AGILE INITIATIVE

OXFORD MARTIN SCHOOL

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EVIDENCE SYNTHESIS REPORT

Societal Resilience and Mental Capital

Environment and National Security: Exploring the Risk Pathways

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About

This document is one of a series of reports from the Agile Initiative's Environment and National Security: Exploring the Risk Pathways project. The Evidence Synthesis Reports provide the detailed evidence underpinning the shorter Priority Policy Questions: Summary of Key Findings reports.

The project also produced a Forward-looking Research Agenda containing an overview of the whole project, a conceptual framework illustrating the links between environment and security, a summary of the current UK government policy position, a research agenda listing almost 200 evidence gaps, analysis of potential interventions, and guidance on how to communicate the key issues effectively based on insights from behavioural science.

The Evidence Synthesis Report Series

- The role of critical natural infrastructure in supporting national security
- Managing demand: energy security, food security and UK national security
- Climate risks and opportunities for shipping and UK maritime trade
- Weaponisation of nature
- Societal resilience and mental capital

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Summary

This evidence synthesis report discusses the following three research questions that were developed in collaboration with policy stakeholders:

Q1

What does societal resilience mean and how do social, economic, and mental capital interact to shape it?

Q2

How does national mental capital and wellbeing intersect with environmental challenges, including toxins, climate change, and food security?

Q3

How do "forgotten ecosystems" (the wider network of green and blue spaces beyond formally recognised parks and protected areas) contribute to mental capital?

Societal resilience depends on mental, social, and economic capital. These interact to generate shared capacity to anticipate, cope, recover, and adapt to stress. Environmental conditions (clean air, secure food and water, quality nature, and safe connected places) underpin all three, while changes in those dimensions in turn shape environmental conditions.

This means that environmental decline is a national security issue. Floods, heat, pollution, and food and water insecurity erode the mental, social, and economic capital that lets people, communities, and institutions absorb shocks. Protecting everyday environments, including overlooked 'forgotten ecosystems', is a low-cost, near-term way to strengthen UK resilience before the next crisis. Investment in resilience creates positive feedback loops, as resilient societies not only recover faster from shocks, but also govern Critical Natural Infrastructure better, helping to prevent future impacts from climate and nature loss.

Policy recommendations

- Treat the three capitals as resilience infrastructure: embed mental, social, and economic capital across project cycles, from appraisal to evaluation.
- Shift resilience investment upstream: fund prevention rather than relying only on crisis response.
- Apply a mental capital equity test to infrastructure and adaptation decisions: who is protected, who remains exposed, who can recover
- Unlock the resilience value of forgotten ecosystems: use Biodiversity Net Gain, Local Nature Recovery Strategies, and planning guidance to protect overlooked habitats.
- Frame mental capital around enabling environments and individual agency together, not individual responsibility alone, reducing structural vulnerability while supporting personal coping.

Introduction

Environmental integrity is linked to national security through the impacts on people and societies, such as floods, droughts, high food prices, and loss of access to nature. These pressures can undermine trust in government and lead to civil unrest and security issues. However, resilient societies can cope better with these pressures, and can also provide stronger governance to protect critical natural infrastructure and provide people with an environment that enables them to sustain their mental capital, reducing risks through a positive feedback loop. To explore these issues, this evidence synthesis report discusses what societal resilience means, how mental capital intersects with environmental challenges, and how forgotten ecosystems can contribute to enhancing mental capital.

Societal resilience is the capacity of a society to resist, cope with, recover from, and adapt to shocks, stress, adversity, and trauma while maintaining the conditions that allow people, communities, institutions, and systems to function. For policymakers, the main implication is that societal resilience must involve sustained investment in the mental, social, and economic foundations that allow people and institutions to function under pressure. Reactive responses, such as economic underpinning in public health emergencies, are insufficient to achieve societal resilience.

The UK Government's Mental Capital and Wellbeing Foresight report defined mental capital as the cognitive and emotional resources people draw on to learn, reason, cope with stress, maintain relationships, and participate in society.[1] Following this framing, recent literature has moved from an individual focus on mental capital toward population level concepts such as brain capital and mental wealth.[2]

Societal resilience literature increasingly treats collective cognitive and emotional capacities, social cohesion, trust, and inclusion as key enablers of resilient responses and adaptation to crises. Wellbeing is a multidimensional construct typically encompassing subjective life satisfaction,[3] psychological wellbeing,[4] and objective social indicators.[5,6]

National resilience depends on more than physical assets. It depends on whether people can process risk, make decisions under pressure, trust information, cooperate, and recover from shocks. Mental health, productivity, social production, and wellbeing are interdependent within wider economic and social systems.[7] It is equally important to note, however, that the goal is not simply to make people more resilient to adversity, but to reduce the structural vulnerabilities that generate adversity in the first place and distribute responsibilities across communities and government/governance.



A mental wealth perspective recognises the collective population-level value of cognitive, emotional, and social assets in the post-COVID-19 era.[8] Ignoring the importance of mental wealth carries significant and long term societal and economic costs.[9] Thus, mental wealth should be understood as a values-led system that protects and strengthens cognitive, emotional and social capacities, capabilities and competencies to support societal resilience.[1,10] We distinguish our concept of 'mental wealth' from similar concepts; e.g. 'brain capital', that frame brain health and brain skills in purely transactional terms as the "currency of a brain economy."[11]

The capacities supporting societal resilience are shaped by wider conditions, including education, financial security, physical health, social cohesion, trusted institutions, and the quality of the everyday environment. Access to nature is one of these conditions. Green and blue spaces can support physical health, mental health, wellbeing, social connection, and resilience. This extends beyond formal parks or protected landscapes to include 'forgotten ecosystems': small, informal, or under-recognised spaces in and around where people live, such as scrub, hedgerows, verges, ponds, brownfield mosaics, and urban-edge spaces, together with the soils, invertebrates and other organisms that sustain them. Although they receive far less attention than formal parks or nature reserves, these spaces support biodiversity, pollination, soil health, water regulation, flood management, cooling, carbon storage, recreation, and social connection.[12-15] Because they underpin everyday conditions for wellbeing, social connection, and adaptive capacity, this report treats them as part of resilience infrastructure.

This report examines how mental capital contributes to societal resilience in the context of national security by making three linked arguments.

1. Societal resilience depends on the interaction of mental, social, and economic capital: people and institutions are better able to cope, recover, and adapt when cognitive-emotional capacity, trust, cooperation, and material security reinforce one another (Figure 1).
2. Environmental challenges such as climate change, pollution, food insecurity, water insecurity, and nature disconnection can erode mental capital and wellbeing, especially where existing vulnerabilities are already high.
3. The environments that sustain mental capital should be treated as part of resilience infrastructure, including overlooked ecological assets that support everyday wellbeing, social connection, and adaptive capacity.

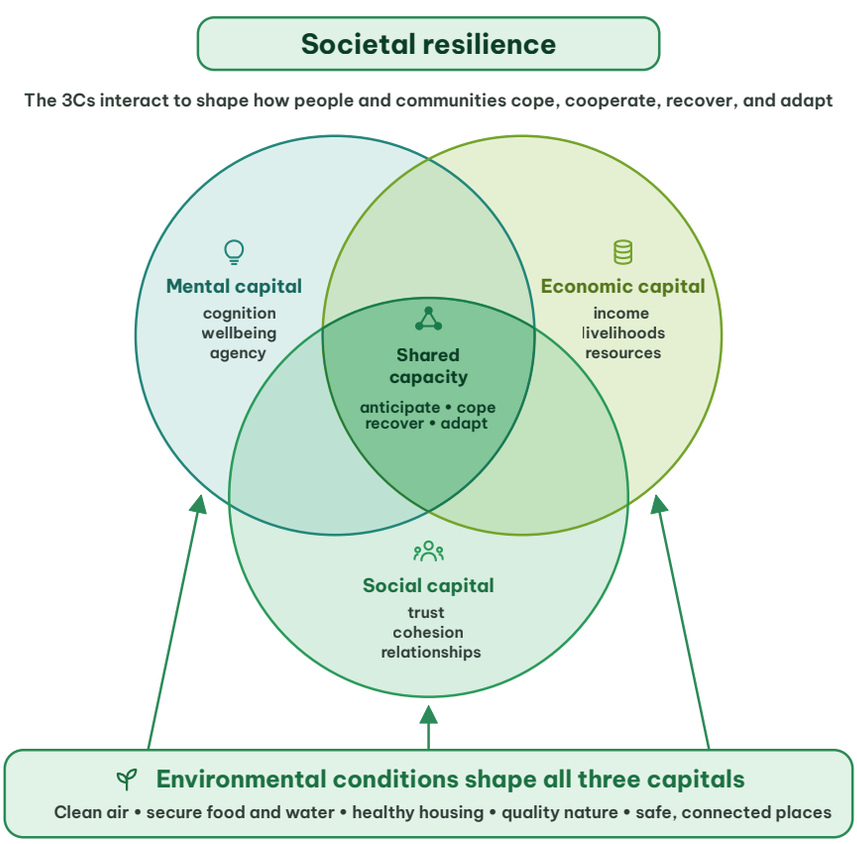


Figure 1. The three capitals of societal resilience. Mental, social, and economic capital interact to generate shared capacity to anticipate, cope, recover, and adapt. Environmental conditions (clean air, secure food and water, quality nature, and safe connected places) underpin all three, while changes in those dimensions in turn shape environmental conditions.

Societal resilience

RQ1. How do social, economic and mental capital interact to shape societal resilience?

Societal resilience describes the capacity of the population and social infrastructure to manage shocks and chronic stresses. It includes communities, public services, institutions, infrastructure, markets, families, and informal support networks.

The literature uses different but overlapping definitions. The National Consortium for Societal Resilience[16] defines societal resilience as the "capability created by local systems that helps people and places to adapt and advance in a changing environment." Other definitions emphasise capabilities created before, during, and after disruption, or the organisational capacity to respond to disturbance.

For policy purposes, societal resilience is defined here as: the collective capacity of people, communities, institutions and systems to anticipate, withstand and recover from acute shocks, and to manage, adapt to or transform under chronic stresses, while protecting wellbeing, legitimacy, cooperation, and future adaptive capacity.

Discussion of resilience means specifying five things: (i) resilience of what, (ii) to what, (iii) from whose perspective, (iv) over what time period, and (v) for what purpose. All responses require adaptation.

This definition moves resilience beyond emergency response to include preparedness. Flood defences, hospitals, logistics, and infrastructure matter, but they are not enough. A society can have strong physical infrastructure yet remain unprepared if the human conditions for resilience (such as public trust, social connection, mental health, and economic security) are fragile.

For example, during COVID-19, unequal trust in institutions and prior experiences of exclusion shaped vaccine confidence and uptake, showing that technical delivery capacity is not enough without legitimacy and trust.[17]



Similarly, a society can have good plans for national economic emergencies, but citizens may lack hope or be too isolated or too anxious to access support. Economic recovery can be underway while inequality, trauma, or political grievance deepen. A fuller account of societal resilience therefore needs to include not only robustness and recovery, but also the values that underpin them: trust, fairness, inclusion, legitimacy, and adaptation.

The three capitals

Societal resilience rests on three human-facing foundations: mental, social, and economic capital, through which resilience is experienced and enacted. Natural and built capital matter too, but we treat them as the infrastructure that helps to sustain these three (see the 'forgotten ecosystems' section).

Mental, social, and economic capital interact closely to shape how individuals and societies respond to environmental and climate-related stress. Mental capital (as defined above) refers to capacities such as cognition, emotional regulation, adaptability, problem-solving, and the ability to cope with uncertainty. These capacities support both individual wellbeing and collective resilience by enabling people to manage stress, make decisions, learn, and cooperate. However, environmental pressures, such as food and water insecurity, biodiversity loss, and a changing climate, can erode mental capital. The UK Health Security Agency identifies flooding, heat, and climate-related anxiety as growing threats to mental health and wellbeing in the UK.[18] Evidence from an English national study found elevated levels of probable depression, anxiety, and PTSD three years after flooding events,[19] while higher temperatures, air pollution, and traffic noise have also been linked to poorer mental health and slower cognitive development.[20,21] These risks also operate indirectly: climate-related pressures on food, energy, housing, livelihoods, and income can produce financial stress, increase demand on services, and weaken people's capacity to cope and recover.[18]

Social capital provides the relational foundations of resilience through trust, networks, belonging, and cooperation. Strong social cohesion influences whether communities share resources, support vulnerable people, resist misinformation, and recover collectively after crises. Conversely, distrust, exclusion, and division can weaken democratic resilience and increase vulnerability to social fragmentation.[22] Environmental conditions shape social capital as well: accessible and high-quality green and blue spaces can strengthen community cohesion, reduce loneliness, and improve physical and mental health.[13]

Economic capital, including income, housing, savings, employment, infrastructure, and public services, determines whether households and institutions can prepare for and recover from shocks. Economic insecurity, poor housing, debt, and fuel poverty reduce adaptive capacity and can worsen mental distress. These forms of capital are interdependent. Mental distress, environmental stress, and weakened social cohesion can reduce educational attainment, productivity, caregiving capacity, and workforce participation, undermining economic resilience. Mental health, wellbeing, and productivity are deeply interconnected, making mental capital a core foundation of both social and economic resilience in a changing climate.[7]



Observable dimensions of resilience

We have identified six factors that make the three capitals observable and can help track whether resilience is being strengthened or eroded: health and wellbeing, economic prosperity, social cohesion, rights and justice, institutional trust, and inequality. The first three track the state of mental, economic, and social capital respectively; the other three are cross-cutting conditions that shape whether the capitals reinforce or erode one another.

- **Health and wellbeing** capture physical and mental health, psychosocial functioning, and flourishing (positive functioning and living well, not just the absence of illness). They are outcomes of resilience as well as being conditions that enable people to cope.
- **Economic prosperity** captures secure livelihoods, economic resilience, and inclusive opportunity. It matters because people need material security to prepare, adapt, and recover.
- **Social cohesion** captures cooperation within groups, across groups, and between people and the state. It supports trust, legitimacy, and collective action.
- **Rights and justice** capture fair treatment, agency, and equal access to protection, services, and support. If people experience risks, burdens, or recovery processes as unfairly distributed, trust weakens and resilience is reduced.
- **Institutional trust** captures institutional integrity, safety, and confidence in public institutions. Corruption and crime weaken this trust, distort resource allocation, and undermine state legitimacy.
- **Inequality** is a cross-cutting vulnerability amplifier. It shapes exposure to risk, access to protection, recovery capacity, trust, and long-term human development.

Resilience and vulnerability feedback loops

A resilience feedback loop occurs when strengthened capitals reinforce one another and increase confidence in public systems. For example, preventative investment in healthy environments, good housing, public services, and trusted institutions can improve wellbeing, reduce stress, strengthen social connection, and increase confidence in public systems. This in turn, makes people more likely to prepare for risks, use services, follow guidance, support one another, and participate in recovery. Evidence from community resilience research shows that social support, communication, collective efficacy, and trusted institutions improve preparedness and recovery.[23,24]

Public health and greenspace literature shows that access to quality green and blue spaces can support wellbeing, reduce loneliness, strengthen social contact, and improve environmental conditions such as heat, air quality, and flood management.[13,25]

Economic security is a key part of this loop because financial costs and benefits shape both policy decisions and people's ability to act on risk. Investment in housing, income, services, infrastructure, and institutional capacity can reduce the long-term costs of crisis response while strengthening adaptive capacity.[26] Over time, these reinforcing conditions can create a positive cycle: greater security supports better coping and participation; stronger participation supports more effective delivery; and more effective delivery increases trust in public systems.

A vulnerability feedback loop occurs when capitals erode together. Environmental shocks or chronic stressors such as heat, flooding, pollution, poor housing, and nature deprivation can increase anxiety, trauma, cognitive overload, and distress. This can reduce people's capacity to prepare, make decisions, work, learn, care, and recover. The evidence is particularly strong for flooding and mental health, with UK studies linking flood exposure to anxiety, depression, PTSD, and reduced quality of life over time.[19,27] Heat and temperature variability are also associated with poorer mental health outcomes, while air pollution and traffic noise have been linked to heightened anxiety symptoms and cognitive development outcomes, including in UK adolescents.[20,21,28]

These pressures can interact with income loss, housing insecurity, service industry strain, and reduced productivity, especially where existing vulnerability is already high.[18,26] Financial stress can weaken trust, increase isolation, and intensify perceptions of unfairness. This can create a negative cycle: stress reduces capacity to cope; reducing coping capacity makes recovery harder; slower recovery increases pressure on households and services; and visible unfairness or poor delivery further weakens trust. The Khan Review adds a UK democratic resilience lens, warning that grievance, distrust, and social division can undermine cohesion and be exploited by malign actors.[22]

This does not mean environmental and climate stressors automatically cause instability. They become national resilience risks when they compound existing weaknesses in population-level mental capital, social cohesion, economic security, public services, and institutional trust. This reflects the wider "risk multiplier" framing in climate security and adaptation literature, in which climate hazards add pressure to systems, but the severity of their impacts depends on exposure, vulnerability, governance capacity, inequality, and available resources.[18,22,26] In this sense, mental, social, and economic capital shape whether societies absorb and adapt to shocks or experience longer-term stress and instability.



Mental capital

RQ2. How mental capital intersects with environmental challenges

While economic and social resilience are well established in policy, mental capital is rarely treated as resilience infrastructure in its own right. This report focuses on that gap, and on the environments that help to sustain mental capital.

In order to understand how mental capital and wellbeing intersect with environmental challenges such as climate change, environmental contaminants, and resource insecurities, we performed a rapid assessment of literature published since 2020. There were no papers that explicitly discussed mental capital; the majority focused on mental health and wellbeing, with components of mental capital such as emotional regulation, executive functions, coping strategies, etc appearing within the papers. Most of the current empirical evidence comes from regions of the world already experiencing high impacts from climate change and ecological degradation (and very few from the UK), but through these we can learn about possible future impacts in the UK as climate impacts accelerate over the next few decades.

Converging evidence indicates that climate change worsens a wide spectrum of mental health outcomes through acute disasters, slow ecological degradation, and anticipatory distress. Impacts fall heaviest on already marginalised communities, including land-dependent populations, women, youth, and people in poverty. Interventions and policies that explicitly address climate-related mental health are emerging but lag behind documentation of risks.

The themes evident in the literature have been divided into a multi-pathway framework:

- **Acute shocks:** Sudden-onset events such as floods, heat, wildfires, service disruptions, etc
- **Chronic exposures:** Long-term stressors such as changing landscapes, pollution, air quality, and other toxic exposures
- **Resource insecurity:** Food, water, livelihoods, displacement
- **Nature disconnection**: Biodiversity loss and environmental degradation, lack of access to green/blue spaces
- **Life course** (cross-cutting): All four areas above can be amplified at particular life stages.

These risks are discussed in the sections below, followed by consideration of coping strategies, emotional/social resilience, and protective resources, and identification of gaps in the evidence base.

Acute shocks

Acute climate and environmental shocks such as floods, storms, hurricanes, wildfires, drought onsets, and water-related disasters are consistently linked to trauma-related mental health outcomes, particularly among socially vulnerable populations.[29,30] These events can produce PTSD, anxiety, depression, substance misuse, suicidal ideation, and other forms of psychological distress by exposing people to sudden loss, danger, and disruption.[31,32]

Water insecurity and service interruptions further intensify distress, especially when supplies are unpredictable,[33] while drought can worsen mental health through reduced water quality, food insecurity, and heat exposure. UK narratives also place emphasis on at-risk groups, i.e. those whose livelihoods and lifestyle are most disrupted by drought, such as farmers.[34]

Acute shocks are therefore best understood as cascading events: direct exposure leads to trauma, while indirect effects can spread through lost income, damaged food and water systems, disrupted schooling, relocation, and weaker access to care.[32,35,36] Land-dependent workers, children and adolescents, migrants, older adults, women, and low-income groups are particularly vulnerable, reflecting broader evidence that climate change acts as a risk multiplier that compounds existing inequalities and psychosocial stressors.[30,32,37-40]

Chronic exposures

Slow-onset environmental changes, including long-term warming, drought, sea-level rise, ecosystem degradation, and pollution, can undermine mental health and wellbeing over time through interconnected social, economic, and biological pathways.

These chronic stressors contribute to ongoing anxiety, depression, eco-anxiety, solastalgia (i.e. distress related to environmental change), and ecological grief.[29,41] Environmental degradation and restricted land and forest access can also worsen poverty and food insecurity, increasing depression risk[42] – and conversely, larger forest area is associated with lower prevalence of mental disorders.[43]

In the UK, a slow-onset hazard such as drought is perceived to affect mental health and wellbeing through stress, worry, conflict over water restrictions, loss of livelihood, and reduced access to restorative green and blue spaces.[34]

There is growing evidence that ambient air pollution is a risk factor for neuropsychiatric disorders (such as depression and neurodevelopmental disorders) and that prenatal exposures can impair children's cognitive development.[44] Biological pathways linking pollution to poor mental health have been described. For example, long-term air pollution (fine particles, nitrogen oxides, heavy metals) causes oxidative stress, neuroinflammation, and blood–brain barrier damage, which can drive psychopathology via central nervous system effects.[30]

Resource insecurity

Climate change can lead to food insecurity, water insecurity, livelihood loss and poverty, and displacement.[35,45,46] These insecurities rarely occur alone: the literature describes linked cascades from climate hazards to reduced resource access, worse health, mental distress, and social instability.[31,35, 41]

Food insecurity is a major component of the resource-insecurity pathway, with climate change reducing crop yields, harming agricultural labour capacity, disrupting supply chains, and reducing food access.[35] Heatwaves and droughts in 2021 were associated with 127 million more people experiencing moderate or severe food insecurity compared to previous years.[35]

Climate change affects water security through more frequent droughts, more variable rainfall and flooding, and rising social vulnerability, which together undermine water quantity, quality, reliability, and safe access.[35,47,48] In the UK, there are significant pressures on the nation's water resources, which will further intensify due to population growth and climate change - with estimates predicting a 5 billion litre per day shortfall by 2055 for public water supplies without continued action.[49]

Water insecurity contributes to emotional distress through uncertainty, deprivation, shame, conflict, and health concerns, while unpredictable water interruptions increase stressful coping behaviours.[33,50] Climate-driven water scarcity generates health burdens through food insecurity and mental health stress, conflict over resources, and displacement, disproportionately affecting women, children, and low-income households.[51] Social capital, predictability, and community cohesion can mitigate distress linked to drought and intermittent water supplies.[32,52]

Climate stress threatens food security, livelihoods, homes, and resource access, contributing to displacement of millions.[46] In Latin America, many child and family migrants leave climate-stressed regions seeking vital resources and greater security.[53] Displacement is tied to mental health risk, including trauma, anxiety, depression, and vulnerability to violence, trafficking, and social isolation.[31,53,54]

Nature disconnection

Loss of connection to land, water, and living systems is a major pathway linking climate change to mental distress. Concepts such as eco-anxiety, solastalgia, and ecological grief describe emotional responses to environmental loss and degradation.[29] Ecopsychology frames the climate crisis as a psychological and spiritual crisis rooted in disconnection from the natural world.[30]

Nature disconnection is most explicitly captured by solastalgia, defined as distress when environmental transformation erodes the solace of familiar places.[31,54] This is described as a loss of connection, detachment from known environments, and a place-based mental health response to landscape modification, drought, extraction, deforestation, disasters, and other long-term changes.[29,37]

These experiences are linked to depression, anxiety, distress, grief, helplessness, and identity disruption.[29,55] Eco-anxiety is broader than nature disconnection alone, but it is a related response to perceived ecological threat, with global evidence showing negative associations with mental wellbeing.[56.57]

Conversely, contact with nature and natural elements has been linked to reduced mental fatigue and cortisol, and increased sense of calm.[30] Natural features such as urban trees can offer provisioning (such as food), regulating (such as air purification), and cultural (such as recreation) services, which provide both physical and mental health benefits; however, inequities in access to green space remain a challenge.[58]

Life course



Climate change affects people through different pathways at different ages: heat and birth outcomes in pregnancy, respiratory-infectious-nutritional harms in childhood, anxiety and trauma in adolescence and young adulthood, occupational and livelihood stress in working age, and heat-related cognitive and emotional strain in older age.[36,59,60]

Climate change heightens women's mental health challenges and adverse maternal and newborn outcomes.[61] Pregnant women face higher risks of heat- and particulate-related morbidity, mortality, and pregnancy complications, and climate-related perinatal stress and trauma are tied to worse mental health in new mothers.[61]

Among children and adolescents, rising temperatures, pollution, and extreme weather amplify respiratory, neurological, and psychological issues.[62] Young people appear to bear a disproportionate psychological burden, including PTSD, depression, anxiety, climate distress, and impaired daily functioning.[60,63]

For working-age adults, occupation and livelihood mediate harms: vulnerable industries report increased depression, anxiety, psychological distress, and suicidality with heat and prolonged drought, especially in agricultural settings.[64] Older adults are identified as a high-risk group, especially for extreme heat and disaster-related mental health impacts.[37,65] Heatwaves are also associated with cognitive difficulty, anxiety, panic, and fear among older adults.[36]

Across all life stages, protective factors include social relations, family support, community cohesion, and access to green/blue spaces.[58,66]

Coping and resilience

In the literature, emotional regulation and coping are framed as social, cultural, and educational resources that shape how people psychologically adapt to climate and environmental stressors.

Among youth, key protective factors after climate-related events include coping strategies, parenting style, social support, community connection, and cultural identity.[60] Social connectedness and community wellbeing also buffer distress among peri-urban farmers facing drought and workers in climate-vulnerable industries, demonstrating the importance of social capital and collective resilience.[52,64]

A framework for climate change education argues that promoting psychological resilience, social and emotional learning, and explicit discussion of emotions and coping strategies is essential to avoid harming young people's mental health; it highlights classroom practices that validate emotions, create spaces to process feelings, and equip students with constructive narratives and coping tools for an uncertain future.[67] The UK's recent Curriculum and Assessment Review recommended stronger climate education across the curriculum, to be embedded across key stages.[68]

The complex relationship between mental capital/wellbeing and climate and environmental change, including vulnerability and resilience loops, is summarised in Figure 2.

Climate and environmental change affect mental capital and wellbeing through multiple, interacting pathways and feedback loops

Impacts are shaped by life stage and other socio-demographic factors, producing unequal outcomes.

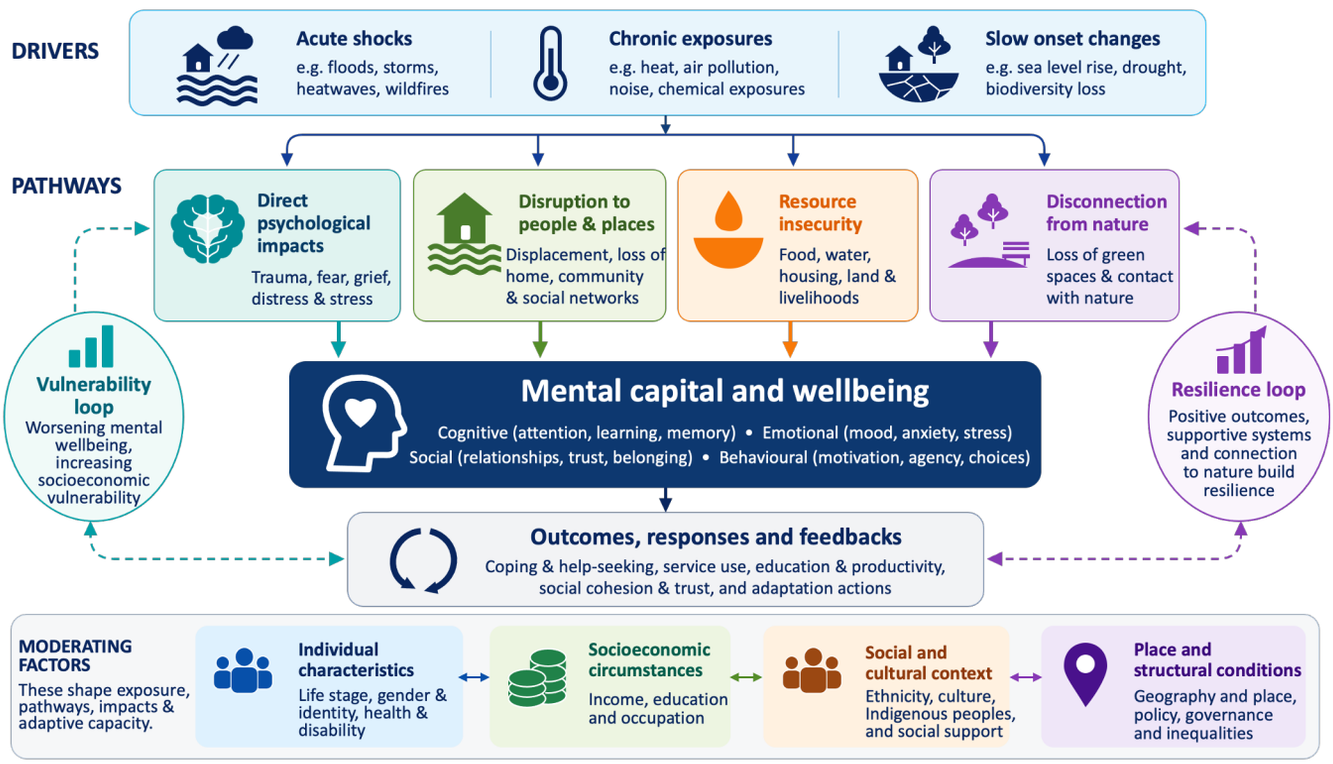


Figure 2: How mental capital and wellbeing intersect with environmental challenges.

Evidence gaps and implications for policy and research

Most evidence on mental capital and the environment is based on reviews, qualitative research, or cross-sectional studies, with little research explicitly examining mental capital as the central phenomenon – rather focusing on mental health/wellbeing and components of mental capital such as emotional regulation, coping strategies, etc. Further UK-based research (particularly in areas vulnerable to climate change and environmental contaminants) is needed, alongside longitudinal evaluations of nature-based interventions to inform long-term policy.

Forgotten ecosystems

RQ3. How do forgotten ecosystems contribute to mental capital?

Green and blue spaces, including parks, woodlands, and lakes, are associated with reduced depression, anxiety, loneliness, and fatigue, alongside improved quality of life, stronger social cohesion, and mitigation of environmental stressors such as air pollution, noise, heat, and flooding.[13] The WHO similarly concluded that green and blue spaces generally have positive associations with mental health, though more evidence is needed on design features and causal mechanisms.[25]

Access and proximity are important. For mental capital and societal resilience, the issue is not only whether green and blue space exists, but whether people have everyday access to restorative environments close to where they live, learn, work, and receive care. These spaces can support stress recovery, attention restoration, emotional regulation, physical activity, social interaction, and environmental quality. They may also shape wider resilience capacities, including adaptive capacity, community preparedness, social cohesion, trust, service industry demand, and recovery from shocks.

Applying the resilience framing means asking: resilience of what, to what, for whom, over what timescale, and for what purpose. In this context, the focus is the resilience of people and communities to environmental shocks and chronic stressors, particularly where everyday exposure to nearby nature supports stress recovery, attention restoration, emotional regulation, social connection, and adaptive capacity over time.

Most green space research focuses on formally recognised spaces and culturally valued habitats such as parks, gardens, woodlands, and rivers. However, people also benefit from the wider network of informal green and blue spaces in their neighbourhood, such as verges, hedgerows, individual trees, scrubland, and small patches of grassland, woodland or wetland that do not meet the criteria to be mapped as 'priority habitats' (and thus do not receive protection in the planning system). These 'forgotten ecosystems' are often overlooked or undervalued, yet play a critical role in ecosystem functioning and human wellbeing, and help to define the character and 'sense of place' of an area.

Some of these spaces, such as scrubland, brownfield mosaics, unmown verges, and urban edge spaces are typically viewed as untidy, transitional and neglected, and thus targeted for development or intensive management, rather than being recognised for their biodiversity value and for allowing people to connect with nature near to where they live.[15,69] For example, scrubland is rich in berries, nectar and shelter; dead wood offers nesting sites for birds, bats and insects; and tall grass and wildflowers (often seen as 'weeds') provide flowers and hibernation sites for pollinators and pest predators that help to sustain the entire ecosystem.[70]

Other ecosystems remain largely invisible because they exist below ground or at microscopic scales, including soils, fungi, bacteria, insects, moths, beetles, flies, and decomposers that sustain flowers, trees, birds, and healthy landscapes.[71,72] Historical land-use change has also contributed to ecological loss, with over 97% of UK wildflower meadows disappearing since the 1930s through agricultural intensification and development.[73] Similarly, brownfield habitats are typically dismissed as degraded land despite often supporting rare species and diverse early-successional ecosystems.[74] Recent research suggests neglected urban spaces, lost wetlands, and underused green areas could be restored to improve ecosystem functioning, resilience, and human relationships with nature.[75]

Invisible ecosystem contributions

An "invisible ecosystem" should be understood through a systems perspective linking ecological processes to mental wellbeing and mental capital. People tend to experience nature through visible and sensory qualities such as birdsong, flowers, fruit, trees, shade, seasonal change, water, and biodiverse landscapes. However, these experiences depend on ecological processes that are often hidden from view, including pollination, nutrient cycling, decomposition, soil formation, fungal networks, microbial activity, and invertebrate food webs.[69,76] These systems underpin the environmental qualities that people perceive as restorative, calming, beautiful, or emotionally meaningful. Despite this importance, conservation research and policy are strongly biased toward charismatic and visible species. Studies show that societal preferences shape biodiversity data collection and conservation attention, meaning insects, soils, fungi, and decomposer systems are frequently under-researched, under-monitored, and undervalued.[77-79]

Insects provide a particularly important UK example. The House of Commons Science, Innovation and Technology Committee identified insect decline as a major risk to food security and ecosystem functioning because insects support pollination, pest control, nutrient cycling, and wider food webs.[80] Insect populations are threatened by habitat loss, fragmentation, pesticides, climate change, invasive species, disease, agricultural intensification, and light pollution. Beyond ecological functioning, insects also provide cultural ecosystem contributions through education, recreation, symbolism, art, and spiritual meaning.[69] Their importance to mental capital is therefore indirect but substantial: insects sustain the flowers, fruit, gardens, orchards, birds, and biodiverse landscapes that people experience as emotionally restorative and cognitively beneficial. Healthy ecosystems all depend on functioning soil and invertebrate systems, even if the ecological work remains largely invisible to everyday observers.

Soil biodiversity is another foundational example. Soil organisms support plant growth, water infiltration, carbon storage, nutrient cycling, food production, and ecological resilience. Recent work argues that soil biodiversity contributes to human wellbeing through provisioning, regulating, and cultural ecosystem contributions while remaining comparatively neglected in policy and public awareness.[70] Healthy soils sustain the visible features people value above ground, including trees, flowers, food production, biodiversity, shade, and water regulation. When soils are compacted, contaminated, sealed, or biologically depleted, landscapes become less capable of supporting the sensory richness and ecological functioning associated with restorative environments. Although the current evidence does not yet demonstrate a direct causal link between soil biodiversity and mental capital, this does not make soils irrelevant to mental capital. Rather, healthy soils should be understood as part of the ecological foundation that enables biodiverse, restorative green spaces to provide wellbeing benefits. Emerging microbiome research on early childhood environments suggests a pathway can be designed to support health and wellbeing by increasing interactions with environmental microbiota.[81] The stronger systems-level conclusion is that soil and insect biodiversity sustain the ecological conditions through which many mental health and wellbeing benefits are generated.

Other reviews reinforce these findings while emphasising complexity. Research suggests that quality-related characteristics such as safety, biodiversity, accessibility, maintenance, and amenities influence the mental health value of green spaces.[82,83] The pathways connecting nature and mental capital include stress reduction, attention restoration, emotional regulation, physical activity, social interaction, improved sleep, concentration, and strengthened place attachment.[84] Biodiversity quality also appears important, though evidence is limited. Species diversity, particularly birds and trees, may be associated with improved self-reported wellbeing, but context and mechanisms remain under investigation.[85] This has practical implications for "forgotten" ecosystems such as flowering verges, hedgerows, orchards, wetlands, scrubland, ponds, and brownfield mosaics, which may provide richer sensory and ecological experiences than highly managed, simplified landscapes.



Birdsong offers one example of how ecological systems become psychologically meaningful. Studies show that hearing or seeing birds is associated with improved mental wellbeing, while listening to birdsong can reduce anxiety and paranoia compared with traffic noise.[86,87] These findings should not be interpreted simplistically, as birdsong is not a universal treatment for mental distress, but they do suggest that natural soundscapes contribute to emotional regulation and attention restoration when combined with safe, biodiverse, and accessible environments. Birdsong itself depends on multiple ecological layers working together: hedgerows, scrub, woodland edges, wetlands, orchards, flower-rich margins, healthy soils, and insect populations all support bird habitats and food webs.[69,88] Accessibility research also highlights the importance of sensory design for blind and partially sighted people. Birdsong, running water, textured planting, scented vegetation, tactile cues, and safe pathways can improve orientation, confidence, and inclusion within green and blue spaces.[89]

Blue spaces function through similar sensory and restorative pathways. Reviews suggest that blue spaces can support health and wellbeing through restoration, physical activity, social interaction, and improved environmental quality, although the strength of evidence varies by setting and study design.[25,90] In planning and public health literature, blue-green infrastructure such as ponds, wetlands, canals, streams, rain gardens, swales, and sustainable drainage systems is also recognised for its wider environmental functions, including biodiversity support, flood management, cooling, air-quality benefits, and recreation.[13,91] These functions matter for mental capital because they shape everyday exposure to stressors and restorative environments; water can provide movement, sound, reflection, cooling, and sensory interest in everyday environments. Features such as wetlands in housing estates, rain gardens near hospitals, or swales around schools should therefore be understood as potential multi-benefit infrastructure, where good design and maintenance can combine climate adaptation, biodiversity, accessibility, and flourishing daily experiences. Overall, the literature suggests that biodiverse green and blue spaces, and the less visible ecological systems that sustain them, can contribute to the environmental conditions that support wellbeing, social connection, and adaptive capacity.[13,35,82,84]



Policy recommendations

Mental capital as resilience infrastructure

The practical implication from this evidence synthesis is that government should consider mental capital across policies, plans, projects, and programmes, from early appraisal and design through to delivery and evaluation. This includes planning policy and spatial strategies, such as Local Plans, Neighbourhood Plans, and Spatial Development Strategies, as well as infrastructure and capital projects, housing and regeneration schemes, transport and flood resilience programmes, nature recovery plans, public service design, and education, outreach, or community preparedness programmes. These decisions shape the conditions that affect people's ability to cope, understand risk, trust institutions, and adapt. The need to enhance mental capital should be considered early in project or programme design, alongside existing climate, biodiversity, health, and equity considerations.

The government should embed mental capital and societal resilience into existing project or programme appraisal and delivery, rather than creating a new framework. This could be done through a simple lens within Green Book and business case guidance for projects and programmes, equity analysis, health impact assessment, climate risk assessment, local resilience planning, and post-project evaluation. The key question should be whether a programme or project leaves people and their surrounding environments able to cope, connect, learn, and adapt under disruption. In practice, this means assessing whether projects reduce avoidable stress, improve access to trusted information, strengthen local trust and participation, support economic security, reduce unequal exposure to harm, and build skills or confidence.

Education should be treated as a core resilience enabler, through risk literacy, climate literacy, mental health literacy, green skills, community preparedness, citizen science, and trusted local communication. This aligns with the UK Government response to the Curriculum and Assessment Review, which supports introducing citizenship education in primary schools and strengthening learning on access to civic engagement; arts and culture; nature, outdoor and adventure; sport and physical activities; and developing wider life skills.[92]

Projects should also be designed to strengthen multiple forms of capital at once: for example, housing energy retrofit can reduce bills and emissions while improving comfort, skills, and trust in delivery; green infrastructure can support biodiversity, flood resilience, wellbeing, and social connection. To avoid shifting responsibility onto individuals, the purpose of this approach should be to reduce preventable harms and improve the conditions that make resilience possible.

A practical next step would be to pilot a mental capital or societal resilience guidance framework in project or programme design for flood adaptation, housing retrofit, green infrastructure, transport redesign, or a regeneration project, and evaluate whether it improves project design, public trust, distributional outcomes, and lived resilience after delivery.

Prioritise preparedness over crisis response

The government should shift more resilience and mental capital investment upstream, focusing on prevention rather than relying mainly on crisis response (Figure 3). Many of the factors that determine whether people cope during disruption are shaped long before a shock occurs: housing quality, health, income security, education, access to nature, trust in institutions, local relationships, and service capacity. Investing in these foundations can reduce the severity and duration of future crises (Figure 3) by lowering overall demand on critical systems before they are under stress. This means treating mental health support, community infrastructure, green and blue space, green skills programmes, housing retrofit, and trusted public communication as preventive resilience measures, rather than discretionary social spending. Shifting to sustainable lower-consumption pathways can also help to reduce the risk of environmental and economic shocks.[93]

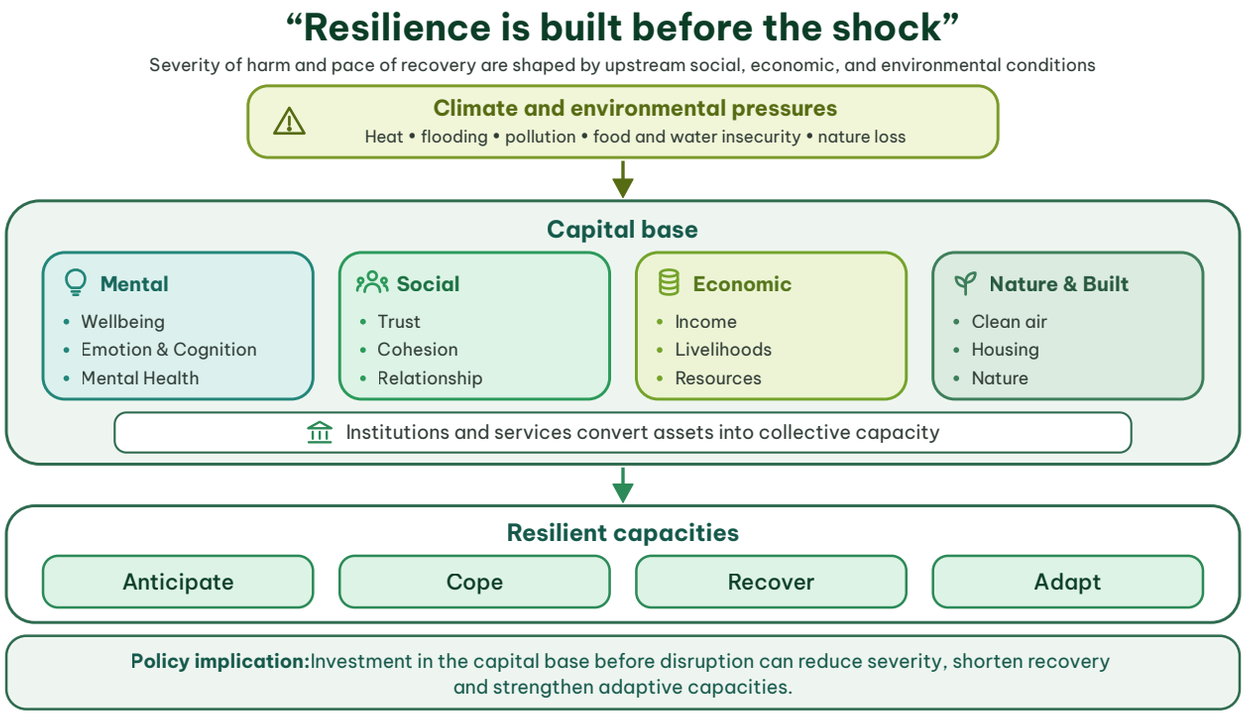


Figure 3. The capital base (mental, social, economic, natural and built) determines a society's capacity to anticipate, cope, recover, and adapt. Building it before disruption reduces severity and shortens recovery.

Make resilience explicitly distributional

Resilience policy should include a clear distributional test: who is protected, who remains exposed, who pays, and who has the capacity to recover. Shocks are rarely experienced equally, and policies that improve aggregate resilience can still leave some groups worse off or less able to adapt. A distributional lens would help avoid resilience strategies that protect assets while neglecting people, or that improve national indicators while deepening local inequality. This is especially important for climate adaptation, housing, energy, transport, and regeneration policies, where costs and benefits can fall unevenly across income, geography, age, disability, race, and health status.

A practical next step would be to pilot this approach in a small number of place-based programmes, such as flood adaptation, housing retrofit, green infrastructure, transport redesign, regeneration, or community resilience planning. These pilots could test whether a mental capital and societal resilience lens improves project design, public trust, distributional outcomes, and lived resilience after delivery.

Enhance the societal resilience value of forgotten ecosystems

One option for identifying, creating, and maintaining mental capital infrastructure would be to apply a 'net gain' approach, in the same way as Biodiversity Net Gain (BNG) policy is intended to incentivise retention, creation and maintenance of ecological infrastructure that does not have a market value. In other words, investment in the built and natural environment should leave communities measurably better able to think, adapt, and cope, as well as delivering net benefits for biodiversity.

This matters for national security because resilience depends not only on physical protection, but whether people trust institutions, cooperate during disruption, and feel that public investment is fair and protective. If environmental investments are visible, fairly distributed, well-maintained, and shaped with local communities, they may also strengthen trust, social cohesion, and confidence in public institutions. At the same time, they can reduce avoidable stressors such as heat, flooding, noise, pollution, isolation, and poor access to nature, lowering pressure on services before crises occur.

A practical next step would be to pilot a light-touch Mental Capital and Resilience Net Gain lens alongside planning policies, such as BNG, Local Nature Recovery Strategies, green infrastructure planning, health impact assessment, and local resilience planning. For projects involving forgotten ecosystems, this lens would ask whether the intervention improves access to restorative environments, reduces avoidable stressors such as heat, flooding, noise, or pollution, strengthens community stewardship, and builds understanding of local ecological value. This should not collapse mental, social, and cultural value into a biodiversity score; it should sit beside ecological assessment as a complementary measure of societal resilience. It can also incorporate elements of existing policies, indicators and guidance such as Natural England's Green Infrastructure Standards, which include targets on accessibility.

This would also help address the literacy gap around forgotten ecosystems. Interpretation, signage, citizen science, school partnerships, community stewardship, and local monitoring can help people understand how these features support insects, birdsong, flowers, water regulation, wellbeing, and resilience. The policy aim is to move from one-off habitat creation to long-term care that protects biodiversity while improving wellbeing.

Table 1: Quick wins and longer-term policy options for embedding mental capital, nature, and environmental wellbeing across government strategy and delivery.

Short-term recommendations

Recommendations	Lead departments/ actors*	Time-frame	Evidence confidence	Implementation complexity	Key dependencies/ trade-offs
Integrate mental health and wellbeing into climate adaptation plans	Defra	Short-term	Established	Low	Political will to expand adaptation scope beyond physical risk; DHSC and NHS cross-departmental sign-off; HM Treasury appraisal alignment
Include wellbeing in climate and environmental appraisal	Defra	Short-term	Established	Low	HM Treasury Green Book revision/ endorsement; analytical capacity in departments; consistency with existing WELLBY valuation framework
Make food insecurity a recognised mental health risk signal	Defra, DHSC	Short-term	Established	Low	DWP and DHSC buy-in; data sharing across departments; political sensitivity around poverty framing
Identify early warning signals for population-level mental capital decline (e.g., food insecurity)	Defra, DHSC, ONS, etc	Short-term	Established	Medium	Cross-departmental data-sharing agreements; ONS indicator framework alignment; resource for surveillance infrastructure
Embed nature in local mental health delivery through existing structures (e.g., GSP)	DHSC, NHS	Short-term	Emerging	Medium	Sustained cross-departmental funding beyond pilot phase; NHS and ICS capacity; local authority engagement; evidence base still emerging

Recommendations	Lead departments/ actors*	Time-frame	Evidence confidence	Implementation complexity	Key dependencies/ trade-offs
Use trusted local institutions to reach vulnerable communities	Ministry of Housing, Communities & Local Government (MHCLG), DHSC; local authorities; voluntary and community sector	Short-term	Developing	Medium	Community sector funding stability; local authority capacity; data governance for targeting; equalities considerations
Fund evaluated community and psychosocial interventions focused on climate preparedness	DHSC, Defra, NHS, etc	Short-term	Developing	Medium	Evaluation infrastructure funding; intervention standardisation; competition with acute NHS spending priorities
Target vulnerable groups and their environmental, community contexts and infrastructure to increase resilience	DHSC, DfE, DWP, MHCLG, etc	Short-term	Developing	Medium	Equity of geographic reach; joined-up data on vulnerability; cross-departmental resource allocation; risk of siloed delivery

Long-term recommendations

Recommendations	Lead departments/ actors*	Time-frame	Evidence confidence	Implementation complexity	Key dependencies/ trade-offs
Develop a national mental capital and environmental security framework (linking mental, natural, human, and social capital in national risk and resilience planning)	Defra	Long-term	Developing	Medium	PM/Cabinet Office sponsorship; cross-departmental consensus on scope; HM Treasury inclusion in national risk planning
Create a longitudinal environmental mental capital observatory	DHSC, Defra, ONS, NHS	Long-term	Developing	High	Long-term research funding commitment; data linkage governance; academic–government partnership model; infrastructure costs

Recommendations	Lead departments/ actors*	Time-frame	Evidence confidence	Implementation complexity	Key dependencies/ trade-offs
Establish a cross-government Mental Capital and Environment Unit	DHSC, Defra, MoD, DfE, etc	Long-term	Developing	High	Cabinet Office mandate and PM-level backing; departmental resource commitments; risk of marginalisation without statutory footing
Create a cross-government evidence lane on toxins and mental capital (covering pollution and neurodevelopment, cognition, learning, and productivity)	UKHSA, Environment Agency, Defra	Long-term	Established	High	Industry pushback (chemical, water, food sectors); regulatory coordination with Environment Agency; international evidence alignment
Build an environmental mental health risk dashboard and register (possibly in collaboration with the ONS)	ONS, Defra, Environment Agency	Long-term	Established	Medium	Data interoperability across agencies; sustained resourcing for maintenance; agreement on core indicators; public communication strategy
Extend the role of Nature Recovery to include mental health resilience infrastructure	Defra, NHS England, Natural England; MHCLG	Long-term	Emerging	Medium	Integration into Local Nature Recovery Strategies; planning system alignment; NHS commissioning buy-in; land access and management costs
Include mental capital in cost-benefit analysis for major environmental and infrastructure decisions	HM Treasury, Defra; Cabinet Office; National Infrastructure and Service Transformation Authority (NISTA)	Long-term	Developing	Medium	Green Book revision process; analytical skills gap across government; industry resistance to monetising social/ mental costs; NICE/ WELLBY methodology consensus

Recommendations	Lead departments/ actors*	Time-frame	Evidence confidence	Implementation complexity	Key dependencies/ trade-offs
Create a mental capital test for environmental policy (ask major policies such as water, food, etc. to address societal resilience specifically)	Cabinet Office, Defra, DHSC; HM Treasury	Long-term	Established	High	Regulatory/policy gateway reform; departmental compliance burden; risk of box-ticking without enforcement; cross-departmental political agreement
Shift the policy frame from crisis response to prevention and long-term resilience	Cabinet Office, DHSC, HM Treasury; NHS England	Long-term	Established	Medium	Cross-spending-review budget reallocation; short electoral cycle incentives working against prevention framing; public and media framing
Develop demand management approaches as a preventive mental health frame	DHSC, NHS England, DWP; Cabinet Office	Long-term	Established	High	NHS provider and commissioner buy-in; workforce reorientation; risk of cost-cutting framing undermining public trust; evidence base for specific demand interventions
Build climate-ready mental health community services (linked to NHS structures)	DHSC, NHS England; Defra; MHCLG	Long-term	Developing	High	NHS capital and workforce capacity; ICS-level implementation variability; long funding lead times; integration with wider climate adaptation strategy

*With cross-appointed scientific advisors recommended to work the respective departments.
Abbreviations: Defra = Department for Environment, Food & Rural Affairs; DHSC = Department of Health and Social Care; DfE = Department for Education; DWP = Department for Work and Pensions; MoD = Ministry of Defence; UKHSA = UK Health Security Agency; ONS = Office for National Statistics; MHCLG = Ministry of Housing, Communities and Local Government; NISTA = National Infrastructure and Service Transformation Authority; ICS = Integrated Care System; GSP = Green Social Prescribing; WELLBY = Wellbeing-adjusted life year; NICE = National Institute for Health and Care Excellence.

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Glossary

Term	Definition
Economic capital	The material foundations of resilience (income, housing, savings, employment, infrastructure, and public services) that shape whether households and institutions can prepare for and recover from shocks.
Forgotten ecosystems	Ecologically valuable but culturally undervalued or overlooked environments, such as scrub, hedgerows, verges, brownfield mosaics, and urban-edge spaces, together with the soils and invertebrates that sustain them, that support both ecosystem functioning and everyday wellbeing.
Mental capital	The cognitive and emotional resources people draw on to learn, reason, cope with stress, maintain relationships, and participate in society.
Mental distress	Used here for significant psychological strain below a clinical threshold, such as eco-anxiety, stress, or low mood.
Mental health	Used here for clinically significant outcomes, such as diagnosable depression, anxiety, or PTSD.
Mental wealth	The aggregate value of mental capital across a population, treated as a national asset whose protection and growth carries economic and welfare benefits.
Social capital	The relational foundations of resilience: the trust, networks, belonging, and cooperation that enable communities to act together.
Societal resilience	The collective capacity of people, communities, institutions, and systems to anticipate, withstand, and recover from acute shocks, and to adapt or transform under chronic stresses, while protecting wellbeing, cooperation, legitimacy, and future adaptive capacity.
The three capitals	The human-facing foundations of societal resilience: mental, social, and economic capital, through which resilience is experienced and enacted.
Wellbeing	A broader, holistic concept describing how people feel about and function in their lives, spanning subjective life satisfaction, psychological functioning, and objective living conditions.

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UKRI Natural Environment Research Council

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