 2021).

A team of Japanese researchers recently carried out a randomised controlled trial (RCT) to test the influence of forest walking on healthy participants’ production of saliva-secreted Immunoglobulin A (sIgA) – a key component in the immune system that protects the body from infection by bacteria, viruses and fungi, by helping to prevent entry through the mouth and nose. Two groups spent up to 90 minutes walking either in a forest park outside Tokyo or an area of urban Tokyo. Both groups were encouraged to engage in their surroundings (taking notice, feeling, listening to and otherwise sensing their surroundings). The study found that, compared with urban walking, forest walking considerably raised sIgA levels and enhanced the immune function of the moist surfaces in the nose and mouth. The authors also concluded that, even after adjusting for different baseline values and the differences in physical activity, forest walking significantly decreased levels of the stress hormone cortisol and positively affected the mood of participants (Ochiai et al. 2025).

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Recovering and recuperating

Being near and able to see and hear nature means a quicker recovery. If you have been ill or you’ve had surgery, it is likely that being able to see or otherwise experience trees and other natural features will help you to recover.

A very well-known and widely cited study of patients recovering after cholecystectomy in a suburban Pennsylvania hospital between 1972 and 1981 set out to determine whether assignment to a room with a window view of a natural setting might have restorative influences. Twenty-three surgical patients assigned to rooms with windows looking out on a natural scene had shorter postoperative hospital stays, received fewer negative evaluative comments in nurses’ notes, and took fewer potent analgesics than 23 matched patients in similar rooms with windows facing a brick building wall (Ulrich, 1984).

Similarly, a study of 296 women who had undergone C-sections at three hospitals in Taiwan were each allocated to one of 46 different patient rooms with diverse window-views and different daylight exposure. Analysis of a range of variables revealed that women who were more satisfied with their window view used significantly less analgesic, perceived that

they had less pain, had less severe pain, and reported that pain interfered less with their relations with others, enjoyment of life and mood (Wang et al. 2019).

Data records of 244 psychiatric inpatients with affective disorders (long-term disturbances in emotional state, including extreme depression and mania) who were admitted to a German psychiatric hospital for between 7 and 100 days between May 2013 and October 2018 were examined to see how the brightness and greenness of the view from their rooms influenced the length of stay. Each window view was assessed using images taken from each room and classified according to whether it contained mainly man-made objects or green trees. The percentage of green within each image was also calculated as ‘greenness of the view’. Brightness was assessed with a luxmetre. The results indicated that both increasing greenness of the window view and its brightness both significantly reduce length of stay in psychiatric inpatients with affective disorders (Mascherek et al. 2022).

A study by three Scandinavian researchers ‘quasi-randomly’ assigned 278 coronary (heart) and pulmonary (lung) patients to different rooms at a residential rehabilitation centre. Rooms either had a panoramic view to natural surroundings, or didn’t (with a view partially or totally blocked by buildings).



MATTHEW ROBERTS

For women, a blocked view appeared to inhibit their physical recovery, whereas for men, a blocked view appeared to negatively influence their mental health. Pulmonary patients with a panoramic view showed greater improvement in mental health than coronary patients with such a view. Those with a panoramic view to nature were more than twice as likely to chose to stay in their bedroom when they wanted to be alone than those with a blocked view. The authors concluded that *“An unobstructed bedroom view to natural surroundings appears to have better supported improvement in self-reported physical and mental health during a residential rehabilitation programme, although the degree of change varied with gender and diagnostic group.”* (Raanaas et al. 2011).

A recent scoping review including 41 studies attempted to arrive at a better understanding of the relationship between exposure to nature and hospital recovery. After dividing the different studies into seven categories of nature exposure, they were reviewed and analysed. The most common nature exposures studied (and included in the review) were the presence of a window/natural light, a natural scene through a window, and nature soundscapes. The authors concluded that: *“A synthesis of the existing literature suggests that the therapeutic effect of exposure to nature on patients admitted to hospital is real but dose-dependent and of relatively low ‘potency’.”* They also noted that greater beneficial effects were seen with greater durations of exposure to nature and greater degrees of immersion into nature (such as by creating multisensory experiences using emerging technology like Virtual Reality) (Guidolin et al. 2024).

Much of the recent understanding of the role of nature and fresh air in patient recovery is starting to be reflected in the design and use of hospitals. At King’s College Hospital London, for instance, a £2 million roof garden has been specifically designed and built to allow critically ill intensive care patients to have easy, safe access to nature and the outdoors. Intensive care doctors at the hospital expect the new facility (the first of its kind in the UK) to make a significant contribution to the recovery of their patients and also to the well-being of staff working in the intensive care unit. The hospital’s Chief Executive, Clive Kay, is reported to have said that he hopes the roof garden will lead to *“shorter lengths of [patient] stays and better use of critical care facilities”* (Loader, 2026).

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Mental Health



Time spent noticing and being in nature lifts our mental health. Being close to nature, even for short periods of time, can significantly change the way people think and feel. What’s more, undertaking activities like walking and gardening in natural settings has been shown to reduce stress, help people think clearly, make them less anxious, less likely to become depressed, and less likely either to dwell on negative emotions or have unhelpful, self-critical thoughts.

Being in nature clears your mind and restores your calm

Science shows that nature actually changes what’s going on in our brains. Being in natural surroundings triggers activity in our brains which translates into feelings of calm.

A recent study of university students revealed that when they were mentally exhausted (after carrying out some specially designed mentally taxing exercises), looking at pictures of natural scenes for as little as five minutes cleared their minds and restored their ability to carry out further mentally challenging tasks. Doing this was significantly more effective than if they spent the same time looking at pictures of un-natural buildings and streets, or not looking at any pictures at all (van Oordt et al. 2023).

A randomised controlled trial published by American psychologists in 2024 found that being in nature helps to rest your brain (McDonnell & Strayer 2024). They compared the emotions and brain activity in two groups of people – one who undertook a 40-minute, low-intensity walk in nature and another that went on a comparable urban walk. In particular, the study looked at the difference in participants’ frontal midline theta (FM θ) oscillations: fluctuations in the electrical activity of part of the brain thought to be particularly involved in the regulation of attention and focusing of mental effort. FM θ oscillations increased in both groups during a pre-walk period of challenging mental exercise and remained higher than at the start of those mentally taxing activities, through to the start of participants’ walks. During the walks, everything else being equal, FM θ oscillations reduced significantly more in the group that was walking in nature than in the group that walked in an urban area. The urban walks were also followed by a raised resting level of FM θ oscillations, while the nature walks weren’t. The authors concluded that it is very likely that the differences in post-walk FM θ activity are linked to differences in the amount of effort required to regulate attention and focus mental effort in natural settings compared to urban ones.

A 2015 study in the United States used MRI (magnetic resonance imaging) technology to explore the effect of walking in a natural setting on brain function. Half of the study group spent 90 minutes walking through a large natural greenspace with grassland, scattered oak trees and shrubs. The other half spent 90 minutes walking along a busy urban street. Afterwards, both groups had their brains scanned and were assessed for their tendency to dwell on negative emotions and have unhelpful self-critical thoughts (a thought-pattern known as ‘rumination’). Compared to participants who walked through an urban environment, those who walked through natural greenspace reported lower levels of rumination and showed reduced activity in their subgenual prefrontal cortex (an area of the brain linked to risk of depression and other mental illness) (Bratman et al. 2015).

Recently, a team of Italian and Danish researchers studied the role of exercise in different locations on stress recovery and psychological restoration. In particular, their study explored the influence of exercise in a green, natural environment, compared to comparable exercise indoors or outdoors in a built-up urban environment. The researchers used a randomised crossover experimental design involving 25 male participants who each walked for one hour at 6km/h, in each of three settings (green, indoor and urban). They each completed various questionnaires and had a number of physiological measures taken (cortisol, heart rate, heart rate variability). Results showed that exercise in the green (natural) outdoor environment consistently brought about greater relaxation, more enjoyment and more psychological restoration than comparable exercise in either indoor or urban locations. Participants experienced higher positive emotions and lower negative ones in the natural green setting and perceived their levels of exertion to be lower (even though they were objectively comparable). The combination of physiological measurements indicated that exercise in a green environment



promoted a more favourable recovery profile than indicated by the physiological measurements associated with either of the other two exercise locations (Laezza et al. 2025).

A study of people walking in contrasting areas of Berlin (one area an urban forest, the other with busy streets), used MRI brain imaging to assess the impact of taking a woodland walk on activity in the amygdala – the part of the brain that looks out for danger and is associated with stress. After one hour walking in woodland, the blood supply to the amygdala of participants reduced; it had shrunk in size and become less active compared to those of participants who had walked the streets instead (Sudimac et al. 2022).

A 2017 systematic review and meta-analysis looked at the link between gardening and health. Universally positive health and well-being effects were reported on depression, dementia, cognitive function, brooding, restorativeness, anxiety, stress, mood, tension, anger, vigour, fatigue, confusion, quality of life, attention, sociability, sense of community, self-esteem, hope, bone mineral density, salivary cortisol (stress), life satisfaction, loneliness, heart-rate (stress) and body mass index (BMI).

The 21 studies included in the review and analysis included participants ranged in age from those in their 20s to those in

their 80s, both male and female, from 11 different countries on three continents. They included people suffering from dementia, depression and other psychological illnesses, those with intellectual and other disabilities, cardio-rehabilitation patients and people with no pre-existing clinically diagnosed conditions. Interventions included short-term gardening experiments, horticultural therapy and ‘daily gardening’. The review’s authors concluded: *“The results presented here suggest that gardening can improve physical, psychological, and social health, which can, from a long-term perspective, alleviate and prevent various health issues facing today’s society”* (Soga et al. 2017).

A recent systematic review and meta-analysis looking at the effectiveness of social and therapeutic horticulture for reducing depression and anxiety included the results from 17 studies (some of which investigated both conditions). Although the authors of the review noted significant variability between studies and a high risk of bias, they reported that all the studies reviewed indicated a beneficial impact on depression (14 studies) and anxiety (8 studies). Combining these into groups that were subjected to appropriate meta-analyses led to the conclusion that social and therapeutic horticulture has a demonstrable large and statistically significant impact on participants who have been diagnosed with depression, and also led to moderate reductions in anxiety (Wood et al. 2025).



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Being in natural spaces reduces feelings of depression and anxiety

You are less likely to feel stressed, anxious or depressed if you live in a green area, or if you get out into a natural place, even for as little as one hour.

In 2023, health data relating to more than 2.8 million Welsh adults between 2008 and 2019 was combined with surveys of 5,300 Welsh residents about their well-being and personal visits to blue and green spaces. The combined analysis showed that people who lived in greener and bluer areas were less likely to seek help for a common mental health disorder than those in less green or blue areas, with those living in the most deprived areas benefiting the most. Overall, each additional hour of outdoor leisure time per week was associated with a 4% reduction in likelihood of seeking medical help for a common mental health disorder such as anxiety and depression (Geary et al. 2023).



A 2024 systematic review of nature-based health interventions targeted at people with a diagnosis of mild to moderate anxiety, depression and/or experiencing stress, reported that across 19 studies, there were large reductions in anxiety and depression symptoms, a small (but non-significant) reduction in stress symptoms and a moderate improvement in overall mental health (Jessen et al. 2024).

The quantity of accessible local greenspace appears to have a relationship with the incidence of a number of mental illnesses. Residential addresses, health and death records relating to more than 360,000 UK residents spanning more than a decade were used to explore the relationship between a person’s exposure to green, blue and natural spaces and their risk of being diagnosed with a range of mental health conditions and psychiatric disorders. The study’s authors found that having high amounts of greenspace within 300 metres or 1km of home was linked with about a 30% lower risk of having a psychotic disorder (such as schizophrenia or delusional disorder) and there was a similar association (about a 20-30% lower risk) with the increasing naturalness of the neighbourhoods where people lived, depending on precise details. The authors also noted a small but meaningful reduction in the risk of both anxiety and dementia in people with the highest exposure to greenspace and natural environments (Liu et al. 2024).

In 2023, a 10-year study of 2.3 million adults in Wales identified a significant relationship between a person’s exposure to green areas where they lived and the likelihood of them developing depression or anxiety. The more green vegetation there was within 300m of where someone lived, the lower the odds were of them subsequently becoming anxious or depressed (Geary, et al. 2023).

The COVID-19 pandemic led to a considerable psychological distress and to a rise in the proportion of people experiencing significant levels of mental illness. A study published in 2023 used a sample of nearly 5,000 people from across the UK to demonstrate that, during lock-down periods, people living close to green spaces experienced far less mental stress than those living further away (Lee, et al. 2023).

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Nature helps to reduce chronic stress

Chronic stress is a major contributor to many long-term health conditions. Living with better access to green spaces has a positive impact on many indicators of chronic stress and poor mental health.

Analysis of health and location data relating to more than 2.3 million Welsh adults between 2008 and 2019 indicated that people who lived in greener areas with greater potential to access green spaces were less likely to develop common mental health disorders (CMD – like anxiety and depression) than those in less green areas. The benefits were greatest in the most disadvantaged neighbourhoods, where a 0.1 unit increase in greenness reduced the chance of being diagnosed with a CMD by 10% (compared to a 6% reduction in the least disadvantaged neighbourhoods). Authors of the study proposed that *“Mechanisms for greater mental health benefits of GBS [green and blue space] among those living in more deprived areas... could include deprivation contributing to stress”* (Geary et al. 2023).

A review of published research papers, carried out in 2014, concluded that even at that time there was considerable empirical evidence of stress reduction from exposure to natural settings. The author recommended that plans for urban settings should consider the human need for restoration, and the accessibility and quality of urban green areas. In her words, *“A well-designed urban landscape can contribute to creating a less stressful day and to providing an opportunity for physical, cognitive and emotional restoration”* (Berto 2014).

A similar review in 2022 concluded that *“independently from the type of exposure (plants, poster, slides, video, virtual reality [VR] settings, or views of natural environments/ stimuli), people experience a general reduction in symptoms related to psycho-physiological stress... for the emotional aspect, [there is] a larger effect for exposure to real nature vs. laboratory simulations”*. The authors highlighted that a person’s workplace should generate well-being and proposed that what they called ‘mindfulness in nature-based intervention (MiNBI)’ could enhance both business production and employee well-being (Menardo et al. 2022).

In 2017, a study of 206 people living in North Carolina linked the amount of vegetation within 500m of where they each lived to a range of variables known to be indicative of their ‘allostatic load’ (the combined health impacts of chronic stress). Across all the stress-related hormone markers and other indicators measured, participants’ chronic stress levels became lower as the amount of greenery near their home increased. The authors noted that *“The observed effects of vegetated land cover on allostatic load and individual biomarkers are consistent with prevention of depression, cardiovascular disease and premature mortality”* (Egorov et al. 2017).

A 2023 study found that walking improved mood and significantly reduced a number of biochemical indicators of stress, whether participants walked in a built-up urban environment or a woodland one. The study also found that walking in a forested environment provided additional benefits for mood not seen following the urban walk. *“While both walking interventions improved mood and reduced physiological stress, the nature intervention (but not the urban intervention) also led to further improvements in total mood disturbance, depression, confusion and esteem-related affect”* (Todorova et al. 2023).

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From before we're even born through to old age, our interaction with the natural world shapes our health and well-being. Childhood habitats often establish lifelong patterns of behaviour that may lead to better or worse health in later life. Even before we're born, nature plays its part in our lives, with good access to nature having a positive effect on birth weights and the health of expectant mothers. Then, as we grow and learn, access to nature during childhood brings a wide range of benefits including improved mental health, cognitive development and impulse control. Meanwhile exploring and having fun in nature facilitates imaginative play and builds social skills.

Nature has a positive effect on us

Living with nature close at hand can improve your health and increase your life chances.

The blood pressure of pregnant women has been found to be lower when they lived near to an accessible greenspace. A 2014 study of 3,400 pregnant Lithuanian women aged between 20 and 45 found that the likelihood of a woman's blood pressure being higher than optimum increased by 9% for every 300m increase in the distance between their home and its nearest

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greenspace. Similarly, the odds of a woman having blood pressure that was considered to be 'high' but still within the normal range, increased by 14% for every 300m increase in the distance between their home and its nearest greenspace (Grazuleviciene et al. 2014).



In Spain, a study of 54 pregnant women living in Barcelona in 2002–2009 found that women living in green areas were exposed to fewer airborne pollutants (especially fine particulates – PM2.5s) than those living in less green areas (Dadvand et al. 2012).

A systematic review and meta-analysis published in 2021 analysed data from 29 studies in an attempt to quantify the influence of residential greenness on birth outcomes. Overall, the authors concluded with “moderate” certainty that an increase in the greenness of the places where mothers and babies lived was associated with higher birth weights and less likelihood of babies having a low birth weight (Hu, et al. 2021).

Growing up in nature sets you up for better health into adulthood

It is widely understood that childhood habits often become established to become lifelong tendencies. Habits relating to food, exercise and other aspects of daily life can become engrained so (for instance) overweight children often become overweight or obese adults, with lifelong consequences for their physical and mental health.

A study published in 2020 investigated the relationship between rates of obesity in children aged 4 to 5 and those aged 10 to 11, and the presence of greenery and accessible greenspace near to where they lived. The authors concluded that, controlling for other influential factors, there was a significant inverse relationship between the density of trees near to the children's homes and the likelihood of them being obese, in both age groups. Living somewhere with more trees was associated with a lower likelihood of being obese. In the children aged 10 to 11, accessibility of quality green spaces was also significant, highlighting that the influence of the wider environment on behaviour becomes important as the age and independence of children increases (Mears et al. 2020).

A recent paper published in the *International Journal of Play* makes an evidence-based case that microbially-rich natural environments play a crucial role in shaping healthy immune systems, preventing inflammatory and allergic diseases, and nurturing curiosity, sensory development and nature connectedness. It made a particular case for the benefits of children being exposed to soil and mud as part of ‘dirty play’ in nature (Barrable et al. 2026).

A pilot study of 45 healthy adults in their sixties and seventies identified a connection between participants' current connectedness to nature, their current participation in green exercise and their exposure to nature – both as an adult and as a child – and their heart rate variability. The authors concluded that connectedness to nature is important for adult health and that childhood nature exposure and participation in green exercise are essential to developing this connection (Wood & Smyth 2018).

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Nature helps development in children

Nature shapes many aspects of our lives, not least when we’re growing up. There are many ways in which growing up in and around natural places, experiencing and interacting with wild plants and animals can make a positive difference, from the size, shape and function of our bodies to the way we feel, think and learn.

It is challenging to accurately measure the amount of nature-exposure experienced by children and adolescents, and much of the evidence that exists comes from higher-income countries such as the UK. With that background, an authoritative overview of 36 systematic evidence reviews, published in 2023, concluded that, overall, greenspace is associated with a range of positive outcomes during our childhood and teenage years. These include beneficial outcomes across many aspects of health and development (including birth, development of the nervous system, thought processes, behaviour, bodyweight, mental health and well-being and school performance) (Sakhvidi et al. 2023).

A comprehensive systematic review of nature and children’s health in 2021, and a meta-review in 2024 both concluded that, across the studies they reviewed, despite various weaknesses and limitations to the research carried out to date, the evidence available at the time indicated a positive association between nature contact and the health and well-being of children and adolescents, especially for physical activity and mental health, and with notably stronger evidence relating to high-income countries (Fyfe-Johnson et al. 2021; Lomax et al. 2024).

A review of 10 high quality and two moderate-quality studies concluded that exposure to nature can enhance cognitive functioning in children and adolescents. Positive effects were found across a range of functions relating to attention and knowledge acquisition, including working memory tests, selective attention tests, impulse control tests and long-term memory (Vella-Brodrick et al. 2022).

In 2020, a systematic review looked at the impacts of unstructured nature play on health in early childhood development. It concluded that despite significant inconsistencies in the studies reviewed and challenges in combining them, nature play had consistent positive impacts on physical activity outcomes and cognitive play behaviours (imaginative and dramatic play) (Dankiw et al. 2020).

A Spanish study published in 2015 explored the relationship between the cognitive development (development of thinking abilities) in primary school children in Barcelona, and their exposure to green spaces. Researchers analysed data from a series of computerised tests performed over a 12-month

period by 2,593 children aged between 7 and 11, attending 36 schools. Results were analysed to identify associations between cognitive test performance and the amount of greenness around the homes, schools and regular travel routes used by each participating child. Over the study period, children with a greater exposure to greenery around where they lived and studied improved their working memory more than children with less exposure to greenery. Also, their ability to handle more complex intellectual tasks increased and their levels of inattentiveness decreased more with greater exposure to greenness. The amount of greenery in and around school grounds was particularly influential. The study’s authors attributed a large part of the impact of greenery to its beneficial impact on traffic-related air pollution, but noted that this only explained part of the association between greenery and cognitive development. They concluded that *“Exposure to outdoor surrounding greenness was associated with a beneficial impact on cognitive development in schoolchildren. These associations were only partly mediated by reduction in TRAP [traffic-related airborne pollution] levels, suggesting that other mechanisms likely underlie this association”* (Dadvand et al. 2015).

A research evaluation carried out for The Wildlife Trusts, by researchers from University College London, used quantitative and qualitative methods to explore the impact of outdoor nature-based education on participating children, aged between 6 and 11. Four hundred and fifty-one children completed questionnaires to generate quantitative insight into their experience of participating in education activities run by 12 different Wildlife Trusts in different parts of England. Six events were also observed, to provide data for a qualitative analysis of 199 children. Overall, the quantitative study revealed that children’s subjective well-being and health increased significantly over time, especially in children with low well-being and health at the start of their nature-based educational experience. Participating children also increased their levels of nature connection and increased their expression of pro-environmental values – again, with the biggest increases reported amongst those with the lowest scores at the outset. The qualitative analysis revealed many ways in which individual children and groups of children interacted with nature and benefited from it. The study’s authors reported that *“When children engaged in observations of nature, they were curious, wanting to discover and learn about animals, plants, and other objects that they encountered”*. They also documented that *“...teachers reported witnessing changes in confidence, behaviours, motivation and willingness to take risks”*. Among many other documented observations, the study included insights into the contribution that nature-based outdoor education can bring to children who are neurodiverse. One teaching assistant commented in an interview that:

“I work with [a child] at school all the time. He’s on the autistic spectrum and finds everything such a challenge. Out here every week he’s been in his element. We’ve got him on the den building each week, as he found the walk last time not a great experience. He’s designed and built some great structures and gone on to help the others, which he never does normally” (Sheldrake, Amos & Riess 2019).

Results of a 2022 systematic evidence review using a ‘meta ethnographic’ approach indicated that playing in nature-based environments not only supports young children’s healthy physical development (including physical activity and motor development), but might also support their social-emotional and cognitive development. Although the studies reviewed were mainly explorative and small-scale, the authors concluded that they *“indicate that nature-based environments have far more to offer than only a space to relax or let off steam. Nature-based environments function as a play partner that helps children to transform the perceptual world into a conceptual world, because it diversifies play, is sensory rich and it plays back. When playing in nature-based environments, children have the possibility to connect with it in an interactive way”* (Prins et al. 2022).

A 2022 systematic review of the evidence relating to the restorative effects of nature on children and adolescents brought together the findings of 30 studies. Overall, the

review concluded that even though the emotional resources and perceived well-being of children and adolescents aren’t always restored in nature, there is strong evidence that in many situations they are. The authors concluded that nature exposure has a significant restorative effect on children and adolescents and that it helps to restore cognitive, social and behavioural resources (Moll et al. 2022).

A 2020 study looked at the difference in brain structure between 16- to 17-year-olds who had lived exclusively in rural and urban locations up to the age of 15. It found that the left hippocampal formation of the brain – part of the brain known to play a role in spatial memory and navigation – was bigger in adolescents exclusively brought up in rural areas than in those exclusively brought up in urban ones. Participating young people with a rural background also performed better than their city-dwelling counterparts in standard tests of spatial processing, suggesting that their rural upbringing played a role in their brain structure and function (Kühn et al. 2020).

A 2024 study of 640 Scottish children aged 10 to 11, published in the British Medical Journal’s “Epidemiology & Community Health” publication, revealed that spending time in nature was associated with positive mental well-being outcomes in all children, but that they were greatest for children in households with a “low socioeconomic position”. This suggests that exposure to nature in early life might help to reduce mental well-being inequalities (Caryl et al. 2024).



A 2022 systematic review that looked at the relationship between nature-based early childhood education (ECE) and children’s social, emotional and cognitive development included 36 studies. While the review’s authors highlighted that the absence of high-quality experiments limits the value of available evidence, they still found positive associations between nature-

based ECE and self-regulation, social skills, social and emotional development, nature relatedness, awareness of nature, and play interaction (Johnstone et al. 2022).

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Loneliness



Nature is often cited as a companion and a refuge that we turn to for solace. This can be the case at any age, but the benefits are often felt more keenly as we grow older. Being

outdoors in nature, or watching wildlife, can provide us the opportunity to connect to the world around us, to other people, and even to ourselves and our own thoughts and feelings.

Nature connects us with other people

A lot of activity in natural places involves social interaction and connection with other people. Either intentionally, or incidentally, people come together in nature and this builds a sense of community. Often it provides lonely people with a way of building friendships, and for some people it provides a non-judgemental, stress-free space where they can escape a sense of social isolation and feel less alone.

In 2020, two psychology researchers from the University of California reviewed what they called “a growing body of evidence finding that nature can enhance social connection”. They concluded that incidental exposure to the natural environment can increase attention to others, facilitate collective engagement, and enhance ‘prosociality’ (tendencies to care for, help, and assist others). In the authors’ words: “Interactions with nature, whether sustained or fleeting, can increase orientation toward others, social cohesion, and prosocial behaviour, effects that are in part driven by nature’s awe-inspiring or beautiful qualities” (Goldy & Piff 2020).

A study published in 2022 measured the general social cohesion, trust and sense of community, and social interactions of 1,249 residents in Singapore. It related these to various types of nature experiences (the amount of green space around people’s homes, the frequency and duration of urban greenspace visits and the frequency and duration of visits to gardens), and also to three aspects of each person’s connection to nature. The authors found that people who strongly identify with nature, who enjoy being in nature, and who visited gardens more frequently were more likely to have a stronger sense of social cohesion across two of the measures of social connection being measured. The study’s authors proposed that: “strategies targeted at encouraging people to engage in nature-related, collaborative activities at the local community level, such as spending time in local gardens, will increase urban residents’ daily nature experiences and its associated benefits such as improving social cohesion.” (Oh et al. 2022).

An international team of researchers, led by the University of Sydney’s professor Thomas Astell-Burt, studied the relationship between nature and loneliness in Australia, India, Singapore, the UK and the USA. About 525 adults were surveyed from each country (2,625 survey responses in all), with questions designed to explore their exposure to and relationship with the natural world, their levels of social and emotional loneliness and the extent of involvement in green prescribing programmes (if any). Self-reported loneliness of either type was found to be common in all five countries surveyed (ranging from just over 60% in Australia up to nearly 67% in the UK). Social loneliness (the type of loneliness that involves having lower levels of contact with other people, resulting in weaker social networks and less integration into a community) was lowest in Singapore (about 22%) and highest in the USA (44.5%). Emotional loneliness (the kind of loneliness resulting from a perception that while opportunities for social contact and community engagement exist, they typically lead to a feeling of rejection and exclusion) was lowest in the USA (at about 37%) and highest in India (at



nearly 54%). Across the whole 5-country sample combined, more frequent nature contact was clearly associated with lower odds of social loneliness, but also with higher odds of emotional loneliness. The authors concluded that participants who reported spending more time in natural environments, or visiting them more frequently, may have lower levels of social loneliness. They suggested that this may reflect the role of natural places as attractive settings in which people can meet. They explained the unexpected finding that higher nature exposure was associated with higher levels of emotional loneliness by suggesting that people who are feeling deprived of social interaction and companionship may seek refuge in nature as an alternative form of emotional support. All in all, the authors concluded that *“Our findings highlight the nuanced experiences of loneliness”* (Astell-Burt et al. 2024a).

A longitudinal cohort study of more than 2,000 Australian participants, over a 16 month period tracked their levels of exposure to nature and their changes in self-reported loneliness. The study’s authors concluded that in this nationally representative cohort, spending at least 1–2 hours per week in nature increased the odds of relief from loneliness by 69% at four months and by 110% at sixteen months (Astell-Burt et al. 2024b).

There is a considerable amount of qualitative evidence generated by social scientists collecting, reporting and analysing data about how people engage with nature and natural places. It often relates to small groups of people who have been interviewed about their attitudes, behaviours, experiences and feelings. In one such study, researchers interviewed a group of 8 people aged between 50 and 75 who meet regularly in Fleetwood, Lancashire as part of an initiative intended to reduce loneliness and isolation. In recordings and transcripts of the interviews, participants often mentioned experiencing their local green and blue spaces with other people – most commonly family; particularly children and grandchildren. There was also a sense of appreciation that being in these spaces created a special kind of quality time with family. For instance:



“We go [for] a walk and my son hasn’t been very well, so we’ve been going out walking with him. We’ve got a little bench that we sit at the back, see like that bench up at the back there, we would sit up there and have a chat and just relax for an hour. And sometimes, it’s amazing how you chat, you know, if you’re in the house you maybe don’t, but if it’s just him and me, we sit on the bench, it’s amazing how you just chat away. It brings out, it brings different subjects up, you know.”

The authors reported that some participants highlighted enjoying these natural outdoor spaces alone; even then, the meaning attached to visits with family seemed to be particularly important, including remembering visits when they were children themselves, evoking a sense of happy nostalgia:

“I was always up on the beach as a child... In the holidays we were up there nearly every day.”

They also recorded that several participants mentioned that local schoolchildren planted the boxes (raised beds) in the Pocket Park, and that was an aspect they appreciated about it. In the words of the authors: “It made them feel ‘lifted’. It also demonstrated a feeling of community, and there was an assumption that the children themselves benefitted from taking part in the planting activity”. They reported one participant’s words:

“You feel quite proud, even though it might not be you who’s done it. You feel proud that the people who have done it should be the children... I think it’s really good and then inspires young children when they maybe never planted a thing in their life, you know.”

Overall, the authors concluded that the personal and social meaning attached to certain natural spaces may underlie some of their well-being benefits. And they noted that for the participants in this study, the spaces with meaning, towards which they demonstrated a sense of connectedness, were often the smaller, local spaces, which they would be likely to encounter during the course of everyday life (Pool et al. 2023).

A similar study explored the personal relationships between young people from diverse ethnic backgrounds living in Sheffield, and their experience of ‘everyday urban nature’. The interviews reported in the study repeatedly brought up participants’ relationships, emotional responses and connection to not just the natural world, but also to other people – particularly friends and family. For example: in the words of the study’s authors, one interviewee (Ivy) “felt that when she was outside she was ‘more with’ her family”, and another (Leila) “found helpful the peaceful ‘atmospheres’ of family time spent in moorland on the edge of the city”. Another participant, Daleel, told the researchers that he went to the park with friends, or took younger members of his family; he told them that it “gives you a flashback from your childhood, playing in the park”. The study’s authors indicated

that such memories of social connections and activities linked to place and environment can be “emotionally restorative”. For several of the young people interviewed, the company of a few friends was important when they were out in nature. For others, the fact of being alone in nature was itself an “...escape from loneliness and a sense of support where people failed to provide it. That support came in the form of peace and detachment from people, which [was] gained from sitting on a bench by a stream”. In her interview, Farida said: “...that was a time, you know, when I guess my friends and everyone around me, they didn’t, they weren’t there for me, like so I kind of felt lonely, so I think that’s when nature, you know, really helped me out because I could sit there and I could forget everything and I could forget everyone, I could just admire nature and, you know, get peace and everything” (Birch et al. 2020).

Another group of researchers documented interviews with members of a group of nine people aged between 50 and 90, who met to go on ‘health walks’. An interdisciplinary team of qualitative researchers from environmental psychology, medicine and geography analysed verbatim transcripts of a series of semi-structured interviews. Participants generally noted how the walking outdoors in a group and the after-walk socialising enabled people who otherwise lead quite different lives to come together and informally enjoy a combined physical and social activity. One walker described this as “you’re chattering away...and finding out different ways of life that people have”. Several participants identified combating loneliness or social isolation as a reason why the group walks were good for people’s well-being. They spoke of their own personal loneliness, their knowledge of others’ isolation, and the ways in which the walking group had made a difference for themselves or others. One participant explained it like this:

“I would reckon that the social implications of anything you do like...walking for health, the benefit is a 60/40 in favour of the social side. It might be 70/30...it’s certainly, in my opinion, more important than the actual activity itself. I thought...this could be of some use to people...because a lot of people are...lonely.”

Two participants who lived alone were particularly forthcoming about their need for company and the way in which joining the walking group helped them:

“My dad passed away so I was on my own. I’m not married and I don’t have children. I was kind of lost after dad passed away ...and I was like, ‘What do I do with my life? What is this?’ and my mood was dropping a bit. I don’t know if it was the grieving process or what. [The walking group provided] company for me because I’m on my own, I’m in the house...if you don’t see the neighbours then you could go all day without anybody.”

and:

“I’ve been a hillwalker for 70 years...I like walking and being out...

Living alone, I thought, ‘Well, this is good because other people with similar sort of things might join up...”

In the words of the authors, “The programme was an opportunity to ‘take us out and do something with other people”” (Irvine et al. 2022).

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Feeling close to nature creates happiness and sense of meaning/purpose in life

Both the definition of ‘happiness’ and the ways in which it might be objectively measured are complex, and so is its relationship with people’s experience of the natural world. Even so, there is evidence that for many people there is a connection between their happiness and sense of personal fulfilment, and their connection with nature.

A meta-analysis published in 2020 reviewed and analysed data from previous studies, to investigate whether nature’s ability to provide uplifting experiences that inspire awe and stretch people beyond their usual boundaries may play a role in promoting personal growth, self-realisation and self-actualisation. The researchers were exploring the impact of nature on people’s ‘eudaimonic well-being’ – the kind of well-being, contentedness or happiness that comes from personal development, growth and fulfilment... a person’s closeness to reaching their personal potential, rather than more short term, immediate, superficial or utilitarian types of happiness. The authors concluded that there is a positive correlation between nature connection and eudaimonic well-being, indicating that individuals who are connected to nature are more likely to be flourishing and functioning well psychologically. But they also indicated that it’s a complex relationship. When looking at the statistical relationship between ‘nature connection’ and ‘personal growth’, the authors reported that the relationship is ‘moderately strong’; about 10% (between 7% and 12%) of the variation in one is explained by variation in the other. So the two are certainly connected. But: there are also many other factors involved and the authors pointed out that it is still unclear whether their findings mean that people with a high connection to nature become personally fulfilled (and feel happy and ‘well’ because of it), or the other way round (personally fulfilled people tending to be better able to

establish a personal emotional connection with nature). They also pointed out that the relationship might work both ways. Despite this complication, they concluded overall that that data supported a finding that “individuals who are connected to nature are more likely to be flourishing and functioning well psychologically” (Pritchard et al. 2020).

Some research carried out in association with The Wildlife Trusts explored the impact of the 30 Days Wild nature engagement campaign on people’s well-being. About 18,500 people were estimated to have taken part in the first 30 Days Wild campaign, during June 2015. Between them carrying out an estimated 300,000 personal ‘engagements’ with nature, with each participating individual aiming to do something that actively engaged with nature every day during the month. Research involving a sizeable sample of participants assessed their nature connection, general happiness, self-reported mental well-being and pro-environmental and pro-nature behaviours, before, immediately after and several weeks after participation. Results showed that in its first year the 30 Days Wild mass engagement campaign led to sustained increases in connection to nature, also bringing associated benefits to happiness, health, and pro-nature behaviours (Richardson et al. 2016).

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Nature is a companion in older age

Many people – of all ages – feel lonely from time to time. The emotional distress of feeling disconnected registers as chronic stress in the brain. This triggers biological changes which can severely impact long-term physical health. While loneliness isn’t limited to older people, it is a challenge they often face... and one with which nature can help. Experiencing nature – including seeing it through the window – can bring great pleasure and can be a source of enhanced well-being, increasing life satisfaction, giving a sense of feeling needed, and boosting older people’s zest for life.

854 residents living in assisted living facilities in Helsinki, took part in a study of the role of nature connection in their lives. All the participants were over the age of 55 years (with a mean age of 83) and more than half of them (54%) had been diagnosed with dementia. Results indicated that accessing the outdoors was important and that nature connection was associated with psychological well-being, especially with life satisfaction, feeling needed, and zest for life. The study’s authors concluded that: “Nature remains important and is highly valued in this older adult and frail population. Nature is a source of resilience because better connection was associated with higher levels of PWB [psychological well-being], especially among those whose mobility was poor”. (Kolster et al. 2025).

A recent Finnish study looked at the effect of weekly group-based nature interventions on loneliness in the residents of 22 assisted living facilities in Helsinki. The study assessed the loneliness of 162 residents who were taking part in weekly ‘nature-based activities’ and another group of 157 residents who were taking part in ‘usual care activities’, four times each – once at the start of the programme of nature-base activities, once after three months, again after six months and also after 12 months. The authors concluded that “Group intervention with nature contacts had favourable effects on loneliness and sleep amongst physically and cognitively frail, lonely older adults in assisted living facilities”. (Pitkälä et al. 2026).

Loneliness is enhanced by reduced oxytocin levels, which fall with increased cortisol (the result of chronic stress). Not surprisingly, nature helps build relationships and reduce feelings of loneliness (as it contributes to reduced chronic stress and so reduces cortisol levels and raises oxytocin levels). But: as well as this, a study that measured social contacts and health in more than 10,000 people living in the Netherlands demonstrated that it also reduces the perception of loneliness. In the words of the study’s authors: “After adjustment for socio-economic and demographic characteristics, less green space in people’s living environment coincided with feelings of loneliness and with perceived shortage of social support”. (Maas et al. 2009).

Thirty two residents from 2 care facilities for older adults in Arizona, took part in individual and focus-group interviews to explore their relationship with outdoor garden spaces. Results revealed that views of nature were fundamentally important to resident well-being, that access to nature influenced facility choice, and use of garden spaces was influenced by the way in which individuals prefer to enjoy nature (Reynolds 2016).

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Summary



We depend on a healthy natural world for the food we eat. Insects pollinate crops while earthworms help keep soil healthy and viable. In addition, food grown with nature in mind can be more nutritious and therefore benefit our own health. However, the effects of climate change and biodiversity loss – from flooding and drought to a loss of pollinating insects and an increase in pests – makes growing food much harder, and is putting our food supply at risk. So it’s in our interest to look to nature, and incorporate nature into our food systems, to boost biodiversity, safeguard our food security, and keep healthy food on our shelves.

Foods grown in natural environments with healthy soil are better for health

Healthy soil means healthy crops, which leads to healthier people. Sustaining and rebuilding healthy natural soils (by avoiding fertilisers and pesticides, preserving the diversity of soil microbes, and restoring the soil’s natural, ecologically intact structure and function) can bring many benefits for our health. These may be indirect, by reducing pollution levels or helping to reduce the intensity of heatwaves and the risk of flooding, or direct, by increasing the nutritional value of the food we eat.

A regenerative, organic approach to farming helps reduce our exposure to harmful pollution and lessens the impacts of climate change – for example, by cutting the risk of extreme heatwaves and flooding. It also supports stronger food systems that can keep producing healthier, more nutritious food.

Farmers who take this approach aim to preserve and restore the soil’s ecological health, partly to reduce environmental pollution, build soil organic matter, improve water retention and promote long-term soil fertility. This is good for the health of the planet, and for the resilience of primary food production. These aspects of regenerative organic farming build local ecological health by increasing biodiversity above and below ground, benefiting pollinators, promoting natural pest control and more diverse and healthy soil microbiomes. It also locks away more carbon and reduces carbon emissions (Singh et al. 2024).

There is some evidence that reduced use of artificial fertilisers and increased organic farming methods can increase the availability to and uptake of important micronutrients by crop plants (Barański et al. 2014; Stephen et al. 2023), and in the meat and milk of farmed livestock (Średnicka-Tober et al. 2016a; Średnicka-Tober et al. 2016b).

Recent evidence reviews found that crop performance and resilience was improved when healthy soil was restored and maintained by farming practices like crop rotation, the use of

organic amendments and precision seed-drilling. Studies also demonstrate clear links between soil health and the nutritional quality of crop plants. The authors concluded that the way in which soil is farmed is critical to its health, which in turn adds to the nutritional value of the crops. Plants grown in healthy soils resulting from organic and regenerative farming practices may:

- be richer in polyphenols (a group of antioxidants and anti-inflammatory agents that may protect human cells from chronic disease)
- have more balanced (and longer-lasting) accumulation of proteins (which may be significant in maintaining the dirty system as well as the function of muscles and other organs)
- accumulate starch and soluble carbohydrates more readily (in root crops such as potatoes)
- have a higher fibre content (in whole-grains, fruit and vegetables)
- have a higher protein content and better balance of essential amino acids (in grains)
- contain higher concentrations of important micronutrients such as zinc, magnesium, potassium, iron and vitamin C

The authors concluded that restorative and organic agriculture “... provides measurable health benefits by improving the macronutrient and micronutrient content of food, enhancing bioactive molecules, and boosting antioxidant properties. These advantages are deeply rooted in the improved soil health and biodiversity associated with these sustainable practices. By prioritizing these agricultural systems, we can not only protect the environment but also promote human health and reduce the burden of diet-related diseases” (Feliziani et al. 2025).

A similar review, published the previous year, presented evidence that healthy soil underpins the health of people and

the planet, while also promoting biodiversity. The authors argued that soil contributes to multiple critical ecological processes, including through biomass production, by regulating the carbon pool, providing a habitat for 25% of global biodiversity, cycling the nutrients upon which terrestrial systems depend, and cycling water. They also argued that soil also underpins human health, on the basis that humans use soil to provide 98.8% of our food, to sustain our nutrition, regulate pathogens and supply medicines. In view of the very significant area of Earth’s un-frozen land surface that is used by humans for the production of either plant-based or animal-based foodstuffs (around 32% of it), and the significant levels of soil degradation across much of that (33% of global soils; 52% of agricultural land), the authors argued that the restoration and maintenance of soil health across all its functions is “... imperative if we are to improve future human and planetary health.” (Kopittke et al. 2024).

Unhealthy soils, containing pollutants like heavy metals, pesticides, dioxins and toxic synthetic chemicals can lead to crop impurities (which may enter the food chain) and may seep into rivers, adding to water pollution (and providing another route to human contact and consequent health impacts). All of these increase the risk of cardiovascular disease (Münzel et al. 2025). Reducing these pollutants through changed farming practices and industrial processes would consequently reduce the associated risk of illness relating to people’s heart and circulation.

There is increasing evidence that soil microorganisms may be either a significant cause of human ill-health, or a potential contributor to good human health and that healthy soil ecosystems may be important in and of themselves as a contributor to public health, particularly in urban areas (Roslund et al. 2024; Sun et al. 2024).

If food is produced and supplied locally, through a short supply chain, there is some evidence that it may have more positive and fewer negative impacts on the natural environment. A study of short food supply chains in Quebec, published in 2016, revealed that farms that were linked into a local food supply chain (rather than supplying to more distant markets) were likely to have more windbreaks, were likely to be certified as ‘organic’ (and so highly likely to use fewer artificial fertilisers, pesticides, etc), and more likely to use ‘green manures’ and winter cover crops (with a likely positive impact on soil health, reduction of erosion, etc). While the study could say nothing categorical about the direct implications of short supply chains for local or global biodiversity or overall ecosystem function (due to lack of appropriate data), it did point to the likely environmental benefits of smaller field sizes, higher abundance of windbreaks and other landscape features that made farms involved in short food supply chains more structurally complex than those that supplied produce to more distant markets (Mundler & Laughrea 2016).





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Nature's recovery can lead to greater food security and more stable cost to consumers

Uncertain seasons and the impacts of extreme weather and biodiversity loss are threatening food production and food security. A food system based on nature-friendly, organic and regenerative principles and practices can increase the resilience and sustainability of food supply chains, leading to greater food security and help limit extra costs for consumers.

In his independent review of the economics of biodiversity, Professor Sir Partha Dasgupta identified biodiversity loss as a risk to the world economy in general and to food security specifically. Among other things, he argued biodiversity loss was damaging the health of soil needed to grow food and that intensive farming techniques and the use of pesticides are damaging the ecosystems necessary to ensure the long-term security of food production. He described the ways in which various organisms contribute towards the health of soil and support food production, as follows:

“Archaea, bacteria and fungi act as chemical engineers, decomposing plant residues and soil organic matter, contributing to nutrient transitions and recovery of polluted soils. Other organisms act as biological regulators, controlling plant pathogens and contributing to food security. Larger organisms, such as earthworms, termites and small mammals act as ecosystem engineers, controlling the structure of the soil matrix. Without these diverse species playing different roles, the soils would fail to support the global food system.” (Dasgupta 2021).

In 2019, the Intergovernmental Science–Policy Platform on Biodiversity and Ecosystem Services (IPBES) estimated the rate of extinction globally is at least tens of times (and possibly hundreds of times) higher than the average rate over the past 10 million years. IPBES forecasted that an average of a quarter of species in animal and plant groups that had been assessed were threatened with extinction. It said this meant around one million species face extinction and that this loss of biodiversity poses a serious threat to food security. The assessment said that 10% of domesticated breeds of mammals and 3.5% of domesticated breeds of birds had already been recorded as extinct. It also said the wild relatives of these domesticated breeds were under threat of extinction, resulting in a narrowing of the gene pool. The assessment’s authors argued this biodiversity loss would leave agricultural systems more vulnerable to threats such as pests, pathogens and climate change. The assessment also said there had been a decline in the biodiversity of pollinators, leading to an increased risk of crop failure and damage to the horticultural industry (Diaz et al. 2019).

In 2019, The Wildlife Trusts working in south west England commissioned Professor Dave Goulson, from the University of Sussex, to produce a report on the importance of insects, the causes and significance of population declines, and the ways in which recent harmful trends might be reversed. The report reviewed and interpreted a wide range of evidence. It highlighted that over the previous 50 years, the abundance of insects may have fallen by 50%, and that in some places insects may be in a state of catastrophic population collapse, with serious consequences for the functioning of whole ecosystems and the production of a considerable proportion of the planet’s food. It included numerous examples of declining insect abundance, recorded by scientists (a 75% reduction in the biomass of insects caught in German traps between 1989 and 2014; a 40% decline in the abundance of large moths in southern Britain between 1968 and 2007; a 46% reduction in the abundance of butterflies of the UK’s “wider countryside” between 1976 and 2017; the extinction of 23 species of bee and flower-visiting wasp in the UK since 1850). And it indicated the significance of these declines (and importance of reversing them) for the future supply, cost and security of food (including reference to a study that had estimated that about three-quarters of all crop types grown by humans require pollination by insects – a service estimated to be worth between \$235 billion and \$577 billion per year worldwide) (Goulson, 2019).

The UK’s third climate change risk assessment analysed the risks posed by climate change. Amongst other things, it included



risks to food supply and availability, and reviewed a considerable amount of evidence relating to this. The authors’ analysis indicated that globally, food yields are already decreasing in response to rising temperatures and increasing water scarcity. They considered that the biggest risks to food security in the UK, however, are not the long-term changes in the average yields, but the variability in access to food (and its ingredients) associated with supply-side disruptions arising from variability in the weather, and what they called “the potential for cascading and interacting risks”. Among other things, the authors noted that food-related climate risks include:

- a 26% reduction in the body size of several North Sea commercial fish species in response to a 1° to 2° temperature rise over a 40-year period
- An increase in climate-related pests and diseases (such as locust swarms affecting the Horn of Africa in 2020)
- Lower protein, iron and zinc content in rice grown under elevated CO₂ (lower by 10%, 8% and 5% respectively)
- Reduced global mean yields of maize, wheat and soybean (all of which have already been observed). (Challinor & Benton 2021)

A different chapter of the Third UK Climate Change Risk Assessment assessed the climate-related risks and opportunities for the UK’s natural environment, including those related to wildfire. While noting various limitations in available data, it reported that from 2009 to 2017, 130,370 wildfire incidents were recorded in England, burning an area of 35,557 ha and representing a significant and rising threat to agricultural production in many areas. Mountain heath and bog made up around half of this area, with improved and semi-natural grassland and arable land making up a further 40%. Analysis found a strong correlation between wildfire incidence and drought conditions, consistent with reports of spikes in wildfires during such periods. One example given by the authors was as follows: “Sustained dry weather in July 2018 in Northern Ireland required the Fire and Rescue Service to attend an unprecedented number of gorse fires (1,061; a 1,053% increase on the same period in 2017)” (Betts & Brown, 2021).

A 2025 report published by Foresight Transitions reviewed and evaluated the climate and biodiversity-related risks faced by the European Union (EU), in relation to the supply of five major imported foods (maize, rice, wheat, cocoa, coffee and soy). These six commodities were selected for their significant contribution to the European food economy and Europe’s significant (and largely unavoidable) dependence on imports to fulfil demand. For instance: up to a third of the protein used for animal feed in the EU is imported – usually as soy. The EU coffee industry supplies 2.3 million tonnes of product, with a total annual value of €13 billion, virtually all of which

is dependent on the import of coffee beans from outside Europe. Similarly, the EU is the biggest consumer, producer and exporter of chocolate globally, with a chocolate market valued at about US\$50 billion – all entirely dependent on imported cocoa. Using trade data for 2023, the study looked at the ‘biodiversity intactness’ and ‘climate readiness’ of exporting countries for each of the six commodities chosen, using them as proxies for the climate and biodiversity risks faced by supply chains from each country into the EU. The vast majority of imports of rice, coffee and cocoa (more than 90% for rice; 100% for both coffee and cocoa) are from countries considered to have ‘low’ or ‘low to medium’ level of climate readiness, representing very significant climate risks to these supply chains. In relation to cocoa supply and chocolate production, this is already being reflected in a global shortage of supply, with consequent impacts on price, availability and re-formulation of chocolate recipes. Supply chains for soy, maize and wheat are all also facing very substantial climate risks, with each having significantly more than 50% of total imports coming from countries with ‘low to medium’ climate readiness. While biodiversity risks to these food commodity supply chains were generally assessed to be lower, but even so, for wheat and maize in particular, the study identified some significant and increasing biodiversity-related risks. For wheat, in particular, 53% of EU imports in 2023 were from countries with only ‘medium’ biodiversity intactness and 13% were from countries considered to have low intactness. Ukraine and the UK were flagged as being key wheat suppliers highlighted by the authors as being “of particular biodiversity-related concern” – in part because of their relatively low current biodiversity intactness and partly because of an expectation that their biodiversity intactness will decline further by 2030 (Hyslop & Workman, 2025).

In 2024, the Department for Environment, Food & Rural Affairs (DEFRA) published its most recent analysis of statistical information relating to food security in the UK. It carried out a comprehensive review and analysis of data and trends likely to influence the security of the UK’s food system and supplies, across five themes: Global Food Availability; UK Food Supply Sources; Food Supply Chain Resilience; Food Security at Household Level; and Food Safety and Consumer Confidence. The role of nature, biodiversity and climate in the UK food system was discussed at several points in the report’s wide ranging analysis. These included the following: “Extreme weather conditions in the UK and across the globe made more likely by climate change have caused further food chain disruptions” (Executive Summary ‘context’); “Climate change, nature loss and water insecurity pose significant risks to the ability of global food production to meet demand over the longer term” (Executive Summary ‘findings by theme’); “Extreme weather events continue to have a significant effect on domestic production, particularly arable crops, fruit and vegetables” (Executive Summary ‘findings by theme’); “Long-

term decline in the UK’s natural capital is a pressing risk to UK food production. Both productivity and sustainability of food production rely on ecosystem services provided by biodiversity, healthy soil and clean water” (Executive Summary ‘findings by theme’); “The impacts of climate change, biodiversity loss and water insecurity both at home and abroad remain pressing risks to food security. They drive volatility in the present and put sustainability and resilience of food production at risk over the longer term” (Executive Summary ‘whole system view’). Among other statistical evidence presented in the analysis, the assessment reported that between 2015 and 2019 the amount of land globally which had been reported as being degraded increased by 4.2 percentage points, from 11.3% to 15.5%. It also indicated that the all-species indicator of headline biological abundance in England had declined to just under 70% of its 1970 value, but had levelled out in recent years. Despite the dependence of UK food security on a healthy, ecologically functioning biodiverse natural ecosystem and a stable climate, the report’s analysis indicates that in recent years UK consumers have responded to higher food prices and wider general inflation by buying cheaper goods and prioritising price over other factors such as environment, health, and wider ethical values (Department for Environment, Food & Rural Affairs 2024).



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Eating food in its natural state is much better for your health and the planet than food that has been processed

Irrespective of the type of food harvested in the field, there is a large and rapidly growing body of evidence that once it has left the farm, processed – and especially ultra-processed – food is bad for public health. So, it is likely to be good for your health to eat food that is as close as possible to its natural state. The manufacture and supply of highly-processed food also depends on mass-production methods that have very significant negative consequences for the natural world. So, eating a more natural, less-processed diet could also help the planet.

A recent large-scale, multi-centre study using data from nearly 429,000 people indicated that eating more unprocessed and minimally processed food is likely to reduce your chance of death and that eating more ultra-processed foods is likely to have the opposite effect. The authors concluded that “higher consumption of unprocessed/minimally processed foods is associated with lower risk of all-cause and multiple forms of cause-specific mortality, while greater consumption of UPFs [ultra processed foods] raises risk of all-cause

mortality and mortality from circulatory diseases (including cerebrovascular or ischemic heart disease), digestive diseases, and Parkinson’s disease, after controlling for education and lifestyle factors, including alcohol intake. Further, replacing 10% g/day of either processed or UPFs with an equal amount of unprocessed/minimally processed foods was inversely related to all-cause mortality and several cause-specific mortality endpoints”. In other words, eating 10% less processed food, and replacing it with minimally processed alternatives will likely increase your lifespan (González-Gil et al. 2025).

After 8 weeks on a controlled ‘minimally processed food’ (MPF) diet developed specifically to comply with the UK’s Eatwell Guide on a healthy diet, participants showed a number of health-related differences when compared to a control group who had been on an alternative ‘Eat Well-compliant’ diet that included ultra-processed foods (UPF). Fat mass, body fat percentage, visceral fat rating and total body water mass were significantly lower at 8 weeks from baseline on the MPF but not UPF diet. Systolic blood pressure and diastolic blood pressure were significantly lower at eight weeks compared with baseline on the MPF but not UPF diet, whereas heart rate (HR) was significantly lower on the UPF but not MPF diet. Craving for sweet, savoury and ‘difficult to resist’ foods were significantly lower at 8 weeks from baseline on the MPF but not on the UPF diet (Dicken et al. 2025).



A study of nearly 127,000 people in the UK, linking dietary recall surveys, hospital and mortality records, suggested that each 10% increase in consumption of plant-sourced, non-ultra processed food (UPF) reduces the risk of cardiovascular disease (CVD) by 7%, and the risk of dying from it by 13%. The study also revealed the reverse relationship between consumption of plant-sourced foods that have been ultra-processed: a 10% increase in consumption of these translated to a 5% higher risk of CVD and a 12% higher risk of CVD mortality (Rauber et al. 2024).

A similar study in 2023, involving more than 197,000 UK residents, showed a similar relationship between cancer risk and the consumption of ultra-processed food (UPF). In this case, each 10% increase in UPF consumption was associated with a 2% increase in the risk of developing any kind of cancer, with bigger implied impacts on the risk of ovarian cancer (19%). The risk of dying from cancer again followed a similar pattern, with each 10% increase in UPF consumption being associated with increased overall cancer mortality risk (+6%), and with the risk of mortality from some specific cancers (breast cancer: +16%; ovarian cancer: +30%) (Chang et al. 2023).

There is a similar emerging realisation that the consumption of ultra-processed food (UPF) is not only bad for the health of individual people, but also for the wider health of the planet. UPF production and delivery to the end consumer is characterised by extensive monoculture crops (that are dependent on high levels of artificial chemical use), high energy demands for processing, a long transport chain and excessive packaging. The food system that generates UPF has tangible negative impacts on climate change, air pollution, land use, energy use, water use and food wastage, and it contributes to biodiversity loss. Nearly 6,000 overweight or obese Spanish people aged between 55 and 75 took part in a study to assess the personal and environmental consequences of reducing their consumption of UPF over a two-year period. Overall, reduced consumption of UPF was associated with lower energy usage and lower greenhouse gas emissions, but higher water usage (largely due to the increased need for water in the production of vegetables, fresh fruits and nuts). In the words of the study’s authors: “UPF are unnecessary foods that should not be present in a balanced diet, and promote overconsumption, which is one of the main reasons for the increasing negative environmental impact”. The participants who reduced their consumption of UPF by the largest amount experienced the greatest weight loss and reduction in body mass index (BMI), and also the greatest reduction in greenhouse gas emissions and energy use associated with their diet. In the group of participants who reduced their UPF consumption by the biggest amount, on average, their associated annual energy use went down by 5.3 MJ (mega joules) and their associated greenhouse gas emissions reduced

by 0.6kg CO₂e, while their water usage increased (by 0.9 m³). The study’s authors concluded that low consumption of ultra-processed foods may contribute to environmental sustainability and that guidance encouraging lower consumption of UPF should be considered not only on public health grounds, but also for its contribution to planetary health (García et al. 2023).

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Summary



Nature is necessary for the air we breathe. Modern air pollution poses a considerable challenge (Royal College of Physicians, 2025). In our increasingly urban world, air pollution from traffic, industrial facilities and agricultural practices can bring multiple health risks, increasing our risk of heart failure, stroke and dementia. But once again, nature can help. Greenery surrounding us – especially trees and hedges – and in the wider countryside can help absorb and filter pollutants and help to create a protective shield between ourselves and harmful particles in the air. This helps keep us healthy and breathing easy – literally.

Royal College of Physicians research reported that air pollution is linked to over 700 health conditions at every stage of people’s lives – from premature birth and effects on organ development in childhood, through to heart and lung disease, diabetes, strokes and dementia in adulthood. It also revealed that 30,000 deaths per year in the UK can reasonably be attributed to air pollution, with an economic cost of £27 billion in the UK due to healthcare costs, productivity losses and reduced quality of life. The authors concluded: “When wider impacts such as dementia are accounted for, the economic cost of air pollution may be as high as £50bn.”

A healthy natural environment means having cleaner air

Natural vegetation and water help to filter pollution from the air and reduce air pollution, with direct consequences for human health. The leaves of plants can help to remove pollutants from the air – especially particulate matter. The green spaces around us – including parks, gardens, woodlands, street trees, and the semi-natural vegetation in the wider countryside – help to clean the air we breathe.

A recent comprehensive review of the scientific evidence relating to the role of greenery on airborne particulate matter cited many studies that independently supported the beneficial role of greenery and green spaces in removing particulate pollution from the air in urban areas. It proposed that greenery (especially trees and bushes) acts in three ways to reduce levels of particulate matter in the air: it encourages deposition (by slowing and disrupting air-flows, and providing surfaces for airborne particles to settle on); it disperses particulates (by altering their direction and speed of travel as they pass through); and it modifies the physical and chemical properties of particulate matter that comes into contact with the vegetation (accumulating fine matter into heavier particles, or preferentially absorbing heavy metals, for instance). The authors concluded that “*Urban vegetation serves as a barrier to PM [particulate matter] either by ‘shielding’ emissions (point or line sources) from reaching the neighbourhood or sheltering vulnerable populations from local and background PM concentrations. In addition to acting as a barrier, the placement of vegetative cover also maximizes deposition*

and net elimination of PM, resulting in the reduction of its local concentrations, particularly during peak pollution hours, which are responsible for short-term health impacts” (Vashist et al. 2024).

A 2024 study looked at the relationship between changing air quality and the abundance of greenspace around monitoring stations in Europe and the USA. It found that increasing amounts of greenspace across a town or city were associated with reductions in air pollution levels – particularly reductions in ozone (O₃) and particulate matter. They also highlighted that the relationship isn’t a simple one, as windspeed, precipitation and humidity all had a bigger effect on pollution deposition and dispersal than the amount of greenspace. In particular streets, very local pollution levels may even be increased as a result of greenery, depending on specific local conditions and the type and positioning of greenspace and trees within the urban landscape. So: at a very local level, greenery may be good, but detail matters (Venter et al. 2024).

Another recent review explored the role of ‘engineered greenery’ (constructed green systems such as green roofs, green walls and areas of green planting intentionally created and maintained to deliver specific environmental benefits) in reducing urban air pollution. It concluded that across a range of pollutants, green systems can significantly reduce pollutant concentrations in both indoor and outdoor environments (Vitaliano et al. 2024).

A 2023 meta-analysis based on data from 56 studies covering 42 cities in 17 countries showed that urban vegetation significantly reduces the concentrations of nitrous oxide

(NO_x), sulphur dioxide (SO₂), and particulate matter (PM) in surrounding green spaces, but—perhaps unexpectedly—increases the concentration of ozone (O₃) (Gong, et al. 2023).

A 2012 study of the relationship between traffic-related air pollutants (TRAPs) and vegetation around 39 schools in Barcelona concluded that higher greenness within and surrounding school boundaries was consistently associated with lower indoor and outdoor TRAP levels (including levels of nitrous oxide {NO₂}, ultrafine particles, black carbon and traffic-related PM_{2.5} – very fine particulate matter). There were also indications that schools with more trees had lower pollution levels than those with other kinds of greenery nearby (Dadvand et al. (2012).

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PAUL HOBSON



TERRY WHITTAKER/2020VISION



KATHY/UNPLASH

You will breathe easier when nature is healthier

Trees and other vegetation usually have a positive effect on respiratory health. For a variety of reasons, including filtering pollution out of the air, people who are exposed to greenery and green spaces are less likely to die from a breathing-related illness, less likely to need to go to hospital with breathing difficulties.

A review looking specifically at the role of greenness in respiratory health reviewed 42 original research papers and concluded that the relationship between a green, natural environment and this aspect of human health is complex. It highlighted that some aspects of greenness may be harmful and that greenness may have different health effects on different groups within the population. Nonetheless, overall, the authors concluded that “This review... shows that greenness is a mainly beneficial exposure with protective effects on respiratory health”. Studies reviewed included studies demonstrating positive effects of exposure to greenness on respiratory mortality, the incidence of lung cancer, hospitalisation due to respiratory problems, lung function, chronic obstructive pulmonary disease (COPD) and asthma (Johanessen et al. 2023).

Another similar review considered 108 papers examining greenspace and respiratory health and reached similar conclusions. The papers reviewed identified 195 different associations between greenness (including greenery, greenspace, vegetation, tree cover, parks and forests) and respiratory health. Two thirds of these were beneficial and only 9% were negative. The authors concluded that across all the evidence reviewed, the most compelling implication was that people are less likely to die from respiratory illnesses if they have more exposure to greenness (Mueller et al. 2022).

A short communication in *The Lancet Respiratory Medicine* summarised an investigation of 660,000 asthma hospitalisations among the 41 million urban residents in England. This study showed that ‘trees’ and ‘greenspace’ were both, on average, associated with lower rates of asthma hospitalisation. Accounting for interactions between vegetation and background air pollutant concentrations (fine particle air pollution, PM_{2.5}; NO₂; SO₂) showed that trees were associated with greater reductions in hospitalisation when pollutant levels were higher, and had no significant effect when pollutant concentrations were very low. By contrast, there was evidence that greenspace was associated with greater reductions in hospitalisation when pollutant levels were lower, and had no significant effect when pollutant concentrations were very high (Soyiri & Alcock 2018).

As little as 10 µg/mL³ of fine particulate matter (PM_{2.5}) in the air is associated with a 10% increase of cardiovascular mortality due to coronary artery disease, stroke, and also congestive heart failure, atrial fibrillation, and ventricular arrhythmias, including sudden death due to cardiac arrest (Zhao et al. 2020). Consequently, measures that reduce levels of in the air – including vegetation and greenspace around where people live and work – are highly likely to reduce deaths caused by all of these things.

A localised study in Southampton objectively confirmed the ability of native vegetation (in this case brambles and ivy) to remove particulate matter from the air – especially smaller particles measuring 2.5 µm and below and especially near to areas of high traffic density (Sillars-Powell et al. 2020).

A 2018 review of evidence for the governments of England, Scotland and Northern Ireland was cautious about the potential for urban tree planting to make major contributions to improving urban air quality, drawing attention to observations that the dispersion of pollution by vegetation may just move the problem elsewhere, that vegetation barriers close to a pollution source may reduce the spread of that pollution while increasing its concentration near the source, and that the potential increases in pollution deposition from realistic tree planting schemes is small. While cautioning against being over-optimistic, the authors nevertheless documented a number of studies that confirm the potentially positive role of UK vegetation in reducing pollutant concentrations of particulate matter (PM), nitrous oxide (NO₂), sulphur dioxide (SO₂) and ozone (O₃) through deposition, dispersion, and altered chemistry. Even though in some circumstances vegetation may increase pollutant concentrations, its barrier effect can halve downwind pollutant levels in specific roadside configurations. Vegetation can reduce PM concentrations by 2–10% in urban planting schemes (Air Quality Expert Group 2018).

A more recent review (2024) concluded – among other things – that “The findings of all the reviewed studies suggest that urban green spaces can significantly reduce PM [particulate matter] exposure in ambient air at both local and regional scales either by altering different properties of PM, such as its trajectories and velocity, or by permanently or temporarily removing it from the air” (Vashist et al. 2024).

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COOLING

Summary



Our planet is warming to a dangerous level, bringing with it huge challenges for us as a society and as individuals. Hot summer weather may have its attractions, but increasing temperatures and heatwaves puts strains on our bodies that can cause significant health problems. Heat stress can cause nausea, dehydration, cardiovascular issues, and even death. It can trigger asthma attacks and can make managing diabetes more challenging. At the very least, it can stop us from getting a good night’s sleep. Hotter temperatures can also assist the spread of disease. A nature-rich environment, including shade-giving trees, water and green surfaces, helps to cool our homes, creating more comfortable living spaces and protecting us from some serious health risks. What’s more, looking to nature can help turn down the thermometer on our rapidly warming planet. In 2015, 195 Parties at the UN Climate Change Conference (COP21) signed the Paris Agreement which aims (among other things) to limit global temperature increase to ‘well below’ 2°C. Natural systems play a powerful role in reducing global heating, protecting us from the damaging effects of climate breakdown such as heatwaves, drought, storms and flooding. Restoring and expanding habitats like forests, peatland, saltmarshes and marine ‘blue carbon’ stores is already helping cool our planet by locking away carbon, reducing greenhouse gas emissions and removing CO₂.

Having natural shade and water nearby reduces the risk of heat-related illnesses during hot weather

Most of us live in urban areas which are typically warmer than the surrounding open countryside. Climate change is making heatwaves more frequent and more intense, which causes significant health problems for many people. More trees, green spaces and water near where we live and work helps keep temperatures down and everyone healthy.

A study of the influence of urban vegetation and water bodies on heat-related death-rates among older people living in Lisbon found a very clear link between the amount of vegetation (parks, gardens, woodlands, street trees, etc) or water (the sea, rivers, lakes, etc) near where people lived, and their risk of dying in extremely hot weather. In the least green areas, a 1°C temperature increase during periods of extreme heat (above 24.8°C) led to a 14.7% increase in deaths amongst people over the age of 65. In the most green areas, the increase was much smaller: only 3.0%. The picture was similar for people living within 4km of a river, lake or the sea: a 1°C temperature increase at times of extreme heat led to a 2.1% increase in deaths, but in areas further from water the increase was 7.1% (Burkart et al. 2016).

In 2022, heatwave temperatures in London exceeded 40°C and caused 387 excess deaths there (deaths that otherwise would not have happened). Following this, a study was

undertaken to assess the potential of urban trees to reduce heat-related mortality in the city. Results showed that areas with the most tree cover (those in the top 10% for canopy coverage) typically had maximum daytime temperatures 0.8°C lower than those with the least tree cover (those in the bottom 10% for canopy coverage). Their minimum temperatures were also typically 2°C lower. Combining this with calculations to estimate the daily heat-related mortality in London resulted in an estimate that the city’s current tree-coverage helped to avoid 153 heat-attributable deaths between 2015 and 2022, 16 of which were during the heatwave events of 2022. The authors concluded that as future temperatures rise and London experiences more days with maximum temperatures exceeding 18.9°C, by 2061-2080, London’s current tree coverage will likely help to avoid 42 heat-attributable deaths per year (Taylor et al. 2024).

In a study of 452 cities in 24 countries across five continents, estimates of ‘greenness’ were combined with a range of health, socio-economic and temperature data to investigate the links between heat-related mortality and urban vegetation cover. Cities were divided into three groups on the basis of their estimated ‘greenness’. On very hot days (compared to days with temperatures that were low enough to be safe from heat-related mortality), the risk of dying was 46% higher than normal in cities with low greenness, 24% higher in cities with medium greenness and only 19% higher in those with high greenness. The clear conclusion from the study was that more urban trees and green spaces lead to fewer deaths during periods of extreme heat. The study’s authors estimated that every 20% increase in a city’s greenness could reduce heat-

related deaths by about 9%. Across all the countries in the study, this could prevent around 933 deaths every year (Choi et al. 2022).

A recent meta-analysis reviewed 182 studies on the cooling effects of urban trees across 17 climates in 110 global cities or regions. Its author concluded that tree ‘implementation’ (the use of trees as a proactive part of urban design) reduces peak monthly temperatures to below 26°C in 83% of the cities. Trees can lower pedestrian-level temperatures by up to 12°C by directly blocking out solar radiation (providing shade) and through the evaporation of water from leaves (transpiration) (Li et al. 2024).

Peatlands are well known for their high carbon content and the role this plays in helping to regulate global temperatures (see below - *Nature helps turn the heat down on a warming planet*). It is also now known that the restoration of peatlands can have a significant impact on the temperature nearby. A recent study of land surface temperature, albedo (the ability of a surface to reflect solar radiation back into space, rather than absorbing it) and vegetation across 72 peatland sites in North America and Europe indicated that degraded peatlands typically have lower albedo (reflection of solar radiation), lower daytime land surface temperatures and higher nighttime surface temperatures than equivalent intact peatlands. As they revert to a more natural state after restoration, their temperature and reflectivity profiles gradually revert to being more similar to those of intact peatlands (Burdun et al. 2025).

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Cooler natural settings reduce strain on the heart and circulatory system

The health risks associated with rising global temperatures are especially significant for the elderly, the very young, and those with existing heart-related health conditions. It is important to keep cool... and nature can help with that.

A 2020 meta-analysis of 266 studies showed that for every 1°C increase in temperature above reference temperatures (temperatures above which a temperature peak is considered to be ‘excessive’, which vary from place to place depending on climate), there is an associated 0.5% increase in the amount of cardiovascular disease and a 2.1% increase in cardiovascular disease-related deaths. Although deaths from all cardiovascular diseases was shown to be related to increased temperature, stronger risks were shown with stroke (3.8% increased risk) and coronary heart diseases (2.8% increased risk). The review’s authors also observed that “during heatwaves, the risk of cardiovascular disease-related mortality significantly increased by 11.7%, with the risk increasing as heatwave intensity increased” (Liu et al. 2022).

Results of a 2024 meta-analysis demonstrated that across a range of urban locations, and for a wide range of diseases, a 1°C temperature increase brings with it a 1.1% increase in the amount of disease in the population, and a 2.1 % elevation in disease-related mortality. Heatwaves were also associated with a 3.8% increase in the amount of disease in the population compared to in periods of cooler temperature, and an overall 22.4% increase in the risk of death. The authors highlighted that there’s considerable complexity in the causes of illness and/or death in different places (with greatest risks in the tropics, for instance) and the socio-economic profiles of those experiencing them, but even in temperate/oceanic parts of the globe such as the UK, overall risk of mortality rises by about 2% for every 1°C increase in heatwave temperature. Likelihood of mortality from cardiovascular diseases increases by fractionally more (2.2% per 1°C) and from respiratory diseases by fractionally less (1.9% per 1°C) (Yang et al. 2024).

In general, relaxation in forest environments (which are typically cooler than their open or built-up surroundings) can bring a range of health benefits, many of which relate to the heart and circulatory system. A 2020 review of the scientific literature revealed that ‘forest bathing’ interventions were effective at reducing blood pressure, lowering pulse rate, improving heart rate variability (HRV), improving cardiac-pulmonary parametres and metabolic function, inducing a positive mood, reducing anxiety levels, and improving the quality of life of participants who either had high blood pressure or who were at risk of it. The review’s authors concluded that “forest bathing,

particularly forest walking and therapy, has physiologically and psychologically relaxing effects on middle-aged and elderly people with pre-hypertension and hypertension.” (Yau & Loke 2020).

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Nature helps turn the heat down on a warming planet

Global warming and climate change are already having a significant impact in the UK: we are experiencing more storms and flooding, hotter summer temperatures and more heatwaves and droughts as the planet heats up. Many natural systems (like forests, peatlands, saltmarshes and seabed sediments) collect and store carbon, helping to reduce global warming. If we extend, restore and protect these systems and habitats, they will collect and store more carbon and help stabilise the planet’s temperature. If we don’t, then they risk releasing their existing carbon stores, and so adding to the problem.

Over 30 percent of human carbon emissions are sequestered (captured and stored) annually through photosynthesis and subsequent carbon storage in terrestrial biomass and soils (Friedlingstein et al. 2021).

The Blue Carbon Mapping Project, led by the Scottish Association for Marine Science (SAMS) on behalf of WWF, The Wildlife Trusts and the RSPB, provides a detailed estimate of the amount of carbon captured and stored in UK seas, including Marine Protected Areas (MPAs). The series of reports uses the best available data on coastal and marine habitats that capture and/or store carbon (known as ‘blue carbon’). It estimates that 244 million tonnes of organic carbon are stored in just the top 10 centimetres of seabed sediments and vegetated habitats, with over 98% of it stored in seabed sediments such as mud. It’s estimated up to 13.5 million tonnes of organic carbon could be added annually to sediment stores – more than by all the UK’s forests. Marine Protected Areas (MPAs) with mapped blue carbon habitats have been estimated to contain 43% of the total organic carbon (105 million tonnes of organic carbon). Better protection of our MPA network could help protect these important stores (Burrows et al. 2024).

Between 1990 and 2025, the UK’s forests removed between 15 and 19.5 million tonnes CO₂e (carbon dioxide equivalent) each year (Forest Research 2024).

A paper published in *Nature*, in 2021, stated that “Decades of work provide strong evidence that nature-based solutions can deliver many local ecological and socio-economic benefits. Restoring a forest next to a stream, for example, might reduce flooding, improve carbon storage and support fisheries. Growing recognition of such benefits means that interest in nature-based solutions is soaring: they can help people adapt to climate change, achieve sustainable

development goals, protect biodiversity and mitigate climate change”. The authors of the paper reported that: “Our analysis shows that nature-based solutions can have a powerful role in reducing temperatures in the long-term. Land-use changes will continue to act long past the point at which net-zero emissions are achieved and global temperatures peak (known as peak warming), and will have an important role in planetary cooling in the second half of this century. Before then, nature-based solutions can provide real but limited mitigation benefits. Crucially, the more ambitious the climate target, the shorter the time frame for such solutions to have an effect on peak warming.” (Girardin et al. 2021)

Prior to 2024, Wildlife Trusts across the British Isles had restored more than 57,000 hectares of previously damaged peatland. A study explored the implications of this for climate change, including an investigation into the complex interactions between climate change and the emission of different greenhouse gases at different stages in the restoration of a peatland. It revealed that these restoration efforts to date are highly likely already to have reduced associated annual greenhouse gas emissions by about 980,000 tCO₂e per year. This is equivalent to nearly 10% of the reduction in emissions that was achieved from Land-use, Land-use Change and Forestry (LULUCF) in the UK as of 2022 – so a considerable amount. The paper’s authors concluded that “Across all of our analyses... a positive conclusion emerges: restoring peatlands results in less [global] warming than if they remain degraded, with no risk of increased warming even in the short term, and a potential to have a long-term net cooling effect” (Zhang et al. 2025).

There are between 36 and 185million ha of ‘blue carbon’ ecosystems (BCEs) around the world, including mangrove forests, tidal marshes and seagrass meadows. Between them, these marine and coastal habitats potentially store between 8.9 and 32.7 billion tonnes of carbon. A 2021 study estimated that protecting existing blue carbon ecosystems could avoid emissions of 304 million tonnes of CO₂e per year. It also estimated that large-scale restoration could remove an extra 841 million tonnes of carbon dioxide equivalent (CO₂e) per year by 2030. This would be equivalent to about 3% of annual global greenhouse gas emissions (0.5–0.8% from protection and 2.3–2.5% from restoration) (Macreadie et al. 2021).

The ocean absorbs about 25% of the atmospheric CO₂ emitted by human activities each year, an amount in excess of 2 billion tonnes of carbon per year (Watson et al. 2020).

A very recent briefing paper released by Cefas (the Centre for Environment, Fisheries and Aquaculture Science) reviewed the latest evidence on how trawling, other human activities and climate change affect seabed carbon. It highlighted that:

■ The UK shelf contains between 240 and 524 Mt (Million tonnes) of organic carbon (880 to 1,923 Mt CO₂ equivalent) in the top 10 cm of subtidal sediments.

■ These OC stocks (in the top 10cm of subtidal sediments) are equivalent to between 1 and 5 times the UK’s annual CO₂ emissions (which are about 371 Mt).

■ Each year, about 424 kt (424 thousand tonnes) of organic carbon (OC) is added to the UK OC stock by burial into sediments where, if left undisturbed, it is likely to remain for decades or centuries.

■ Human activities, such as trawling or infrastructure development, can disturb sediments and the OC within them but the exact impact and loss or gain of OC depends on a variety of local factors.

■ Over 20% of the UK seabed is trawled and the carbon disturbed, at least once (in some areas up to 15 times) every year, with particularly high pressure in areas with higher OC stocks.

■ Current evidence isn’t good enough to be able to say with any certainty how much of the carbon disturbed by trawling silty seabeds is released into the water column or how this might contribute to atmospheric CO₂ concentration, but it is likely that avoiding new disturbance and allowing disturbed seabed to recover would help.

■ Climate change itself is likely to influence rates of carbon deposition and release on the seabed, as factors such as the severity and frequency of storms, the occurrence of marine heatwaves and marine water temperatures change. (Parker et al. 2026)

A report by the British Ecological Society, published in 2021, brought together a comprehensive overview of nature-based solutions for climate change in the UK. Amongst other things, it included the following:

■ The United Kingdom’s forests currently store 1.09 billion tonnes of carbon and sequester about 4.6% of the country’s total emissions.

■ Creating heathland from ex-arable land will result in increased carbon sequestration in soils and vegetation; restoring degraded heathland (such as where it has been overgrazed and transformed into grassland), will also result in increased carbon sequestration in soils and vegetation.

■ Conversion of arable land to grassland across the UK has the potential to remove 8.72 million tonnes of carbon dioxide

(CO₂) from the atmosphere per year. In contrast, conversion of grassland to arable land could result in net emissions of 14.29 million tonnes.

■ Hedgerows are very important in arable landscapes, with current estimated stocks of up to 100 tonnes of carbon per hectare in established hedge networks.

■ In the farmed landscape, natural pest regulation has the potential to reduce the need for pesticide use, which could help reduce the approximate 8,300 tonnes carbon dioxide equivalent (CO₂e) involved in the manufacturing of pesticides.

■ Marine and coastal ecosystems can contain and absorb significant amounts of carbon, especially given the large area some habitats occupy.

■ There is significant restoration potential for habitats such as seagrass and saltmarsh, given the historic loss of these habitats through pollution and development (Stafford et al. 2021).

Another comprehensive review of the evidence relating to carbon storage and sequestration in UK habitats, published in 2021, gave a very broad and wide-ranging insight into the relationship between nature and climate change here. Amongst other things, it reported that:

■ the UK’s forests store about 4 billion tonnes CO₂e – about 30% above ground in trees and 70% in their soils.

■ Establishing 30,000ha of new woodland each year was estimated to result in an additional 14 million tonnes of CO₂e being sequestered (removed and stored) each year, by 2050.

■ Over a 100 year period 1 hectare of typical mixed broadleaved woodland in England might be expected to capture and store 700 tCO₂e.

■ Just the top 15cm of soil under a typical hectare of semi-natural grassland in the UK is likely to store between 33 and 87 tonnes of carbon (depending on the type of grassland and its location).

■ Realistic estimates of the amount of carbon stored in UK peatlands range from 3.2 to 5.1 billion tonnes, but are highly variable as they are heavily dependent on estimates of peat depth (which is difficult to do accurately over large areas) and typically don't include areas where peat is considered to be ‘shallow’ (even though these can be extensive).

■ Damaged (and especially drained) peatlands are a very significant source of greenhouse gas emissions (between 1.15

and 37.61 tCO₂e per hectare, depending on the peatland type and its current condition) that could be reduced if they were restored.

■ Floodplains are important carbon sinks and have the potential to store significant amounts of carbon, but have been subject to intensive management.

■ At the coast, the UK’s saltmarshes may contain as much as 5.4 million tonnes of carbon and each hectare of saltmarsh may capture and store between 2.35 and 8.04 tonnes CO₂e each year. (Gregg et al. 2021).

In an attempt to quantify the overall climate change impacts of creating or restoring new semi-natural habitats in the UK, a literature review and associated assessment published in 2022 indicated that on the basis of available evidence and taking a conservative approach, several types of habitat creation or restoration are likely to bring reasonable climate benefits as well as being good for people and wildlife in other ways. Highlights include:

■ Restoring intensively managed (drained) arable land to re-wetted fen is likely to reduce overall annual greenhouse gas emissions by about 29.6 tCO₂e per hectare.

■ Restoring peatlands that have been damaged previously in a variety of other ways is extremely likely to reduce overall greenhouse gas emissions by anything from 0.7 tCO₂e per hectare to 24.6 tCO₂e per hectare each year, depending on the type of peatland, its starting condition and the approach taken to its restoration.

■ Creating mixed native broadleaved woodland on arable land with mineral soil is very likely to reduce overall greenhouse gas emissions by more than 4 tCO₂e per hectare each year over the first 30 years of the woodland’s development (and to continue this at a lower rate for many decades beyond).

■ Creating dry acid grassland on previously arable land with mineral soil is likely to reduce future overall greenhouse gas emissions by about 1.6 tCO₂e per hectare each year.

■ At the coast, creating saltmarsh on currently arable land is very likely to reduce overall greenhouse gas emissions by more than 2.3 tCO₂e per hectare each year. (Thom & Doar 2022).

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Summary



It's so often taken for granted, but without water, we're nowhere. To keep clean water running from our taps, we need a healthy natural world.

Our immune systems are being damaged by chemically polluted water. Treating water to make it drinkable is expensive, but the presence of certain plants and species helps remove chemicals, bacteria, and antibiotic residue from entering our drinking water in the first place. 'Leaky dams' and specially-created ponds, for example, help trap and remove sediment and pollutants, while riverside

buffer strips on farm edges have been found to lessen the amount of agricultural chemicals entering our water systems. The presence of beavers has also been found to improve water quality, with lower phosphate concentrations recorded downstream of beaver dams in Devon. Dam-building also helps slow the flow of water, protecting us against flooding.

We have all encountered if not felt the effects of flooding in our communities and in the wider countryside. Wetland areas hold back floodwater and help filter pollutants, while serving as vital homes for a wealth of wildlife. Coastal wetlands also protect coastal communities against storms. Meanwhile peatland that's in good condition holds onto water, preventing it from flooding communities downstream. And in urban areas, green roofs can retain 45–60% of annual rainfall.

Nature cleans the water you drink, cutting reliance on artificial treatment

Many pollutants that cause problems for people and wildlife can be removed from water by plants and the natural systems that they are part of. Ponds, leaky dams, riverside buffer-strips and urban 'bioswales' can all help... and so can the dams built by beavers. Healthy natural peatlands can help to clean water, while damaged and degrading peat soils can pollute it and increase treatment costs. Across the board, investing in healthy natural ecosystems can improve water quality and reduce the costs of treating it.

The removal of dissolved organic carbon (DOC) is a key treatment process for the supply of drinkable water in catchments where peatlands higher up the catchment have often been degraded. In a paper published in 2016, researchers showed that the fast-growing vascular plants that become more abundant in damaged peatlands shed softer, more easily rotted material than is produced by the natural vegetation of undamaged peatlands. This adds fresh nutrients to the ecosystem each season. This type of DOC is harder to remove and is also broken down less easily by natural microbes before it reaches the treatment plant, so more of it arrives in the water to be treated. The authors suggested that restoring sphagnum moss on damaged peatlands could help. DOC created by Sphagnum is easier to remove and breaks down more before entering water supplies. Bringing back sphagnum could lower water treatment costs and make treatment more effective). The authors concluded that "These results provide evidence

that practices aimed at re-establishing sphagnum moss on degraded peatlands could reduce costs and improve efficacy at water treatment works, offering an alternative to 'end-of-pipe' solutions through management of ecosystem service provision" (Ritson et al. 2016).

Degrading peat releases dissolved organic carbon (DOC) into the water draining from a damaged peatland. When water from peatland catchments is treated with chlorine, to remove microbes and make it safe to drink, carcinogenic byproducts are produced (trihalomethanes – THMs). These then have to be removed by the water company at high cost, using specialised filtration processes. A 2019 study modelled the implications of global climate change for the release of DOC and the consequent formation of THMs in the downstream water treatment process (which is influenced by a number of factors including summer temperature as well as the condition of peatlands in a catchment). The authors' "mid-range scenario" indicated a 1.8°C temperature increase leading to a 39% increase in THMs by 2050. In the words of the authors: "Such an increase has major implications for potable water around the world, either an increased health risk or increased water treatment costs to maintain an equivalent quality potable supply". This is clearly a problem that is likely to become more significant, and to which peatland restoration could contribute significantly (Valdivia-Gargia et al. 2019).

A study of two small agricultural catchments in the upper Thames Valley assessed the ability of natural flood management interventions (such as leaky dams) and on-line ponds to trap and remove sediment, phosphorous and organic

carbon from the streams in question. The masses of sediment, phosphorus, and organic carbon trapped by 14 features (since construction 2–3 years previously) were quantified. The features trapped a total of 83 tonnes of sediment, 122 kg phosphorus, and 4.3 tonnes of organic carbon. Although the footprint of the features was <1% of the catchment area, they drained 44% of the total land area and captured the equivalent of 15% of the total suspended sediment yield, 10% of the total phosphorus yield, and 8% of the particulate organic carbon yield. Compared with topsoil in each contributing area, trapped sediment was enriched in phosphorus and carbon in the majority of features, having on average 50% higher phosphorus and 17% higher organic carbon concentrations than surrounding arable soils. The authors of the study took this to demonstrate the potential of nature-based solutions, including natural flood management schemes, to reduce diffuse pollution in lowland catchments (Robotham et al. 2022).

A study in an agricultural catchment with flat topography, north west of Beijing, assessed the ability of different types of vegetated river-side buffer strip to remove agricultural pollutants in surface runoff draining from the adjacent fields. The study's authors considered that: "... the results highlight the remarkable capacity of woody vegetation within 18-metre Riparian vegetated buffer strips (RVBS) [to remove pollutants]". Across all four seasons and in various weather conditions, these strips of woody vegetation trapped 100% of the sediment, 89.8% of the nitrogen and 92.82% of the phosphorous contained in the surface run-off encountering the buffer strips, preventing it entering the river (Nsenga kumwimba et al. 2024).

A recent review of the evidence relating to nature-based solutions for water management in Europe found that nature-based solutions are effective at reducing surface runoff, mitigating floods and improving water quality when facing frequent low- to moderate-intensity events involving urban runoff and seasonal flooding, but concluded that their performance remains uncertain under extreme climate scenarios. The review included evidence that:

- Wetlands, both constructed and natural, serve multiple roles by reducing peak stormwater flows by 60–80%, filtering pollutants, sequestering carbon, and enhancing habitat diversity.
- Riparian buffer zones adjacent to waterways reduce sediment and nutrient runoff by 40–90%, especially in agricultural landscapes where they act as critical filters for diffuse pollution.
- Rain gardens and bioswales help localised pollutant removal.
- Nature-based solutions to water management effectively reduce flood risk, improve water quality, support biodiversity, and strengthen climate resilience, often delivering greater long-



term value compared to traditional ‘grey’ (usually concrete, hard, engineered) infrastructure. (Santos 2025).

Research at the Devon Beaver Project site on the River Otter measured a number of variables relating to water quantity and quality above and below a stretch of river on which beavers had constructed multiple beaver dams. Monitoring of water quality during storm events showed less suspended sediment leaving the site compared to the amount entering it, and also lower concentrations. The researchers suggested that beaver dams and ponds can exert a significant influence over the accumulation and distribution of channel sediment. Measurements of total oxidised nitrogen (TON) and phosphate (PO₄) indicated that the concentrations and amounts of these leaving the site downstream of the beaver dams were lower than in the water entering from upstream; in the words of the researchers, “... *indicating that beaver activity at the site created conditions for the removal of nitrogen and phosphorus entering the site.*” Because of this, the study’s authors suggested that in ‘agriculturally dominated’ catchments, beaver ponds could be effective tools to manage nitrogen-related diffuse pollution problems from intensive agriculture upstream and that they might also act as sinks for phosphorus associated with sediments. (Puttock et al. 2017).

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Natural vegetation helps water flow and prevents contamination

Many pollutants that cause problems for people and wildlife can be removed from water by plants and the natural systems that they are part of. Ponds, leaky dams, riverside buffer-strips and urban bioswales can all help.

A recent review of the evidence relating to nature-based solutions for water management in Europe found that nature-based solutions are effective at reducing surface runoff, mitigating floods and improving water quality when facing frequent low- to moderate-intensity events involving urban runoff and seasonal flooding, but concluded that their performance remains uncertain under extreme climate scenarios. The review included evidence that:

- Coastal wetlands and mangroves stabilise shorelines and increase ecosystem resilience against sea-level rise and extreme events.
- In urban areas, green roofs retain 45–60% of annual rainfall and can reduce peak stormwater flows by 20–80%, depending on design and climate conditions.

Urban parks and green corridors designed with hydrological principles contribute to delayed runoff and enhanced infiltration, typically reducing neighbourhood-scale stormwater volumes by 20–40%.

- Rain gardens and bioswales facilitate localised infiltration.
- Reforestation and afforestation within catchments enhances soil stability, evapotranspiration, and carbon storage.

Floodplain restoration reconnects rivers to their natural floodplains to attenuate flood peaks and boost biodiversity.

Nature-based solutions to water management effectively reduce flood risk, improve water quality, support biodiversity, and strengthen climate resilience, often delivering greater long-term value compared to traditional ‘grey’ (usually concrete, hard, engineered) infrastructure. (Santos 2025).

A computer modelling study (using the ‘INCA’ model) on two small, heavily polluted urban rivers in north-east London concluded that constructed wetlands can significantly reduce nitrate, ammonium and phosphorus levels in the water if a proper catchment-scale wetland implementation strategy is put in place. The authors also indicated that the nutrient reduction efficiency of the wetlands should not be affected by climate change. (Bussi et al. 2022).

Amongst other things, a report published by the Environment Agency, for the Chief Scientist’s Group, indicated that “*Buffers of tall vegetation can be very effective at interrupting and reducing airborne pollutants such as pesticides and ammonia entering watercourses. Planting trees offer some advantages over grass or herb vegetation in removing pollutants, as well as generating a source of income*” (Stutter et al. 2022).

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Summary



The effects of climate change and nature loss put our very homes at risk, for instance, from flooding and fire. The UK Climate Change Committee’s 2025 progress report highlighted that 6.3 million properties in England were in areas at risk of flooding. As climate and biodiversity breakdown worsens, this risk, and these numbers, will only rise. Restoring nature’s balance is like giving our homes an added layer of protection. Natural coastal and inland flood defences, healthy uplands, restored rivers and less concrete keep floodwater at bay and make wildfires less likely. Unseen, unlikely heroes like water voles and beavers help create these healthy habitats by making dams and burrows, indirectly protecting our homes while they create theirs. Nature has also been found to influences house prices, with leafy neighbourhoods commanding a premium. Homes close to National Parks and other natural spaces also gave a house more value, in both the sales and rental and market. It might come as little surprise, equally, that homes at a high risk of flooding are harder to sell, and have lower values. In protecting nature, we’re protecting hearth and home.

Working with nature will help to limit the risks of your home being flooded

Climate change is increasing the frequency and severity of extreme weather, including storms. This is increasing the risk of flooding in many areas, and also the difficulty and cost of managing it. Natural flood management (NFM) can play an important part in reducing flood risk in many places, by restoring the natural function of rivers and streams, slowing the flow down catchments, spreading water out and storing it in natural places away from people’s homes and businesses. Natural habitats like saltmarshes and seagrass beds can help to protect against coastal flooding.

The UK Climate Change Committee’s 2025 progress report to Parliament highlighted that at the time of the report, 6.3 million properties in England were in areas at risk of flooding from rivers, the sea, and surface water. It went on to report that this is predicted to rise to around 8 million (25% of all properties) by 2050 (Climate Change Committee, 2025).

A comprehensive literature review published by the Environment Agency in 2025 included numerous studies of natural flood management in action, including river restoration, floodplain restoration, the use of leaky barriers, the impact of beavers, the creation of water storage areas away from river channels, woodland creation and management, soil and land management, approaches to headwater drainage, and management of habitats at the coast. The authors assessed the implications of these for the reduction of flood risk and for other benefits that each intervention might deliver. Amongst other things, the review reported the following:

- Between 3 and 25 years after restoration, the relative area of

water storage was twice as large in restored sections of river compared to those that were concreted, in 6 heavily urbanised catchments in Wisconsin (USA).

- Re-meandering within a chalk stream in Norfolk resulted in a 16% increase in channel length and a 0.5m decrease in mean channel width, increasing the total river channel surface area.
- Modelling the potential flood risk benefits of constructing a wetland near Rise Park Stream (a tributary of the River Rom, Romford, London) indicated that after channelling water through the proposed constructed wetland, there would be a 28% reduction in peak flow downstream. The model suggested that this would shrink slightly to a 24% reduction when the water re-enters the Rise Park Stream. This reduction translates to a 10mm to 50mm reduction in flood levels for properties south of Rise Park for smaller events (as seen during June 2020). Also, for 1 in 20-year return period (bigger) events, the modelling showed a 9% reduction in peak flow downstream of the constructed wetland and a 15% reduction in peak flow for a 1 in 100- year (major) event.
- At Hardcastle Crag, in the Calder Valley, West Yorkshire, flood peak delays of 1 hour and 1.5 hours were observed within a stream after passing through 9 leaky barriers over an 80m stretch.
- Researchers recently estimated the bankfull storage volume upstream of one leaky barrier in Shropshire to be 80 m3, with a net storage increase of 52 m3 during events with a return period of less than 2 years (fairly frequent, quite small flood events), increasing to 102 m3 during the 4-year return period event (a flood that is larger and less frequent).

- In the Coalbrookdale catchment, Shropshire, for a flood event in February 2020, which had a 75 to 100-year return period (it was large and expected to be infrequent), hydraulic modelling suggested the 32 leaky barriers there had no impact on peak flow, but did delay the peak flow by 10 to 15 minutes.
 - The average flood event lag time increased by about 56% after the introduction of beavers in the Budleigh Brook catchment in Devon, compared to about an 18% decrease at a control site with no beavers.
 - A three-order-of-magnitude increase in surface water storage within ponds was observed following beaver reintroduction in the headwaters of the River Tamar, Devon. This increase included the creation of 13 dam-pond structures covering a surface area exceeding 1,500 m2, with approximately 1,000 m3 of water stored within them at any given time.
 - A study of 5 peatlands in the southern Pennines (Kinder Scout, Bleaklow, Rishworth Common, Turley Holes and Black Hill) found that revegetation of past damage increased surface roughness, leading to reduced storm flow, as well as increased lag time of 30 minutes and decreased peak storm discharge by 1.91 Ls-1ha-1 (Pearson et al. 2025a).
- In the research report accompanying the Environment Agency literature review above, the authors drew a number of conclusions from the evidence as a whole, including the following:

- River restoration can increase surface water area, slow flows, delay peak flows and store water – especially if undertaken along entire river segments, and in small catchments.
- Floodplain and floodplain wetland restoration can reduce or delay flood peaks, reduce high frequency, low return period floods and reduce overall flood risk, but it may take time to achieve results and may also increase flooding downstream – so it needs to be handled carefully.
- Leaky barriers have a rapid impact (especially in small catchments) reduce the local risk of small floods, reduce and slow flow velocities, can reduce peak flow and increase upstream water depth and volume.
- The introduction of beavers can help to reduce small flood events locally and in small catchments; their dams increase water storage and elevate water tables, reduce and slow flow velocities, create temporary storage and reduce flood flows.
- Woodland in the upper part of a river catchment can reduce flood risk and peak flows (particularly in small catchments) but may be less effective in winter and reduce baseflows (which reduces the general availability of water).
- Floodplain woodlands slow the flow of water and retain it in the floodplain; they are more effective at reducing peak flows in small flood events.
- Riverside woodland increases above-ground water storage and slows flows; it may reduce flood peaks, but its impact on flood risk is very dependent on where it occurs.



■ At the coast, saltmarshes and mudflats reduce wave and tidal energy, which can contribute to reducing flood risk and coastal erosion risk; saltmarsh may also reduce current velocities and reduce high-water levels.

The restoration of peatlands (by re-wetting and revegetating them) has many impacts on downstream water flows, generally slowing the flow and having a significant impact on flood risk. (Pearson et al. 2025b).

Modelling the potential for natural flood management (NFM – approaches that restore the natural functions of rivers) to play a role in the UK’s future flood risk management indicates that NFM has the potential to contribute significantly to flood risk reduction in many river catchments. By the 2050s in some more rural catchments, with limited existing flood defence infrastructure, NFM is projected to provide about 80% of the benefits achieved by the flood risk management portfolio as a whole. In most catchments, the modelling indicated that it is much less than this but remains significant. The authors of the paper modelled two future scenarios – one assuming a 2°C global temperature rise and the other a 4°C rise. They concluded that *“In both [climate scenarios] significant investment of between £550 million and £775million (Value) is justified, achieving a Benefit to Cost Ratio (BCR) of about 5”*, based solely on the benefits

accrued through the reduction in direct property damage. That is: every £1.00 spent on these flood management approaches would bring £5 of benefit in reduced damage to property, alone. They conclude that well-targeted investment in natural flood management measures of around £20–30 million per year through to the 2080s has the potential to significantly reduce overall flood risk (Sayers et al. 2025).

On one catchment in the Scottish Borders, a detailed programme of monitoring has demonstrated the effectiveness of a natural flood management approach in some detail:

■ Log structures in headwater streams of the Eddleston Water have increased the ‘lag time’ between rainfall and peak river flow by up to 7 hours and the upper catchment 2-year return period flood peak has reduced by about 30% since installing them.

■ Re-meandering the river channel and reconnecting it to the floodplain can locally improve flood storage by up to 6%.

■ Modelling the potential impact of large floodplain ponds suggests that they could locally reduce the discharge peak by up to 20% and delay it by up to 6 hours.

■ Infiltration of rainfall under mature broadleaf woodland is 5 to 8 times that under adjacent grazed pasture, with rough grazing also good for infiltration.

■ Modelled impacts of planting trees at a landscape-scale show up to 40% reduction in high flows and flood peaks delayed by 45 minutes under different climate scenarios.

■ NFM measures already implemented show a positive present value of £950k from flood damages avoided. For a hypothetical maximum scenario this increases to £2.85 million (PV) over 100 years.

■ The total value of other benefits delivered by NFM across the catchment (£4.2m PV) is four times larger than the value of flood damages avoided alone. Biodiversity, carbon, water quality, access and recreation are key added NFM benefits. (Tweed Forum 2025).

Flood risk at the coast is a significant consideration for many homes and a considerable amount of critical infrastructure (including roads, railways, power stations and port facilities). As the climate changes, this risk is increasing. A 2024 study modelled the impact that seagrass restoration might have on coastal protection in Morecambe Bay. Researchers used a Habitat Suitability Model (HSM) developed previously by the Environment Agency, to select a location for the establishment of a 3,700 ha ‘virtual patch’ of *Zostera marina* as part of a computer model used to simulate water movements (hydrodynamics) in Morcambe Bay. The seagrass patch’s effect on hydrodynamics within the bay was tested against a control simulation (without the seagrass patch), under different storm intensities. Researchers looked to assess how seagrass would have influenced flow velocity, wave height, dissipation and other aspects of hydrodynamics as part of a system experiencing the more frequent and detrimental storm waves in recent history. The modelling indicated that a seagrass patch could reduce the height of an incoming 56cm wave by up to 51.9% and that its effectiveness at reducing wave height increased with rising sea level. The authors concluded that the reestablishment of seagrass beds might become an effective part of natural coastal defences. (Forrester et al. 2024).

An economic assessment of natural flood management (NFM) interventions delivered by Wildlife Trusts across England, indicated that over a thirty year timeframe these projects will typically generate (and are already generating) an economic return between £1.20 and £17.60 for every £1.00 spent... and that (depending on the details of the natural flood management intervention) 30-year returns may be as high as £23 for every £1.00. The introduction of beavers into a small river catchment like the River Otter catchment in Devon was estimated to bring an economic return of between £12.90 and £60.00 for every £1.00 spent, over 30 years. The report indicated that the benefits from natural flood management projects go far beyond just flood risk reduction, and that this can be a relatively minor part of the overall economic assessment. Nonetheless, it also concluded that NFM measures can lead to a reduction in peak flows during flood events, protecting properties, commercial premises, key infrastructure and utilities (Morris et al. 2024).



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Keystone species such as beavers help slow down rivers, clean the water and protect towns

Most nature-based flood management needs people to take action to reverse past changes that someone has previously made to the natural function of rivers. But we also have natural allies in this. Beavers naturally build dams and change the way water moves through the landscape. Their reintroduction can make a big difference and can be very cost effective.

A recent comprehensive literature review of natural flood management interventions published by the Environment Agency reported evidence from the headwaters of the River Tamar in Devon, concerning the impact of beaver activity there. It reported that it resulted in a three-order-of-magnitude increase in surface water storage within ponds in the area. This increase included the creation of 13 dam-pond structures covering a surface area more than 1,500 m2, with about 1,000 m3 of water stored within them at any given time (Pearson et al. 2025a). In an accompanying research report, the same authors concluded from their review of the available evidence that the introduction of beavers can help to reduce small flood events locally and in small catchments. They considered that beaver dams increase water storage and elevate water tables, reduce and slow flow velocities, create temporary storage and reduce flood flows (Pearson et al. 2025b).

In a study of four sites where beavers had been reintroduced, in Yorkshire, Gloucestershire, Devon and Cornwall, analysis of more than 1,000 storm events, across the four sites showed an overall trend of reduced total stormflow, increased lag times (between peak rainfall and peak flow) and reduced peak flows. The authors indicated that all of these suggested flow reduction resulting from the presence of the beavers. Data also indicated that flow regimes were overall becoming less “flashy” following beaver reintroduction. Statistical analysis showed the effect of beavers to be statistically significant in reducing peak flows, with estimated overall reductions in peak flows from –0.359 to –0.065 m3 per second across the four sites (Puttock et al. 2020).

A recent PhD thesis documented three years of study exploring the effects of beavers on the hydrology of river catchments in eastern Scotland. It used 25 months of monitoring data from two adjacent catchments, one with an area of 165 ha that contained 28 beaver dams, and another with an area of 58 ha, with none. Hydrological models built, calibrated and validated using this field data demonstrated that average flows downstream of beaver dams are approximately 29% lower than you would expect without the dams, and median peak-flows about 3% lower (within the range from +4% to -11%) (Van Biervliet 2024).

Research at the Devon Beaver Project site on the River Otter measured a number of variables relating to water quantity and

quality above and below a stretch of river on which beavers had constructed multiple beaver dams. Results from above and below the beaver dams indicated that beaver activity reduced overall flow, leading to: longer peak rainfall to peak discharge lag times, lower peak discharge and lower total storm event discharges. Results also showed more water in total entering the site than leaving, indicating that (1) water storage within the site is significant and (2) that the lateral redistribution and storage of water within the site led to significant infiltration, transmission and evapotranspiration losses (though these were not measured). Monitoring of water quality during storm events showed less suspended sediment leaving the site compared to the amount entering it, and also lower concentrations. The researchers suggested that beaver dams and ponds can exert a significant influence over the accumulation and distribution of channel sediment. Measurements of total oxidised nitrogen (TON) and phosphate (PO4) indicated that the concentrations and amounts of these leaving the site downstream of the beaver dams were lower than in the water entering from upstream; in the words of the researchers, “... indicating that beaver activity at the site created conditions for the removal of nitrogen and phosphorus entering the site.” Because of this, the study’s authors suggested that in ‘agriculturally dominated’ catchments, beaver ponds could be effective tools to manage nitrogen-related diffuse pollution problems from intensive agriculture upstream and that they might also act as sinks for phosphorus associated with sediments. (Puttock et al. 2017).

Taking all the likely benefits generated by the introduction of beavers at the Devon Beaver Project site on the River Otter, a study commissioned by The Wildlife Trusts in partnership with Intact Insurance estimated that the introduction of beavers there will bring an economic return of between £12.90 and £60.00 for every £1.00 spent, over 30 years (Morris et al. 2024).

A recent study that considered the potential of beavers to play a role in reducing nutrient levels in English chalk streams compared the water quality upstream and downstream of a 6 ha enclosure containing beavers in the headwaters of the River Glaven in Norfolk. Samples taken over a 2 year period indicated that nitrate concentrations were reduced by 42.5% downstream of the beaver wetland and by 64.2% compared to a nearby control site. Phosphate concentrations were similarly reduced by 51.2% downstream of the beaver wetland and by 86.4% compared to the control site. The study also found that dissolved organic carbon concentrations significantly increased downstream of the beaver wetland (by 93.6% compared to upstream and by 272.3% compared to the control site), but overall, the authors still concluded that “these results demonstrate that beaver wetlands can significantly mitigate eutrophication risk in agriculturally impacted chalk streams and provides further evidence in support of their wider reintroduction to English catchments” (Cooper et al. 2025).



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Homes with street trees and other vegetation are worth more than those without

Many things influence the amount we are willing to pay for somewhere to live, whether that's buying or renting. The value of a property has long been known to come down to 'location, location, location'... and the greenness of that location is a major factor. It is often the case that people prefer, and are prepared to pay more for, homes in leafy neighbourhoods and on tree-lined streets compared to those that are less green.

A preference study involving 281 participants assessed the influence of cars and trees on the attractiveness of streets in the Dutch city of Leiden. Participants were asked to express views on photographs illustrating street scenes containing varying numbers of trees and cars, rating them in terms of safety, friendliness and beauty. They were also asked to rate two residences in each photograph, for their attractiveness, estimated price and estimated income of the current owner. Analyses using multilevel modelling found that both the neighbourhoods and the residences were appreciated less when the street was overfull with parked cars. Participants estimated approximately 5% higher prices for residences when there were trees in the street, as well as rating the neighbourhood as more attractive (Staats et al. 2020).

A study exploring people's willingness to pay for environmental benefits generated as a result of investments on Blonk Street in Sheffield reported that participants in a large-scale survey were willing to pay up to £10.56 or 2% more in monthly rent or additional mortgage payments to live in locations that have a high-quality green environment (Mell et al. 2016).

A group of Chinese researchers assessed the impact of street trees and their management on house prices in New York. The authors reported that various previous research studies published between 2006 and 2019 have linked residential house prices to street trees, private trees, urban parks, and to a window view of green spaces. Their study created spatial models of New York that allowed the relationship between house prices and various local environmental variables to be identified and conclusions to be drawn about which variables were most strongly related to differences in house price. They concluded that "Increased tree abundance and greenery are associated with higher house prices. Tree stewardship and tree guards are [also] statistically associated with increased house prices." (Lin et al. 2024)

A 2014 study looked at the relationship between 3,854 residential sales transactions and public green spaces across Belfast during 2011, to see what difference the proximity of public green spaces made to the price of residential properties. The authors concluded that, everything else being equal, the

presence of nearby urban green space had a significant positive impact on the sale price of flats and terrace houses. Terrace and apartment property near to public green spaces sold at up to 49% more than comparable properties that were further away (McCord et al. 2014).

As long ago as 2000, a study of nearly 3,000 house transactions in eight towns or regions in the Netherlands estimated the effect of environmental variables on sale prices. The researchers found increases of as much as 28% for houses with gardens facing water that was connected to a sizeable lake. They demonstrated that a pleasant view can lead to a considerable increase in house price, particularly if the house overlooks water (8–10%) or open space (6–12%). Their analysis also revealed that house price varied by landscape type. Attractive landscape types attracted a premium of 5–12% over less attractive settings (Luttik 2000).

An analysis of one million housing transactions that took place between 1996 and 2008 assessed the impact of a large number of environmental characteristics on house prices across England. Results revealed (amongst other things) that gardens, green space and areas of water nearby all increase house prices considerably. The study's authors also reported a strong positive effect from freshwater and flood plain locations, broadleaved woodland, coniferous woodland and enclosed farmland. Increasing distance away from natural amenities such as rivers, National Parks and National Trust sites was reported to be "... unambiguously associated with a fall in house prices". (Gibbons et al. 2014)

Nature's impact on house prices isn't just restricted to its direct impact on the aesthetic appeal of a street or neighbourhood, or the immediate benefits trees and other greenery bring (by providing shade and cool during heatwaves, protection from high winds, the pleasure of encountering birds and other wildlife and so on). The role of natural flood management – including the impact of rain gardens, parks, gardens, woodlands and other urban green spaces – in reducing the flood risk faced by homes is also important. A study investigating the impact of flood risk on the value of English residential properties found that a location within a flood zone significantly lowers property values, even controlling for a number of related factors. Although the negative impact of flood risk on property value is biggest for waterfront properties, it is still highly significant for dwellings further from the water. The authors also reported that: "... the effect of flood risk on house prices is stronger in the months following major flood events but... it almost disappears in a 'hot market' when buyers have arguably less negotiating power." (Belanger et al. 2018).

Similarly, a more recent study in which researchers from City St George's University London modelled the impact of flood risk on house prices in England found that residential properties with flood risk are sold about 8% cheaper than those without. They indicated that the size of price discount is strongly correlated

with the probability of flood risk and can be as high as 31% for very high risk properties. Looking forward, the authors reported that between 2050 and 2080, property-level flood risk is projected to increase by a further 8%. Their model suggested that one percentage point increase in a property's flood risk is associated with a reduction of 0.11–0.19% in both sold and asking price (Skouralis & Lux 2023). As a consequence of the relationship between flood risk and natural flood management (especially in small catchments – often in rural areas), it is definitely fair to say that nature can have a significant impact on people's financial circumstances, not just because it can reduce flood risk and have a knock-on influence on insurance costs (see below), but also because of its impact on the price people will pay for somewhere safe to live.

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Summary



There is considerable evidence of the economic importance of a healthy, wildlife-rich natural environment. Functioning natural ecosystems play a critical role underpinning every aspect of the global economy. They make it more productive in the long run and more resilient. UK businesses could save money and unlock new opportunities for growth by investing in nature. Those that plan ahead and recognise the impact of the changing climate can also avoid costly damage to their businesses resulting from increasingly frequent and severe fires and floods.

Nature-related sectors of the economy provide employment and tourism. Green cities and high streets encourage people to visit, stay and spend, and nature-rich workplaces are more attractive, healthier places to work. Meanwhile short food chains support a vibrant and more resilient local economy.

Protecting and restoring the UK’s natural asset base is an effective way to secure a stable, productive future for the national economy. In abundance, nature is a self-sustaining wealth generator. Fixing nature leads to fixing our economy.

Nature is a self-sustaining wealth generator, not a cost to be managed

Nature is a productive asset comparable in scale to the UK’s built infrastructure. Investing in a healthy, wildlife-rich natural world – putting time, effort and money into protecting wildlife-rich ecosystems and restoring nature where it has been damaged in the past – is a cost effective way of building a productive, resilient and sustainable economy. It sustains livelihoods, creates jobs, saves money and sustains many industries by providing the natural goods and services on which they (and we) depend. Failing to invest poses a systemic threat to UK financial stability. It is already costing us more, and in future may bring with it costs that we simply cannot afford to pay.

Much of the evidence of nature’s fundamental value to the economy (especially the aspects relating to nature’s living systems – its biodiversity) was reviewed and considered thoroughly in a landmark report published in 2021 by the UK Government. The review systematically articulates the foundational biological, social and economic evidence and reasoning behind placing biodiversity more centrally in the way economic decisions are made and investment is allocated. The evidence is too wide ranging and abundant to usefully present here, but needless to say, it presents considerable relevant and authoritative evidence of the economic value of healthy and restored natural systems around the globe (Dasgupta 2021). The review articulated an evidence-based case that even current demands far exceed nature’s regenerative capacity, causing supply chain fragility that will threaten the long-term viability of the UK food and water sectors.

UK-specific statistics relating to the economic value of the nation’s ‘natural capital’ are published by the Office for National Statistics. Among other things, even in its currently severely depleted state, the most recent UK Natural Capital Accounts put the total asset value of ecosystem services delivered by nature in the UK at £1.6 trillion in 2023, and estimated that this natural asset base contributed £41 billion in value to the economy during that year (Office for National Statistics 2025).

In 2024, a news blog by researchers at Oxford University’s Environmental Change Institute reported that a major study by the Green Finance Institute had concluded that damage to the natural environment is slowing the UK economy. This damage was considered likely to reduce future gross domestic product (GDP) by 12%, which is more than the impact of the Covid pandemic (an 11% loss) and more than twice the damaging impact of the 2008 financial crisis (a loss of 5%) (Alvarez, 2024).

The UK Government also recently published a national security assessment of the potential impact of global biodiversity loss and ecosystem collapse. Assessing a series of ‘worst case scenarios’, it considered with ‘high confidence’ that “global ecosystem degradation and collapse threaten UK national security and prosperity.” (HM Government 2026).

In April 2025, independent environmental think tank, Green Alliance, estimated the impact nature degradation and climate change are having on household budgets and the cost of living in England. Their analysis looked in detail at three areas of household expenditure – home insurance premiums, water bills and food shopping, as these are significant areas of household expenditure that have clear and unequivocal links to climate change and the state of the natural world. In total, across these three areas of household expenditure, the Green Alliance

analysis concluded that climate change and nature degradation are already costing the average English household more than £233 each year and that this is set to rise. In the words of the authors: *“Our analysis shows that investing in protecting and restoring nature is a cost effective use of limited government resources, as healthy ecosystems will deliver multiple benefits in return, to the economy and wider society, including bringing consumer bills down”* (Green Alliance 2025).

The Green Alliance analysis deduced that the £1.2 billion in weather-related insurance payouts in 2024 added £42.25 to the average home insurance premium in England, and indicated that this is likely to rise in future as climate change drives more frequent and intense storms. Similarly, they reported that the Energy & Climate Intelligence Unit had estimated that climate-related impacts added £361 to the average household’s annual food shop over two years in 2022-23 (an average £180.50 each year). This increase was attributed to supply disruptions, yield variability and subsequent higher prices on agricultural markets because of global warming and extreme weather events. The third aspect of the analysis identified the portion of increasing water bills that could be attributed to climate change and pollution. On average, they estimated that households will typically pay £10.74 per year more on their water bill as a result of these issues. The drivers behind these added costs were identified as sewage and agricultural run-off, accelerated by loss of vegetation from land and riverbanks which would otherwise filter and reduce this impact, plus decreasing summer rainfall leading to a reduction in available water and an increase in the risk of drought (Green Alliance 2025).

In 2017, Vivid Economics was commissioned by National Trust, the National Lottery Heritage Fund and the Greater London Authority, to produce a natural capital account for public greenspace in London. It identified many valuable benefits delivered by the city’s green spaces to local residents and visitors and quantified several of them. Among other things, the account estimated the total value of avoided healthcare costs due to London’s greenspace at £950 million per year. Recreation in parks was valued at £17 billion pounds for London, which translates into an annual economic benefit of £930 million. London’s green spaces were estimated to reduce the city’s temperature by 2°C during heatwaves... bringing with it an economic value of £594 million. For every £1.00 spent by local authorities and their partners on public parks, Londoners were estimated to receive at least £27 in value (Vivid Economics 2017).

An economic assessment commissioned by The Wildlife Trusts in 2023 concluded that, on the basis of its impacts on mental health and well-being alone, an annual investment of £534 million into ‘green prescribing’ (health programmes that engage people with the natural world as a form of treatment) could realistically result in gross annual cost savings of £635.6

million. So not only does nature help to improve health and well-being, it is very cost effective and could directly save the NHS a considerable amount of money (Sendall et al. 2023).

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Nature-filled high streets are economically vibrant

Restaurants, cafes and a diversity of other food-related outlets are central to the ability of a town centre to attract people. Street trees, parks, gardens and other green features add to an attractive and pleasant experience for those who live and work there, and for those who visit. Opportunities to buy high quality local produce add more value. And all of it together can generate economic value that is retained locally, reflected in more employment, income and resilience.

A recent systematic review of evidence carried out by researchers from the University of Oxford looked at the economic impacts of nature-based solutions across the globe. It highlighted that the economic impacts of investment in nature are typically significant and positive. The review indicated that there’s considerable complexity and variability in the evidence – including trade-offs and shifting risks, and a scarcity of studies that directly compared nature-based solutions with alternative approaches. Within the variability and uncertainty, the review highlighted several case studies of positive economic impacts, including (for instance) a forest tourism initiative in China that provided employment to 500,000 farmers in 4,654 villages. It also highlighted another situation (in Kyrgyzstan), where development of a walnut growing enterprise led to 16,000 people being employed in the supply chain. And another in Peru, where 36,000 ecotourism jobs had been created. Overall, the researchers concluded (variously) that “nature-based interventions can stimulate both low- and high-skilled jobs”, and that there is compelling evidence that nature-based solutions “can stimulate growth across a wide array of industries (e.g., via gross value added, economic multiplier effects)”, and that “This systematic review demonstrates that NbS can significantly contribute to economic recovery by stimulating economic output and creating employment. NbS can generate direct jobs and incomes, offering a high return on investment compared to other sectors. This leads to cascading benefits throughout the economy. Well-designed and carefully implemented NbS can respond flexibly to economic shocks, by providing diverse employment opportunities across different skill levels and targeting underserved communities and disadvantaged groups. NbS can also diversify income sources and enhance resilience to future shocks.” (Chausson et al. 2024). All of the economic values, risks, opportunities and threats recognised on a global and national scale have roots in local economies and places, and are reflected to a greater or lesser extent in the cities, towns and high streets where we live, work and shop.

Written evidence submitted to The House of Lords’ Built Environment Committee on behalf of the High Streets Research Network (HSRN) – a multi-disciplinary group of around 120

researchers and practitioners, co-ordinated by Sheffield Hallam University – considered what a sustainable future high street will be like. The authors considered that winning and retaining the trust of local communities is key to the future of high streets in towns and small cities, that high streets need to be genuinely inclusive and that their sustainable regeneration depends on local communities and local leadership valuing and supporting them. The ability of high streets to generate ‘pride of place’ was highlighted, and the role of many things combining to achieve that was discussed. Among other things, the authors highlighted the important role of community organisations and social businesses, the influence of transport arrangements that favour pedestrians and bicycles over cars and other motorised transport, and the need for greener, more biodiverse town centres. In the words of the authors, “There is extensive evidence that greener, more biodiverse places where people can connect with nature are more welcoming and better for physical and mental health... there is no reason why high streets should continue to be sterile, hard-surfaced environments designed for vehicles rather than people” (Dobson et al. 2024).

A modelling study combined footfall data from 960 counters across UK town centres with Open Street Map data to predict the relative influence of various town centre features on the number of people and where they went. The results indicated that the presence of grass landscaping, gardens and parks were each relatively minor predictors of footfall, with relative importance values of 11%, 12% and 14% respectively (compared to hotels – scoring 100% – pedestrian walkways – 67% – theatres – 31% – and shopping malls – 26%, for comparison). Overall, however, the study indicated very clearly that no single element is overwhelmingly significant in driving footfall and that vibrant and economically lively town centres typically need a diverse mixture of features. Restaurants, cafes and other food outlets were more influential than most elements (cafés: 35%; restaurants: 50%). The authors concluded that their analysis underlines the value of increased diversity of uses in the existing town centre environment and the influential role of some features (such as cafés, restaurants and hotels) in that (Taecharungroj & Ntounis 2024).

In 2023, a policy briefing published by the Organisation for Economic Co-operation and Development (OECD) highlighted a ‘key message’ that (in the author’s words) “Greening high streets can be a win-win – helping to both address climate change and making these places and the businesses that locate there more attractive to residents and visitors”. The briefing contained a summary case-study of how implementing ‘renaturing urban plans’ in parts of Liverpool had contributed to economic improvements on its high streets. In one location (Stafford Street), 82% of local businesses stated that greening the area had benefitted their business to some or greater extent and 52% believed that increased footfall was the most important benefit. This stated perception aligned with the responses of

local residents, 94% of whom rated the appearance of their area nearly twice as highly post-greening as previously and 68% of whom said they felt encouraged to spend more time outdoors (OECD 2023).

This need for a diverse and locally-tailored approach to the regeneration and sustainability of town, city and village centres was also reflected in the conclusions of an inquiry into the future of our high streets, undertaken by the House of Lords Built Environment Committee in 2024. As key components of this, the committee concluded that people wish to have a mix of provision on the high street, that local markets can boost footfall and contribute to the unique character of different places, and that more greenspace and a well designed ‘public realm’ should be key considerations in regeneration schemes (House of Lords 2024).

In an assessment of the impact of urban greenspace and nature-based solution interventions in Liverpool’s Business Investment District and Baltic Triangle, representatives of local small & medium enterprises (SMEs) and other local businesses noted that greener, interactive, and ecologically diverse environments both attracted businesses and supported additional footfall and returns on investment, justifying relocation costs to “greener areas”. They supported the view that employee productivity would increase if and where neighbourhoods had a higher proportion of nature-based solutions. Individual responses from local businesses and SMEs included:

“A city that is greener, with a lot more nature in it...is a much more attractive place to work and to attract businesses. It is a healthier place to work. Therefore, during breaks, you can get out, and very quickly, you are under a tree. You are looking at flowers; you are sitting on a bench where there is some grass around; there is a water feature, or whatever it is. That, of course, impacts the people who come into the city to work, the visitors to the city, and the people like us who live here; it impacts significantly on our well-being and our health.”

And:

“Inward investors are more likely to choose greener cities for their businesses and employees.”

The study’s authors noted that overall, urban greening initiatives delivered to provide nature-based solutions to a range of social and economic issues and challenges need to be located, planned and designed carefully, with particular attention to the profile they have with local people and businesses. The size and location of interventions were highlighted as being critically important in promoting their visibility, and both visibility and associated communications were similarly highlighted as key components for generating public awareness and support (Mell, et al. 2023).



One of the things that makes town centres pleasant and vibrant is a cool and shady environment for outdoor eating and other forms of leisure and entertainment. The UK’s natural capital accounts for 2025 put the annual value of urban heat regulation delivered by natural capital (urban green and blue spaces, urban trees, etc) across Great Britain in 2023 at £1.016 billion. In 2024, this annual value fell to £486 million (because there were fewer hot days in that year). The UK’s annual number of hot days over the latest decade (2015 to 2024) has nearly doubled compared with the previous decade (2005 to 2014) (Office for National Statistics 2025)... so nature’s role in cooling of our towns and cities is likely to become even more economically important in future, as the climate changes.

Keeping food supply chains short, with local producers supplying local customers (either through local shops and restaurants, or directly through farmers’ markets and other similar food retailing arrangements) can be very effective at supporting a vibrant local economy. A systematic review of 103 studies from 21 countries (mainly from the USA, but including several European countries, including the UK) investigated the

characteristics of people who buy produce at farmers’ markets. The review identified 27 typical characteristics which showed little variation from place to place or time to time. Among other things, the review identified that farm market customers tend either to visit farm markets occasionally (a few times per year), or to shop at one weekly or fortnightly. The review found that people visiting farmers’ markets are typically willing to pay 15 to 20% more for produce that they would elsewhere for the same item. 64% of farm market customers travel less than five miles to the market. Environmental sustainability is important to farm market customers, who are also typically interested in how food is produced. Buying local food is important to farm market customers, partly because local food chains are better for biodiversity than long ones. The review’s authors concluded (as what they identified as their “key finding”) that farmers’ markets can be a solid basis for local economic development. In their words, “Typical sellers at FMs [farmers’ markets] are local farmers who are solidly engaged with local and fixed resources. Further, typical FM buyers also support local economic development as they (i) are typically located in the same municipality as the FM itself, (ii) travel an average of 6.5 miles to reach the FM, and (iii) are committed to supporting local farmers and willing to pay a price premium. Therefore, money spent at FMs has a clear local multiplier effect, and such markets can serve as a policy lever for local and national governments” (Maró et al. 2023).

Global food supply chains that take fresh produce and raw materials from many countries that may be distant from the consumers that will eventually eat the resulting food, process and/or package them and transport them long distances to market are often vulnerable to geopolitical disruption, pests and diseases, climate change or extreme weather events, and other hazards. Systematic centralisation, industrialisation and standardisation within increasingly large markets can bring efficiencies, opportunities and benefits, but they can also lead to peaks and troughs in food availability and access to it, and to increased food price volatility. And they can contribute to environmental, health and other problems linked to the production, distribution and consumption of food. For food systems to resist future shocks (which will likely increase as the climate continues to change), they must become more resilient. Part of the answer may be provided by an increased role for local food production tailored to local environmental conditions and consumer needs that are met by much shorter supply chains linking farmers to the retail consumers of their produce. A paper published in 2024 explored the role of farmers’ markets (an important part of local food arrangements that are explicitly dependent on producers and consumers interacting directly, trading locally grown and fresh produce) in helping to build resilience into the future food system. The authors of the paper pointed out the benefits to farmers from maximising the added value of their production, and the benefit to customers of combining food shopping with a leisure experience. Their study

collected qualitative data from farmers’ market organisations in nine countries, across three continents – looking to capture an insight across the breadth and variety of farmers’ market operations rather than a statistically significant sample. The authors concluded that on the basis of their analysis, despite their niche status limiting their impact and reach, farmers’ markets play a pivotal role in supporting food system resilience. They put this down largely to their ability to innovate, but more significantly to their reliance on short supply chains and direct relationships between producers and consumers (Lucas et al. 2024).

A case study looking at perceptions of Aberdeenshire farmers’ markets illustrated how the direct sale of local produce by farmers to retail customers might contribute to the economic, social and environmental well-being of an area. Questionnaire surveys and researcher observations indicated that there was a positive attitude to local products with the majority of buyers wanting to support the local economy and local businesses through their purchasing. They saw the local products on sale as high quality, nutritious and sustainably produced and had strong positive attitudes to buying locally. This contrasted with the observation that the main products bought (baked goods and meat), are associated with negative impacts on the environment and/or human health. The study’s authors reported that “The Aberdeenshire FMs [farmers’ markets] were highly valued for the quality, freshness and locality of goods, and as a means of strengthening local communities”. They concluded that “Aberdeenshire FMs facilitate farmers to benefit from the region’s unique circumstances and are supported by locals who place importance on high-quality local products.” (Wardle et al. 2024)



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You will spend less on insuring your property if nature is allowed to do its job

Our homes, livelihoods and incomes can be vulnerable to flooding and fire, both of which are increasing in frequency and severity as the climate changes. Nature can help to reduce and manage the risks and put more money in our pockets.

While it is currently very difficult to link investments in nature’s recovery directly to reduced individual insurance premiums, it is clear that the more nature is encouraged to return, the bigger its contribution will be to reducing flood risk and reducing the risk of wildfire. This in turn makes home insurance more affordable. Costs don’t stop with insurance: premium rises added to lost work days, damaged property and produce, and clean-up costs affect us all. Not to mention the trauma to those affected.

Governments and developers can make better choices to deliver better policy and more effective planning, and the choices we make at home (such as creating ponds, planting and looking after trees, retaining natural lawns and flowerbeds) can make a difference too.

Analysis of data from a natural flood management project on the Littlestock Brook in Oxfordshire showed successful reduction of storm event discharge peaks (up to 55% reductions) and that over 40% of the total storage volume remained available throughout all events. The project involved construction of 27 woody dams, creation of 14.4 ha of new riparian woodland and creation of various retention ponds, sediment traps and bunds in fields. Authors of the study reported that flood storage areas were able to provide multiple benefits through significant sediment trapping, particularly during the larger storm events where features were connected to the stream via spillways. They concluded that “... **implementing Nature-based solutions (Nbs) can potentially reduce the flood risk in catchments and improve water and soil quality and biodiversity**” (Rameshwaran et al. 2024).

The authors of a 2016 investigation of the insurance value of green infrastructure in and around cities considered that **“Urban residents stand to benefit from urban ecosystems that are resilient so as to reduce the risk of an enduring loss of ecosystem services due to disturbance or management error... Our research supports the notion that investments in green infrastructure can enhance insurance value, reducing vulnerability and the costs of adaptation to climate change and other environmental change. Although we recommend that urban authorities consider the insurance value of ecosystems in their decision-making matrix, we advise caution in relying upon monetary evaluations of insurance value”** (Green et al. 2016).

Researchers recently compared insured rainfall damages in two similar neighbourhoods in Amsterdam – one of which had been renovated using climate adaptation measures including nature-based solutions, and the other of which had not. They found that implementation of the climate adaptation measures reduced insured rainfall damages by between €1,375 and €5,648 per ‘rain day’. The authors also identified a clear relationship between the amount of daily rainfall and the insurance value of the damage caused. They proposed that **“nature-based and other adaptation measures can be installed by local governments and stimulated by insurers and banks to increase climate resilience in urban areas”** (Ooms et al. 2025).

Insurance underpins nearly every sector of the economy, from housing to infrastructure to agriculture. A recent report by the Environmental Defense Fund set out the global case for insurance companies to support investment in nature-based solutions. In its authors’ words: **“Wetlands store floodwaters. Urban greening mitigates heat... These are examples of nature-based solutions that can lower the frequency of disasters and/or the losses when they occur. Since insurance is easier to provide and less expensive when risks are lower, investments in these approaches help support well-functioning insurance markets. Insurers can adjust their underwriting and pricing in response to the risk reduction services of nature-based investments... When nature-based approaches provide risk reduction benefits, those should be captured in insurance sector underwriting and pricing. Not only does that reward loss reduction, creating both a financial incentive and an information signal to policyholders, but it is also important for how individuals and communities view their insurance”** (Kousky & Burley 2025).

A recent report on Natural Flood Management, commissioned by The Wildlife Trusts on behalf of Intact Insurance, identified many positive benefits of nature-based approaches to flood management, including their ability to reduce peak flows during flood events, providing protection to properties, commercial premises, key infrastructure and utilities. It also discussed several challenges to commercial businesses such as insurance companies investing significantly in natural flood management schemes. These included a lack of national design standards, a lack of certainty about responsibility for long-term maintenance of natural flood management infrastructure and a lack of consistency in project monitoring. The authors highlighted that: “Whilst there is currently a lack of commercial incentives for the insurance industry to directly invest in NFM measures (including increased premiums, free riding, the role of Flooding in housing cover, and a lack of regulation or government drivers), there is increasing interest in furthering the understanding of NFM and the impact it may have on business, in particular in light of increasing risk due to climate change”. They concluded that the multiple benefits

arising from natural flood management projects: **“... provide the case for increased investment from the public sector, and if a framework associated with new projects can remove the uncertainties described here, the opportunity for increased investment from multiple sources can increase the benefit”** (Morris et al. 2024).

Insurance risk (and cost) is not only related to the risk of flooding. Another major risk is fire. Similar to flood risk, changing climate is likely to increase the frequency, intensity and scale of wildfires as changing weather patterns lead to more frequent periods of drought and higher peak temperatures. Increasing wildfires not only bring immediate damage and increased insurance risk (and costs), but also add to atmospheric carbon dioxide levels, and so contribute to more global warming and associated climate change. This is a serious problem globally (Kelley et al. 2025) and also in the UK, where the risk of wildfire could double if global temperature rises by 2°C, or quadruple if it increases by 4°C. Risks are highest (and are likely to remain so) in the south-east, east and midlands of England, due to increased temperatures and decreased relative humidity, but proportionally they are likely to increase most in the north and west, where risk is currently rather lower, but where significant areas of dry heathland and drained blanket bog will come under increasing threat (Belcher et al. 2021).

The Third UK Climate Change Risk Assessment assessed the climate-related risks and opportunities for the UK’s natural environment, including those related to wildfire. While noting various limitations in available data, it reported that from 2009 to 2017, 130,370 wildfire incidents were recorded in England, burning an area of 35,557 ha. Mountain heath and bog made up around half of this area, with improved and semi-natural grassland and arable land making up a further 40%. Analysis found a strong correlation between wildfire occurrence and drought conditions. One example given by the authors was as follows: “Sustained dry weather in July 2018 in Northern Ireland required the Fire and Rescue Service to attend an unprecedented number of gorse fires (1,061; a 1,053% increase on the same period in 2017)”. They also cited a report by the NFU Mutual insurance company that farm fire costs for the UK during the dry summer of 2018 were nearly £32m – an increase of 137% on the previous year, with the overall cost of claims for farm fires over the harvest period up by 21%, at £5.5m (Betts & Brown 2021).

A recent briefing document published by the European Environment Agency indicated that between 2000 and 2024, an average of 3,770km² of land was subject to fires annually in European Economic Area (EEA) member countries, and that climate change, urban expansion and land abandonment in rural areas are increasing the occurrence of fire-prone conditions. In the West (Atlantic and North Sea regions), which is the zone within which the UK and Ireland sit, the guidance notes that there is “increasing occurrence of large scale

wild fires” and that there are “densely populated, important pressures and risks related to wild and urban interfaces”. It recommends a number of actions to enable nature-based solutions to play a role in reducing and managing these risks, including green fire breaks and buffer zones, “close to nature” and “adaptive” forestry, rewetting and hydrological restoration, restoring heathlands, wetlands and similar habitats and controlling invasive non-native species (INNS) (European Environment Agency 2025).

The uplands of the UK are dominated by peat soils covered by vegetation characteristic of wet or dry heathland, or of blanket bog. The areas of dry heath are largely a consequence of past and current human activity that has drained the landscape to make it drier than it otherwise would be, and has shifted the vegetation towards a community dominated by a monoculture of heather. Prescribed burns on moorland increase the

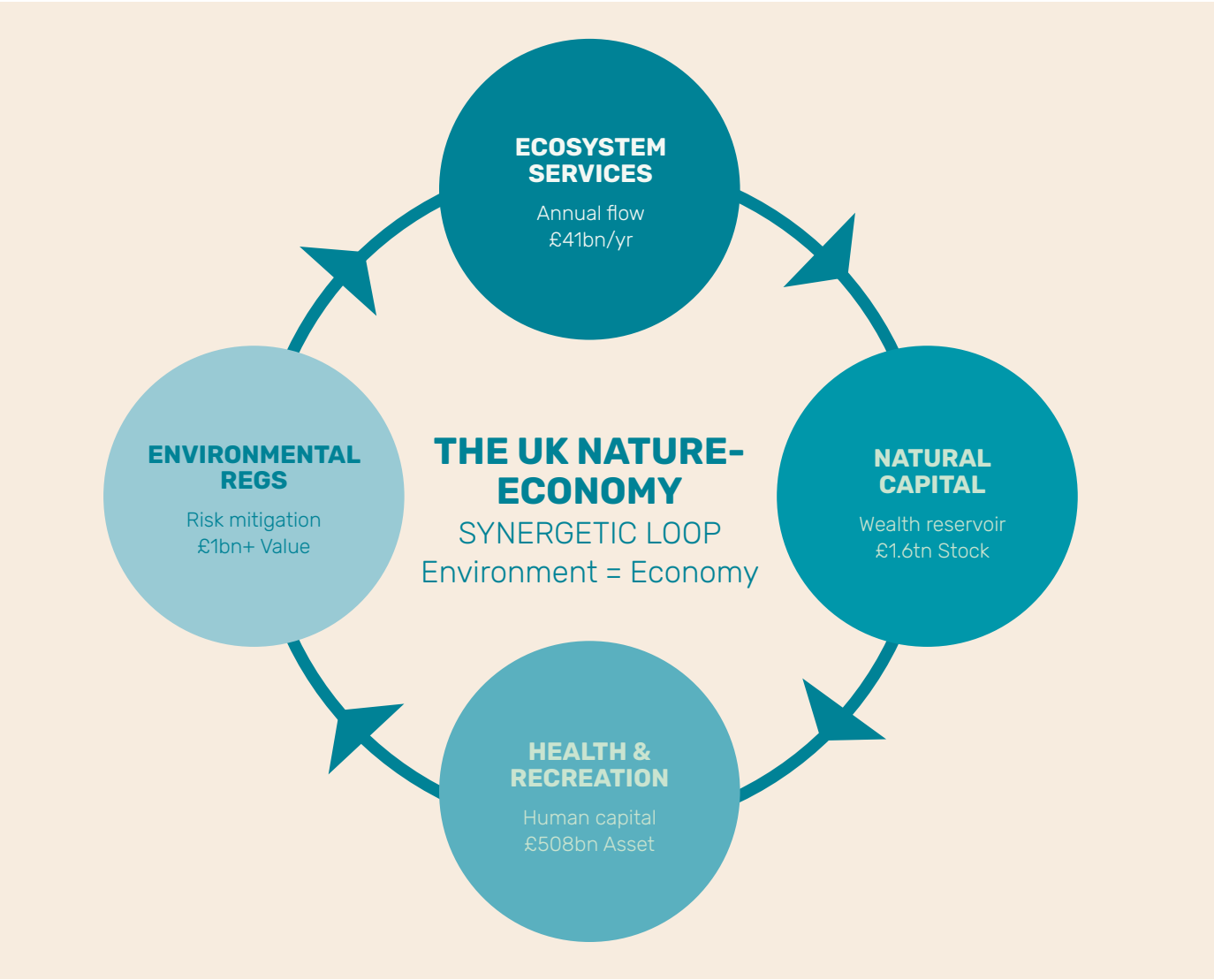


dominance of fire-prone heather vegetation over blanket bog vegetation that is less easily burned (Worrall et al. 2011), so a reduction in management burning and widespread re-wetting of upland areas – reinstating the conditions for healthy peat bog to thrive – would likely move the landscape towards one that is more diverse, wetter, more natural and less prone to wildfire.

There is widespread agreement that most wildfires are caused by people, either accidentally or intentionally. Many of them occur near to where people live and work, bringing risks to property and health-risks associated with poor air quality. A study comparing the incidence of fires on land owned by National Trust for Scotland (which is not managed by burning), with the incidence of fires on other Scottish moorlands, indicated that the majority (more than 60%) of Scottish moorland fires are likely to be caused by escaped prescribed (management) burns. Only 2% of the National Trust for Scotland moorland had been affected by wildfire in 18 years, suggesting that refraining from prescribed management burning would likely result in less moorland being burnt, both intentionally and unintentionally, and a correspondingly lower fire-risk to adjacent woodlands. The study’s author pointed out that

prescribed management burns are typically carried out in spring, in dry weather after periods of low rainfall and high winds, which increases the fire’s effectiveness at removing vegetation (its management purpose), but also greatly increases the risk of wildfire (Luxmore, undated).

A study investigating the factors affecting the severity of wildfires on Scottish heathlands and bogs analysed data relating to 92 wildfires that occurred between 2015 and 2021, looking for relationships between fire severity and a number of potentially influential variables. Fires on dry heath were more severe than those on either wet heath or blanket bog. More severe fires were associated with south-facing slopes at higher altitudes. Unsurprisingly, rain within two weeks before a fire reduced its severity and higher winds on the day of the fire had the reverse effect, so fires on dry heath, in periods of dry, windy weather, were most likely to be the most severe (Naszarkowski et al. 2024). This again supports the conclusion that restoring peat bogs and re-wetting heathlands across the UK’s uplands (putting them into a more natural state) would likely play a significant role in reducing the future severity of wildfires (reducing the hazard posed).



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TAKING ACTION

Summary



When we recognise a problem, it's natural to want to try and do something about it – to solve it. Every year, thousands of people volunteer, working unpaid on projects intended to improve local neighbourhoods, maintain nature reserves and other wild places, to bring nature back to our landscapes and seas, to clean up rivers, streams and the seashore. Taking action whether you are remunerated for it or not brings wide-ranging benefits to the natural world and to the people who do it. Every day, Wildlife Trusts and other organisations come across people working to make a difference – for themselves, their friends, families, neighbours, the places they live and the communities of which they're a part.

The benefits are clear for all to see, and academic research sometimes captures added insights into what these are and how valuable they can be. We're always looking for more.

Nature-positive activity such as planting trees or bringing nature back into your community gives a sense of purpose and agency and improves self-esteem, which in turn improves mental health well-being

Taking direct personal action can make us feel better in many ways. It gives us motivation with a sense of purpose. Working with others on nature-related community projects can improve people's confidence and self-esteem, give them a sense that they can make a difference and build their knowledge and skills. It can make people feel good about themselves and their relationships with those around them; it can make a real difference to people's mental health and well-being.

A qualitative study of a group of semi-retired volunteers involved in a community conservation project in northern England was published in 2017. A combination of detailed interviews and focus group discussions with five long-term volunteers, over a three year period, clearly revealed that they saw enhancements to personal, social and community capital as significant benefits resulting from their conservation volunteering. The study's author identified several specific positive outcomes from the volunteering activities, which included assisting individuals make the transition into retired life; establishing new social networks; enhancing mental health and contributing to the renewal of their park. The motives for the volunteers engaging with the project, and for sustaining their participation, included a perception that the activities undertaken were varied, challenging, purposeful, rewarding, and that they were making a difference. It was seen as important that the work undertaken was bringing benefits both to the volunteers themselves and to others – in the form of improved mental health, physical health, overall quality of life, reduced social isolation, stronger social networks, and park enhancement that benefited all its users and had a

positive impact on its biodiversity (amongst other things). In the words of the study's author, the volunteers communicated "... a clear sense of pride in the results of the specific tasks assigned to the group. When completing the renovation of a bird hide, creating new flower beds, tackling invasive weeds and planting new trees, volunteers felt these projects were considerably rewarding. They felt they were making a difference to the biodiversity of the park, and that their work positively impacted upon the local community". The study's author concluded that volunteers' health was enhanced as a result of their participation. And he identified the main factors contributing to that: engagement in motivational activities (variety, intensity, challenge); group interaction (conversation, making friends, working together); the direct influence of the natural environment (aesthetic appeal; sounds; features); and the productive outcomes of engagement (transforming the park with the associated pride and satisfaction derived from that process) (Christie 2017).

Between 2016 and 2021, a consortium of 8 organisations worked with the National Lottery Community Fund to deliver 31 different environmental projects that were intended to empower 128,000 participating young people (aged 11 to 24). A final evaluation of the £33 million programme was carried out by independent evaluation partners, drawing on data collected over the 6 years of the programme. The final evaluation report documented evidence that the young people participating in the programme:

- Improved mental health and well-being;
- Increased self-esteem and self-confidence;
- Gained new skills and knowledge; and
- Increased employability and enhanced or influenced career aspirations.

The evaluation's authors presented several types of evidence relating to the impact of participation in the programme's environmental enhancement activities on young people's self-esteem and self-confidence. They noted that: *"practical tasks with tangible outcomes allowed participants to visibly, and often immediately, see the impact of their work, providing a sense of achievement and supporting associated well-being gains"*. 95% of respondents to a participant impact survey indicated that participation had improved their self-confidence at least 'somewhat', with 52% saying that it had increased 'a lot'. In another part of the evaluation, the average self-assigned rating given by 891 participants against the statement 'I feel confident in myself' went up from 3.1 before participation to 4.1 (on a scale from 1 to 5) afterwards. Reasons for increased self-confidence were many and various, and were reported by the authors to include the development of new skills, knowledge and qualifications (which led to a sense of achievement), hands on practical environmental activities (which readjusted young people's sense of what was possible for them) and taking on new experiences and challenges such as carrying out conservation tasks (which, among other things, made them feel that they could make a valuable contribution) (Haswell-Walls et al. 2022).

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CATLUN KENNEDY



JOHN HAWKINS/SURREY HILLS PHOTOGRAPHY



PAUL HARRIS/2020VISION

Improving the environment where you live creates a sense of achievement and collective pride

People who contribute to local nature recovery or environmental improvement projects will often tell you how proud they are of the difference they make and what they and others like them achieve. When we get involved in community greenspace initiatives or volunteer in other ways to improve the places where we live, it often goes hand in hand with a sense of achievement and collective pride. You feel good about making a positive difference on your own doorstep. It brings communities together, makes people feel part of something bigger, pulling together as part of a collective effort that increases community pride and builds a feeling of belonging.

A study of community tree planting initiatives on vacant lots in Detroit in the 1990s documented the experiences, observations and opinions of those involved. The authors documented a range of factors that motivated local action, including making neighbourhoods more beautiful, deterring crime and promoting local places where children can play safely. They reported the words of two neighbourhood leaders involved in a vacant lot tree planting scheme:

“When you wake up and you turn the corner and you see trash, you see lots not cut, homes burned out and everything, you can’t feel good about that. And so when you feel good about where you are, you do more.”

And:

“We wanted the vacant lots for beautification and we didn’t want the blight there and we didn’t want the crime there.”

They also captured an explanation of another community leader’s aim for their tree planting project:

“Our goal was to put swings up there and to get a butterfly garden. We wanted the park edible. With... an edible landscape, architecturally designed with fruit trees, boysenberry trees, raspberry trees, and everything that was in the park would be edible. I feel that the garden is a wholesome thing.”

The study’s authors discovered that the stories told by the leaders and ‘lot keepers’ (local volunteers who worked to restore the lots and to maintain them) demonstrated complex relationships between personal identity and physical place. They documented how once-vacant lots became important parts of the neighbourhood landscape, where residents sought quiet moments, met others or saw familiar faces tending or using the lots, all of which reinforced people’s perception and belief in shared ownership of a common resource. Projects in which the people involved achieved

success helped to build their confidence, willingness and ability to take on other projects intended to improve their neighbourhood; they helped to establish a ‘win-win’ spiral of action leading to improvement that led to more action. The authors’ concluding reflections included an observation that the high visibility of restored, planted and well-maintained lots enhanced both the community’s sense of collective identity and the personal sense of identity of those who created, maintained and used them (Austin & Kaplan 2003).

An ‘interpretative phenomenological analysis’ was carried out to study the impact of disrupting the volunteering activities of conservation volunteers, on their well-being and levels of concern for the environment. Ten volunteers whose conservation activities had been disrupted by the Covid-19 pandemic took part in interviews that each lasted between 45 and 90 minutes. During these, they discussed their nature-related experiences before and during the pandemic (including during the lockdowns of 2020). Analysis of the transcripts subsequently allowed the study’s authors to identify common themes and insights, including an observation that the experience of nature, the act of doing something active to protect, maintain or improve it, the positive impact achieved and the of a volunteer’s sense of personal well-being can be closely interwoven. One of the study’s participants highlighted that her more frequent visits to locally accessible natural places during lockdown had prompted her to notice more issues that she might be able to actively address through her volunteering. The study’s authors deduced from part of their findings that: “...easily accessible sites of mundane nature are important both in terms of supporting well-being in a post covid landscape and for enabling people to foster a sense of environmental concern” (Furlong et al. 2024).

The final evaluation of the Welsh Government’s Local Places for Nature programme documented how £66 million was spent between 2020 and 2025, to support a range of activity delivered within communities aiming to create ‘nature on their doorsteps’. Among other things, surveys of participants indicated that they consistently felt that participation in the programme’s nature enhancement action was good for their mental well-being (74% of respondents), acquisition of new knowledge or skills (63%), opportunities to meet new people (59%) and improved physical health (49%). Discussions on site visits undertaken by the programme evaluators highlighted a number of motivations and additional benefits. Participants consistently highlighted the positive influence of “being outdoors”, engaging in “purposeful activity” and “connecting with others”. The evaluation’s authors reported that “a large group of participants spoke about a sense of purpose and motivation, describing the satisfaction of contributing to something positive for their community and the environment”. They reproduced quotes from two participants, as follows:

“We get out and feel we’re doing something useful for nature.”

And:

“A sense of achievement when you’ve finished things.”

The most popular response to a question about people’s motivation to participate in activities involving green and natural spaces was “to improve my local area” (81%), with “I’m interested in giving back to the community” in third place (77%) (Griffiths et al. 2025).

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Acknowledgements

There is always more to understand and learn. We welcome additional evidence of how nature’s recovery can help solve the problems that people and society are facing. Likewise, if you can help us understand or communicate the evidence here more effectively, please get in touch: evidence@wildlifetrusts.org.

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Designed by Yorkshire Wildlife Trust Design Studio

We can all agree our country needs repair.

What most of us don't realise is that we all have the power to do something about it.

Fix nature and other things will benefit too.

The consequences of nature's recovery can be felt by both people and wildlife.

This document is not intended to be shared externally.

All Wildlife Trust staff can utilise the information within - community organisers, volunteers, media spokespeople, reserve staff, land advisers, comms experts, campaigners, advocacy leads, and more.

Underpin and support statements and messaging. Draw out key studies and data for advocacy, include references in training materials, funding bids, MP Briefings, supporter emails. Add some science into your conversations, when speaking on a topic at an event or on the radio, or talking to supporters old and new. Bring the science to the emotion, and check for more detail when you want it.

This is the 'evidence in your pocket' that boosts the bold and confident voice the 'Fix nature. Fix the nation.' campaign will be steering forward.

Campaigning & Organising to Fix Nature - WildNet

The Wildlife Trusts are a federation of 47 charities, 46 individual Wildlife Trusts and a central charity, the Royal Society of Wildlife Trusts. Together, we have more than 945,000 members, over 33,000 volunteers, 4,100 staff and 600 trustees, and manage over 2,600 nature reserves for nature and for people. We undertake research, we stand up for wildlife and wild places under threat, and we help people access nature.

We work with businesses who are committed to being nature positive and take action to help restore 30% of land and seas for nature by 2030.