Policy Briefing

Nature-Based Solutions:
Achieving net zero, a just transition and improved wellbeing

Scottish Wildlife Trust

July 2020

Restoring nature is essential to tackling climate breakdown, reversing the decline in biodiversity and realising a green and transformative economic recovery in Scotland. Restoring nature should be people-led, place-appropriate and help tackle environmental injustices.

Nature-Based Solutions: Achieving net zero, a just transition and improved wellbeing

- Nature based solutions must be at the heart of a more coherent approach to government policy that joins up climate change, biodiversity, infrastructure, planning, land use, marine and economic strategies. Our actions in 2020 will set the course for the next 25 years.

- The Scottish Government, local councils, and civil society should take a joined-up approach in realising the social, climate, and ecological needs of restoring nature, especially in securing economic recovery from COVID-19.

- The evidence[1] is clear: "Only immediate transformation of global business-as-usual economies and operations will sustain nature as we know it, and us, into the future".

- It is possible, necessary, and desirable to *both* eliminate fossil fuel dependence in the economy *and* initiate large-scale restoration of nature, focused on the needs and wellbeing of people. Restoration, however, must not justify existing unsustainable practices.

- Nature-based solutions should adhere to five principles of: *Additionality; Place-appropriateness; Justness; Connectivity;* and *Knowledge sharing.*

- Our climate change plans must have nature-based solutions at the centre as they can enable mitigation, resilience, adaptation, and positive social change. They have unique advantages in terms of adaption as they do not require extreme climate trigger events to realise the many benefits of the ecosystem services they provide.

- In Scotland, nature-based solutions include expanding and restoring native woodlands, peatland restoration, rethinking urban design, enhancing the health of our marine environment, and new approaches to agriculture.

- Marine and urban carbon stores have significant potential for storing carbon and involving communities. The approach to natural urban regeneration must be sensitive to local understandings of place and avoid marginalising residents[2]. For many marine environments, restoration can only be achieved by removing pressures to allow natural habitat recovery.

- Peatlands store around 140-160 years' worth of Scotland's annual emissions and policy must focus on their restoration and management but also preventing damaging extraction.

- Evidence shows commercial softwood plantations do not offer the same carbon, biodiversity, or resilience benefits as diverse, native woodland and the *Big Climate Conversation* showed people strongly support permanently reforested native species.

- Agricultural land management also has a significant role to play by increasing natural carbon sinks, such as agroforestry, and improving sustainable farming methods, such as conservation agriculture and organic farming.

- Greater access to nature and urban transformations have been shown to be necessary *precursors* to positive environmental, health and wellbeing behavioural changes.

- The *Place Principle*[3] should help define the approach. Place-based natural solutions ensure communities and residents are central to decision-making.

- As the Scottish Government plans to move towards a wellbeing economy, it is paramount that nature, placemaking, sustainability and environmental justice are prioritised.

- New funding will be required to deliver the necessary scale of nature-based solutions, and this can be achieved by making better use of existing government funding and developing new innovative ways of finance, such as those set out in the Route Map to £1bn.

The approach

The IUCN [defines](#) nature-based solutions as "actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits".

Restoring and protecting nature, and re-centring it in our lives and livelihoods, must play a significant role as part of the wider [transformation necessary](#)[4] to tackle climate breakdown and the [sixth mass extinction](#)[5]. The need to rethink how we use land and how we plan is not new. However, the COVID-19 pandemic means we must start to reimagine and rethink everything, including the design of our cities, the purposes of our economy, what we value most, and what the crisis has further revealed about social and environmental injustices.

We must also recognise how interconnected these crises are. The United Nations and World Health Organisation have [already warned](#)[6] that coronavirus pandemics result from the destruction of nature. who Scientists conducted the largest [study](#)[7] to date on the global decline of nature have warned that we "must save lives, protect livelihoods, and safeguard nature to reduce the risk of future pandemics". Restoring nature and tackling climate breakdown need to lay at the heart of a just, [green recovery](#).

It is necessary to be able to determine nature restoration and real climate action from practices that undermine them both. Here, we set out a series of principles and briefly discuss the main areas where authentic nature-based solutions can contribute to this transformation. In doing so, we seek to centre people's and communities' needs while emphasising the need for a [Just Transition](#)[i] and a wellbeing economy to help confront the systemic drivers of climate breakdown, the sixth mass extinction, and alienation from nature.

A place-based approach reflects the fact that in local implementation, the way we make sense of land-use change is a social process, for example how we understand and communicate its benefits, and how we re-imagine and use urban green infrastructure. Ecologically, place-appropriate restoration will take account of local sensitivities, such as the needs to protect and restore peatlands and allow woodland to regenerate.

In 2019, the Scottish Government announced a 'net-zero' emissions target for 2045, based on advice from the UK Committee on Climate Change (CCC). In theory, net-zero means Scotland's remaining emissions from domestic sources (i.e. not including embedded emissions in imports) will be sequestered by natural or technical means. It is essential that 'net-zero' be interpreted strictly: no emissions should remain as a result of fossil fuels, and we must not rely on unproven technical or market fixes. This must be done as part of a Just Transition while restoring nature to re-balance the natural carbon flux between the atmosphere and other earth systems.

Nature-based solutions must be at the heart of a more coherent approach to government policy that joins up the Climate Change Plan, Biodiversity Strategy, Infrastructure Investment Plan, National Planning Framework 4, Land Use Strategy, Regional Land Use Partnerships, National/Regional Marine Plans and Economic Strategy.

---

[i] The [Climate Justice Alliance](#) defines a *Just Transition* as "a host of strategies to transition whole communities to build thriving economies that provide dignified, productive and ecologically sustainable livelihoods; democratic governance and ecological resilience." The Scottish Government's [Just Transition Commission](#) advises on the application of the International Labour Organization's [principles](#) for a Just Transition.

Principles

To inform this approach the Trust advocates five core principles that should lie at heart of nature-based solutions:

1. **Additional –** Nature restoration must be *in addition to* radical decarbonisation and emergency climate action across every sector. It must be in addition to tackling systemic conditions that ultimately cause and/or worsen social and environmental crises. No amount of nature-based solutions can replace the necessary systemic changes to the economy: what we value, what we consume and produce, how needs are met, how we move around, and how these things are distributed in society. Similarly, greenhouse gas sequestration and storage cannot be the only measure of value or success – nature is far more than its ability or inability to store carbon.

2. **Place-appropriate –** *Place* is a combination of a physical space and the social context, or how we apply meaning to particular spaces. This process of meaning-making and placemaking is ongoing and remade over time. Place-appropriate projects are led by residents, communities of space (who relate to the project on geographic level), and communities of practice (who relate to the project through shared interests, practices, and knowledges). This aims to maximise knowledge and values sharing and participative governance, where diverse stakeholders have a say in decision-making. Ecologically, place appropriateness includes an analysis of the suitability of species and habitats to a particular area, taking account of both naturalness and relevant physical geography.

3. **Just –** Environmental justice takes account of the distribution of environmental benefits and burdens in society, such as access to nature, as well as the potential for environmental policy to tackle social inequalities. For example, access to nature is impacted by the availability of leisure time, closeness to greenspace, and often gendered impacts, such as safety of access routes. Realising a green recovery from the COVID-19 in Scotland must a secure a Just Transition to help reverse inequalities. This should be factored into all stages of natural solutions, including financing, design, and implementation. Urban natural solutions must combat the potential for green urban development to displace and/or marginalise residents (green gentrification).

4. **Reconnecting –** Nature in Scotland is fragmented, and we are frequently disconnected and alienated from it, which also falls unequally across society. When species and ecosystems are forced to exist in isolated pockets, they are significantly less resilient to shocks, such as from climate change, and often exhibit poorer genetic diversity, increasing the population's susceptibility to rising problems such as disease. Crucial needs provided by nature, such as pollination in food production, are hampered by fragmentation. Nature-based solutions therefore must help reconnect people to nature, including through the process of community-based action, and help establish corridors and connections for nature to pass through the landscape and increase nature's resilience.

5. **Sharing knowledge –** There remain gaps in our collective understanding of nature-based solutions, including scientific knowledge – despite this, there is sufficient evidence to show the urgency, scale, and needs of restoring nature. The connections between local expertise, experiences, and needs and wider policymaking and coordination are often weak. NBS projects should aim to foster a collaborative, sharing, and supportive network both to maximise local benefits and to realise landscape-scale ecosystem benefits. We must learn from experiences and share our findings across regions and projects.

Responding to the climate emergency

Unique advantages

Done sensitively and appropriately, [the restoration of nature can increase the natural stores of greenhouse gas emissions][8], primarily in peatlands and soils, with additional benefits from sensitively restored and regenerated biodiverse woodlands, urban trees, and other urban measures. By avoiding impacts and restoring seabed ecosystems, the colossal store of carbon in the marine environment can expand naturally. The approach can help bridge connections between biodiversity, climate action, and community engagement. In urban areas, this includes trees and other green infrastructure, with a focus on proactively engaging local residents and communities of space. Natural climate solutions are already set to be discussed at the United Nations biodiversity talks, UN COP15, with the host country, China, saying a new deal must include natural climate solutions[9].

Nature-based solution also have unique advantages with respect to [climate change adaptation][10]. For example, investing in artificial flood defences such as bridge or sea wall improvements require a financial outlay, the benefits of which do not materialise unless an extreme flood event occurs. In contrast, the benefits of nature-based solutions investment are that they do not require an adverse climate change or extreme weather impact to yield benefits. They deliver a range of ecosystem goods and services - such as cleaner air, water and the food we eat - on which we all depend for survival and economic activity. As a result, "a shrewd adaptation policy is one that renders benefits irrespective of whether or not there is a trigger event. In so-doing, the ongoing benefits could 'pay' for the adaptation measures."

Committee on Climate Change advice to Scotland

As the CCC, in [advice][11] to the Scottish Government, points out, the 'importance of urban greenspace to people has been highlighted by the COVID-19 crisis, but is in decline both in area and quality', while Scotland should 'lead the UK in delivering transformational land reform'. The advice makes clear that tree planting, peatland restoration and green infrastructure 'can deliver significant benefits for the climate, biodiversity, air quality and flood prevention' while better preparing our environment for future climate change'. We urge this advice be taken, whilst highlighting that natural regeneration of woodland and better protection for what remains of our ancient trees and woods are expanded and deepened.

The CCC [2019 Scotland report][12] also notes our collective actions during 2020 will impact the next 25 years. This must be a time of action. While COVID-19 has severely disrupted this, it has also reconfirmed and amplified the need for large-scale changes. As has been [highlighted] by IPBES scientists and others, "Only immediate transformation of global business-as-usual economies and operations will sustain nature as we know it, and us, into the future".[13] As we delay this transformation, the changes necessary will have to occur within an ever-narrower timeframe. We must begin these systemic actions now in order to ensure people and nature are not left behind.

The Trust believes this requires a coordinated, ambitious, and rapid transition in which nature's decline and climate breakdown are tackled and reversed. In the context of a green recovery from COVID-19, this requires an emergency response across every sector, with nature-based solutions providing significant contributions to a broader Just Transition. Whilst ambitious, the approach is people-centred and evidence-based. For instance, [scientists and conservationists have shown] that:

> As more and more carbon dioxide is emitted into the atmosphere, humans and the natural world are beset by the damaging consequences of a rapidly changing climate. **Natural and seminatural**

ecosystems are likely to be the best starting place for immediate adaptation and mitigation solutions. First, though, many natural environments need restoration to maximize their own resilience to climate change.[14]

Offsetting caution

Crucially, it is necessary to *both* eliminate fossil fuel dependence in the economy *and* initiate large-scale restoration of nature. An article in Global Change Biology on the issue concludes that 'both can and must be done in the coming decades to avoid greater costs to society posed by climate change'. In addition to ethical debates, it has been pointed out that the "promise of offsetting triggers a rebound away from meaningful mitigation and towards the development of further high-carbon infrastructures". Therefore, "net-zero" should not mean "offsetting" avoidable carbon emissions by paying for nature restoration.

It is therefore necessary that nature-based solutions and nature recovery generally are not used to justify continued fossil fuel use and further greenhouse gas emissions.

The CCC Land Use Report similarly concludes that:

> It would be important to ensure that carbon-credits from land-based solutions are not allowed to reduce effort elsewhere in the economy … they should not be used to offset emissions that need to fall close to zero to meet net-zero across the economy [p.98].

Some land uses, for example in agriculture (including meat-free, arable uses), incur inherent emissions as a result of land management. Ecosystems have a natural flux of emitting and storing carbon/carbon dioxide and methane, which human activity can unbalance leading to anthropogenic emissions. These residual emissions should be tackled by increasing the ability for ecosystems to sequester greenhouse gas emissions whilst reducing human impacts.

Nature-based contributions to climate action

Restoring nature alone will not solve climate breakdown, but it does provide essential contributions to mitigating and adapting to it, both for biodiversity and people. Anderson et al conclude that '[n]atural climate solutions (NCS) can be a substantial contributor, while also providing valuable co-benefits for people and ecosystems' but that 'the benefits of NCS do not decrease the imperative for mitigation from the energy and industrial sectors'. We outline how mitigation, resilience, adaption, and social goals can be (partly) delivered by pursuing place-based natural solutions.

Mitigation

This includes storing carbon and other greenhouse gas emissions as part of healthy ecosystems, encompassing urban forestry, woodlands, peatlands, and agricultural systems and practices. It has been estimated[15] that ~37% of near-term climate mitigation could be achieved 'through protection, improved management, and restoration of ecosystems, as we increase overall ambition'. Whilst this figure is a global aggregate, it indicates a substantial piece of the climate change puzzle that remains under-explored. In addition to pursuing decarbonisation across every sector, we need to restore natural carbon sinks and rebalance natural greenhouse gas flux.

Resilience

We distinguish resilience as the (ecological/social) system's ability to recover from shock, such as a severe weather event. For example, less resilient ecosystems may be pushed into an alternate state by severe flooding.[16]

Some features of healthy ecosystems can help minimise an area's or species' risk to environmental change. For example, greater genetic diversity in tree species can increase the population's resilience to new pests and diseases.

Adaptation

While resilience concerns a system's ability to recover (or the *response* to risk), adaption concerns *exposure* to risk, such as steps which may reduce the impact of a severe weather event, e.g. increased woodland cover reducing the impacts from flooding.

Our climate is already changing and set to continue to do so even under ambitious pathways of emissions reductions. We need to build climate adaptation into town, city, and rural planning. For instance, more trees in urban areas help reduce the overall temperature (mitigating against the 'heat island' effect, which is set to worsen) in cities while providing shade and mitigation against city pollution, as well as refuge and food for birds, and corridors for other species. Trees also provide this service elsewhere – riparian woodlands help shade rivers, while agroforestry provides shade for livestock and wildlife.

Participation

Evidence shows that appropriate infrastructure and more green spaces enable people to adopt lifestyle changes with beneficial environmental outcomes, such as replacing vehicle use with walking and cycling. It is important to recognise the wider planning, infrastructure, and policy changes necessary beyond relying on the market to 'green' individual choices. Instilling a greater sense of stewardship and ownership over the local environment is thus a key nature-based solution in its own right. A place-based approach is essential for ensuring this is led by residents and communities of practice, that it is inclusive and deliberative, and that decision-making takes place as close to communities affected as possible. This allows people to take action without being understood only as consumers, but as political citizens with rights of participation and expression.

Nature-based solutions cannot offer complete solutions to the climate emergency, nor are they the only lens through which to view or value nature. Nevertheless, they remain an essential part of the picture. As with any policy, they are dependent on strong, well-funded institutions and other contextual enablers, such as advisory services, knowledge, and practice sharing, and join-up with other policies.

Nature-based solutions in Scotland
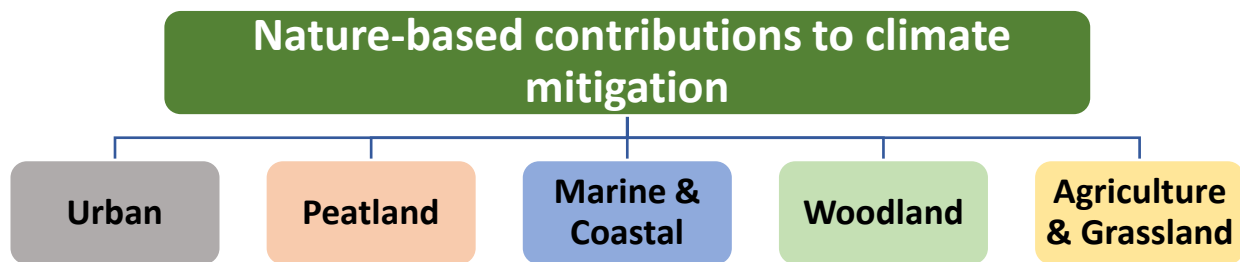
Whilst the following is not an exhaustive list of possible nature-based solutions, it captures the key categories and specific interventions likely to be of greatest carbon mitigation benefit when deployed in Scotland. This has been adapted from Griscom *et al* (2017). The Trust is working with partners to help fill in the knowledge gaps whilst advocating for greater policy and ecological coherence across these categories.
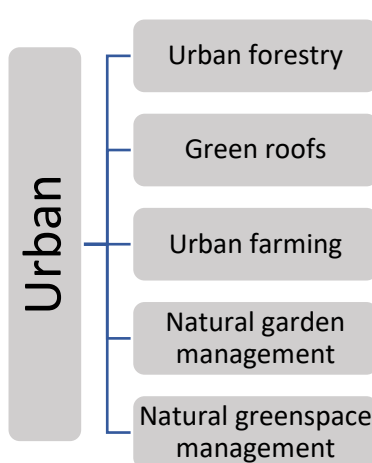
Urban

Greater access to nature and urban transformations have been shown[17] to lead to positive behavioural change, including for the environment, health, and wellbeing. A greater sense of stewardship and shared ownership of the local and global environment is itself part of the solution.
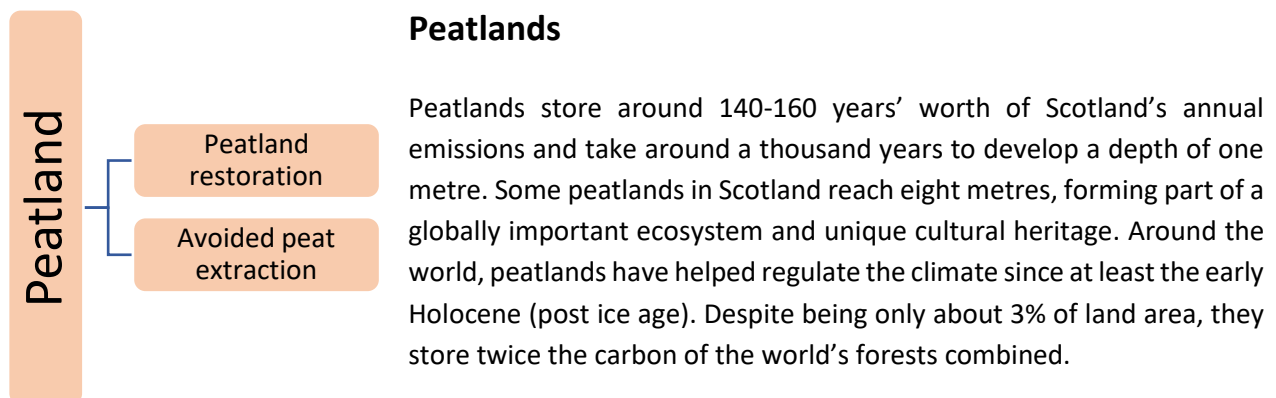
Urban natural climate solutions are often underacknowledged, likely due to knowledge gaps. However, increasing amounts of evidence are showing they are an essential part of the solution for climate mitigation and resilience, as well as making cities qualitatively better places to live for people and wildlife.

A LiDAR study[18] has shown that, area-for-area, UK urban forest can store as much carbon as tropical rainforest, while a separate study[19] showed significant urban socio-nature benefits from increases in city tree cover by 20%. Another 20-year study[20] showed the heat-island effect (which leads to cities frequently being warmer than surrounding areas and is set to worsen with climate change) was also mitigated in urban areas with more extensive green roof coverage. Increasing the quantity, quality, and connection of green spaces will help provide green corridors for people and wildlife, as well as aesthetic, health, and social benefits[21]. This should inform how we re-design and socially reproduce the city, especially in the wake of the COVID-19.

Research has shown that 'access to green space is associated with better health outcomes and income-related inequality in health is less pronounced where people have access to green space'. Meanwhile, the use of greenspace by people is highly circumstantial, with fewer opportunities for Black Asian and Minority Ethnic (BAME) people and for those from poorer backgrounds. For example, the MENE 2018-2019 survey showed that only 19% of BAME respondents strongly agreed that local greenspaces were 'within easy walking distance', while 33% of white respondents strongly agreed. Therefore, particular attention should be paid in those areas with historically lower rates of green infrastructure investment and a higher index

of multiple deprivation to help resolve inequalities in access to greenspaces and nature. This will also help deliver other needs, like health and wellbeing improvement, in the areas that need it the most.

These types of actions should be led by residents and communities of practice. The Trust advocates for a place-based approach to ensure communities, wellbeing economy principles, and inclusivity are at the heart of urban regeneration. Any approach to natural urban regeneration must also be sensitive to local understandings of place, as well as avoid [gentrification by greening](.)[22]. As investments are made in poorer communities, local authorities should ensure that these do not result in residents and local business owners being displaced by knock-on impacts in rent, housing, and land prices.

Peatlands

Peatland

- Peatland restoration
- Avoided peat extraction

Peatlands store around 140-160 years' worth of Scotland's annual emissions and take around a thousand years to develop a depth of one metre. Some peatlands in Scotland reach eight metres, forming part of a globally important ecosystem and unique cultural heritage. Around the world, peatlands have helped regulate the climate since at least the early Holocene (post ice age). Despite being only about 3% of land area, they store twice the carbon of the world's forests combined.

The CCC [Land Use Report](.) [23] notes that, taking account of **carbon sequestration alone**, the net present value of restoring upland peat is **£10,300 per hectare** and for lowland peat is **£9,800 per hectare**. This means that the value of carbon storage over time is around £10,000 per hectare *above* the initial investment. This is before benefits for nature and water quality are considered. Whilst it is important not to reduce nature to numbers, and we should not trade one for the other, this shows how essential peatlands are in the fight against climate change.

Despite this enormous role in sequestering greenhouse gases, a recent study by the James Hutton Institute and the Centre for Ecology and Hydrology confirmed that 'the current overall condition of our peatlands contributes to climate change' and that there is 'significant merit in further stepping up of peatland restoration efforts from a greenhouse gas mitigation perspective'[24].

Political will and investment for peatland restoration have increased in recent years, and the Scottish Government has set a target to restore 250,000 hectares of peatland by 2030. We welcome the spending commitment of £250 million for peatland restoration over 10 years. But contradiction in policy remains – **some areas have licences for peat extraction in place for decades yet**. Auchencorth Moss in Midlothian, for instance, has a licence secured until 2042 for peat extraction, which accounts for 20% of peat extraction emissions in Scotland with fears the local authority becomes liable for loss of income if the licence is revoked[25]. However, a new licence was approved in 2017 for extraction of millions of cubic metres[26].

While peatland restoration is vital, it is equally important to ensure that once restoration has taken place, protections and funding are in place to ensure they continue to function as essential habitats. We should not restore peatlands with one hand whilst extracting peat with another. Together with partners across the environment sector we call for the end of horticultural peat extraction.

Marine & Coastal

- Coastal restoration
- Avoided coastal impacts
- Avoided seabed impacts
- Kelp and seagrass resotration

Marine

Direct exploitation of marine organisms (particularly fish and shellfish), and changes in how we use the seas and coasts (e.g. for coastal development, offshore aquaculture, and bottom-trawling) have had a significant impact on marine environments across the globe. Meanwhile, climate change is intensifying the impact of other drivers (such as pollution, exploitation, changes in sea-use and invasive species), making the oceans less resilient to change overall[27].

The IPCC in 2019 concluded that 'coastal 'blue carbon' ecosystems' could

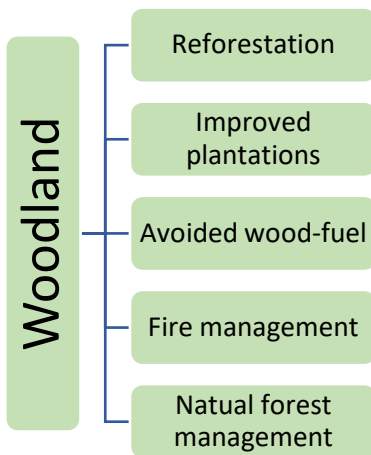'provide climate change mitigation through increased carbon uptake…these actions also have multiple other benefits, such as providing storm protection, improving water quality, and benefiting biodiversity and fisheries (high confidence).[28]

The marine environment in Scottish waters represents an essential carbon store, even greater than peatlands, and tackling drivers of change will be essential for maintaining and increasing this carbon store. **Scotland's marine sediments alone can capture the equivalent of around two-thirds of the nation's annual carbon emissions each year**. As the State of Nature Scotland report (p.16) states 'Protecting and enhancing blue carbon habitats will ensure these stores of carbon are protected, while at the same time enhancing their health'. In contrast, the role of marine ecosystems and the impact on marine carbon stores, such as the seabed and fish populations, are underrepresented in the existing Climate Change Plan.

Seagrass meadows play a vital role in supporting marine ecosystems and economy – they provide protection and nursery grounds for many species of fish and invertebrates (including many commercially important species), increase biodiversity, and stabilise marine sediments. Seagrass can also store 400kg of carbon per hectare, per year, making them essential for fighting climate change. Project Seagrass are working to map and monitor the health of existing seagrass meadows, and actively planting seagrass to restore lost meadows.

Oyster reefs can provide a number of services, from increased biodiversity, carbon sequestration, and water purification. Due to years of overfishing in the 19th and 20th centuries, oyster reefs in Scotland have largely disappeared, but partnership projects like the Dornoch Environmental Enhancement Project (DEEP) between Heriot Watt University, Marine Conservation Society and Glenmorangie are looking to restore these reefs and the many services they provide, including purifying the discharge from the Glenmorangie distillery.

For most marine environments, restoration can only be achieved by removing pressures and allowing the habitats and ecosystems to recover themselves. Therefore, Marine Protected Areas and, in particular fully protected areas (i.e. no extraction or disturbance), will play a vital role in enhancing the health of Scotland's seas and improving climate resilience. The Lamlash Bay No Take Zone (NTZ), off the south coast of Arran, is the only NTZ in Scotland. After 10 years of full protection, significant increases in the size, fertility and abundance of lobsters and scallops have been observed within the NTZ, and seabed biodiversity has increased by approximately 50%.

Woodland

- Reforestation
- Improved plantations
- Avoided wood-fuel
- Fire management
- Natual forest management

Woodlands

Woodlands and trees sequester and store carbon[29] while contributing to rejuvenating soils, which in turn sequester carbon and help alleviate flooding. In cities, over rivers, and throughout the landscape, their shade mitigates temperature increases[30] while greater connectedness lets species move more freely[31], building their resilience against ecosystem change.

At the moment, natural regeneration of woodland can be hampered by herbivore impacts. With the human-caused extinction of natural predators in Scotland, managing numbers of deer and sheep is essential to restore this balance, while long-term visions for wildlife in Scotland should incorporate the potential for returning this essential ecosystem function.

The CCC shows[32] how forestry expansion is essential to meet Scotland's greenhouse gas pollution goals, while the Land Use Report also outlined that:

> There are significant non-market benefits from planting woodland, including carbon sequestration, recreational opportunities, air quality improvements, public health benefits from additional physical activity and flood alleviation. [p.63]

Scotland's *Big Climate Conversation* showed that the public are particularly engaged in the restoration of nature, both for nature's sake and to tackle the climate. It showed that:

> Participants suggested that the Scottish Government should incentivise and encourage large landowners to **reforest land with native species**, ensuring this is **permanent reforestation**, not tree planting for the purpose of harvesting timber.
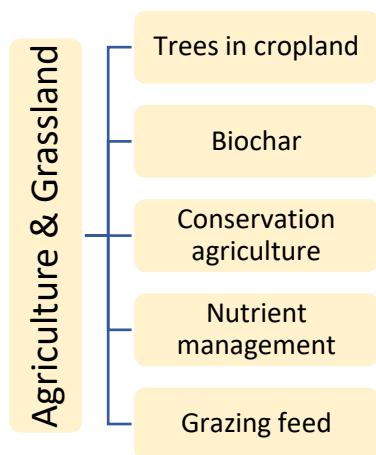
Moreover, it has been shown recently how a substantial amount of the carbon sequestered by plantation forestry is stored in harvested timber products with a short life-span. 23% is simply burned, while only around 18.5%[ii] has a service life of greater than 50 years. The remainder of the products, the majority, have a service life of 0-25 years, with uses such as pulp offering a maximum of 2 years. In failing to account for this short-lived storage, we risk measuring significantly more carbon sequestration than has actually occurred over time.

Native and permanent woodland is of clear public and community benefit, providing copious life-support systems for people, planet, and local economies, and as places of recreation. The CCC report backs this up, concluding that:

> Bringing neglected broadleaf woodland back into sustainable management that is compliant with the UK Forestry Standard delivers a wide range of benefits including increased carbon sequestration, and improved resilience to potential threats that may increase with a warmer climate (e.g. pests and diseases, wind and fire). [p.93]

[ii] Sawmills account for 56% of timber use, of which 33% is used in construction with a half-life of 70-100 years, though some estimates put this as low as 50 years. In comparison, CO_2 has a radiative forcing effect for centuries.

As such, their protection and enhancement represent incredible value for money. Access to woodlands, and nature more generally, can contribute to wellbeing and other health and recreational benefits[33], climate change mitigation, air pollution mitigation[34], adaptation, resilience, and biodiversity. We need to join up parts of government and local policy to ensure the full benefits of investment in woodland generation and regeneration are realised: from preventative health spend to flood mitigation to carbon emissions.

Agriculture and grasslands

Agriculture & Grassland
- Trees in cropland
- Biochar
- Conservation agriculture
- Nutrient management
- Grazing feed

Agriculture in Scotland accounts for over 75% of land use. At the same time, 'intensification of agriculture has been one of the major causes of biodiversity decline due to loss of traditional farming practices and changes in management'[35]. The sector is the second highest contributor of domestic emissions[iii] in Scotland, after transport. Scottish agriculture is on the frontline of climate change impacts in Scotland, but our land can also play a significant role[36] in combating the crisis by increasing natural carbon sinks, such as agroforestry[37], and improving sustainable farming methods, such as conservation agriculture [38] and organic farming. These nature-based solutions are a necessary part of a broad package of methods to reduce emissions in agriculture.

The most recent report by the Intergovernmental Panel on Climate Change (IPCC) warns that 'transitions in global and regional land use are found in all pathways limiting global warming to 1.5°C with no or limited overshoot'.[39]

The UK CCC has pointed out that "it is possible to reduce land-based emissions of greenhouse gases while contributing to other strategic priorities for land such as food production, climate change adaptation and biodiversity" while it makes clear that "changes must start now".

Work by the University of Edinburgh's UK Biochar Research Centre shows that biomass waste from agricultural processes can be looped back into soils as highly stable carbon, increasing soil functions such as water retention, while providing a long-term store for carbon.

How we get there

The following steps provide a coordinated and place-based approach to achieving the necessary scale of nature-based solutions:

- Ensure place-appropriate natural solutions are embedded in Scotland's climate emergency response, including the Climate Change Plan update

- To be effective, ensure natural climate solutions are ***additional to*** decarbonising Scotland's economy and are planned for in the National Planning Framework 4.

- Appropriately resource and equip local authorities to support communities in carrying out place-based natural solutions, recognising the wide social benefits these bring.

---

iii These are emissions that are released in Scotland – they do not include emissions released elsewhere as a result of demand in Scotland, such as imported food. Food production is globally the highest emitting sector.

- Co-ordinate nature restoration at larger spatial scales, including nationally, to ensure nature is better connected as part of a Scottish Nature Network. This should inform the development of the Land Use Strategy, the Regional Land Use Plans, and National Planning Framework 4.

- Build local and Scotland-wide communities of practice and foster a legacy of action from COP26.

- Ensure place-based natural solutions are a central part of Regional Land Use Partnerships and Plans, as well as Marine Planning Partnerships and Regional Marine Plans, giving a guide to identifying stakeholders, communities of practice, and outcomes.

- As the Scottish Government plans to move towards a wellbeing economy; nature, placemaking, sustainability, and environmental justice will be paramount in realising it.

A place-based approach

The Communities Empowerment (Scotland) Act 2015 and the Christie Commission on the future of public services can form the basis of place-based approaches to policy. The approach

> "offers a holistic or 'whole place' approach that crosses policy sectors and silos. Its added attraction for policymakers is that it sounds tangible, immediate and local. It's something an individual can identify with – a place to live, a place of work, and a place to care about and protect."[40]

It is therefore an essential lens through which to view the linked and intersectional crises of climate breakdown and biodiversity loss, whilst actively including communities in the development of solutions. As such, it is possible to contribute to multiple Sustainable Development Goals.

Access to greenspaces and nature is not only an issue of space – where we see poorer communities generally having poorer spatial access – but also of time to access these spaces. Paid and unpaid work can reduce the time available for enjoying nature and deriving the health and wellbeing benefits of this. Similarly, the unavailability of safe transit routes in rural and urban environments, as UN Women highlights, has gendered impacts on the freedom of movement, especially for walking, cycling, and public transit, with impacts on health and wellbeing. The creation of green transit routes must therefore also take into consideration the diverse needs of society. This is only possible if those impacted have a say in the design and implementation of solutions.

Whilst particularly urban solutions will benefit from a place-based approach, ecosystem and carbon benefits are maximised with greater spatial connectivity. At the national level, therefore, the emphasis should be on ensuring policy and planning is coordinated, consistent, and coherent across sectors. National Planning Framework 4, Regional Land Use Partnerships, the Land Use Strategy, and the Forestry Strategy need to be better integrated to ensure this. Habitat fragmentation should receive far greater attention in environmental policy broadly.

The Infrastructure Commission has recently suggested the inclusion of green and blue infrastructure in the Infrastructure Investment Plan which, if deployed according to the principles of a wellbeing economy, the Place Principle, and with the support of the National Performance Framework 4, could be instrumental in meeting the scale of nature restoration required for both people and planet. The emphasis on *placemaking* in proposals for NPF4 are encouraging. It is imperative that this reflects a substantial approach embedded at multiple levels, and a central principle of deliberation in the planning system.

Sustainable and inclusive prosperity is a central objective of Scotland's National Performance Framework which all policies should work towards. New policies need to be able to take account of wellbeing derived from access to nature, with communities actively engaged. This should include recognising and mitigating social inequalities in access to green spaces. The Scottish Government's and COSLA's *Place Principle*[41] should define this approach which "helps partners and local communities unlock the National Performance Framework and make it applicable to where and how they live and work".

Funding nature-based solutions

Many nature-based solutions represent good value for money compared to other forms of mitigation and contribute to much more than just climate change mitigation. As funding for mitigation, adaptation, and resilience must all be increased substantially if we are to achieve net zero, it is essential that nature-based solutions receive a share proportionate to their potential. Securing a green recovery from COVID-19, as well as ensuring just climate action and nature restoration, highlights even more starkly how additional funding for nature-based solutions is required.

We need new innovative ways to finance investment in our natural infrastructure. The Trust, in partnership with SEPA, have launched a new 'Route Map to £1bn', which identifies new funding pathways for protecting and restoring nature.

There is already a £2bn commitment for funding for the Infrastructure Investment Plan and natural infrastructure must get its fair share. We also need to consider how to make better use of existing funding and the CCC has advised that we must also consider changes in tax policy. The Scottish National Investment Bank also has a key role to play given its objectives to invest to promote environmental wellbeing and biodiversity.

References

[1] Díaz, S., Settele, J., Brondízio, E., Ngo, H., Agard, J., Arneth, A., Balvanera, P., Brauman, K., Butchart, S., Chan, K., Garibaldi, L., Ichii, K., Liu, J., Subramanian, S., Midgley, G., Miloslavich, P., Molnár, Z., Obura, D., Pfaff, A., Polasky, S., Purvis, A., Razzaque, J., Reyers, B., Chowdhury, R., Shin, Y., Visseren-Hamakers, I., Willis, K. and Zayas, C., 2019. Pervasive human-driven decline of life on Earth points to the need for transformative change. *Science*, 366(6471): 1-10. Available online: https://science.sciencemag.org/content/366/6471/eaax3100.

[2] For a detailed discussion, and policy suggestions for avoiding gentrification by greening, see: Gould and Lewis (2016) *Green Gentrification: Urban sustainability and the struggle for environmental justice,* Routledge: London. https://doi.org/10.4324/9781315687322

[3] https://www.gov.scot/publications/place-principle-introduction/

[4] *Ibid.* at 1.

[5] https://www.pnas.org/content/pnas/114/30/E6089.full.pdf

[6] https://www.theguardian.com/world/2020/jun/17/pandemics-destruction-nature-un-who-legislation-trade-green-recovery

[7] https://ipbes.net/covid19stimulus

[8] https://scottishwildlifetrust.org.uk/our-work/our-advocacy/current-campaigns/natures-emergency-service/

[9] https://www.scmp.com/news/china/society/article/3027846/china-wants-nations-tackle-climate-change-nature-based-solutions

[10] https://blogs.ei.columbia.edu/2019/06/28/nature-based-solutions-climate-adaptation/#:~:text=By%20Pushpam%20Kumar&text=Of%20the%20summit%27s%20six%20action,to%20climate%20change%20and%20disasters.

[11] https://www.theccc.org.uk/wp-content/uploads/2020/05/CCC-to-Cabinet-Secretary-Roseanna-Cunningham-Covid-19-recovery.pdf

[12] https://www.theccc.org.uk/2019/12/17/new-ambitious-actions-needed-for-a-net-zero-scotland/

[13] https://science.sciencemag.org/content/366/6471/eaax3100

[14] https://science.sciencemag.org/content/366/6471/eaaw9256

[15] https://onlinelibrary.wiley.com/doi/10.1111/gcb.14612

[16] Jones, I. (ed.), 2013, *The Impact of Extreme Events on Freshwater Ecosystems*, British Ecological Society. Available online: *https://www.britishecologicalsociety.org/wp-content/uploads/small_single-pages.pdf*

[17] https://www.tandfonline.com/doi/full/10.1080/23748834.2019.1574954

[18] https://cbmjournal.biomedcentral.com/articles/10.1186/s13021-018-0098-0

[19] https://www.sciencedirect.com/science/article/pii/S0304380017300960?via%3Dihub

[20] https://www.mdpi.com/2075-5309/9/7/157

[21] https://committeeadmin.lancaster.gov.uk/documents/s21579/Appx2_TreesInTowns.pdf

[22] For a detailed discussion, and policy suggestions for avoiding gentrification by greening, see: Gould and Lewis (2016) *Green Gentrification: Urban sustainability and the struggle for environmental justice,* Routledge: London. https://doi.org/10.4324/9781315687322

[23] https://www.theccc.org.uk/publication/land-use-policies-for-a-net-zero-uk/

[24] https://www.hutton.ac.uk/news/human-activity-means-uk-peatlands-contribute-climate-change

[25] See Midlothian Council's 11 Oct 2019 statement: https://www.midlothian.gov.uk/news/article/2837/statement_on_peat_extraction_at_auchencorth_moss_penicuik

[26] https://scottishwildlifetrust.org.uk/news/plans-approved-large-scale-peat-extraction-near-penicuik/

[27] https://www.ipbes.net/system/tdf/ipbes_7_10_add.1_en_1.pdf?file=1&type=node&id=35329

[28] https://www.ipcc.ch/srocc/chapter/summary-for-policymakers/

[29] https://dopa.jrc.ec.europa.eu/sites/default/files/DOPA%20Factsheet%20J2%20Above%20Ground%20Carbon_0.pdf

[30] https://www.sciencedirect.com/science/article/abs/pii/S1618866712000611

[31] https://www.environment.gov.scot/our-environment/state-of-the-environment/ecosystem-health-indicators/function-indicators/indicator-8-connectivity/

[32] https://www.theccc.org.uk/publication/reducing-emissions-in-scotland-2019-progress-report-to-parliament/

[33] https://www.nature.com/articles/srep11610

[34] https://link.springer.com/article/10.1007%2Fs13280-014-0507-x

[35] https://www.nature.scot/sites/default/files/2019-10/State-of-nature-Report-2019-Scotland-full-report.pdf

[36] https://scottishwildlifetrust.org.uk/2019/02/working-with-nature-to-produce-sustainable-food-in-the-cairngorms-guest-blog-from-lynbreck-croft/

[37] https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/agroforestry

[38] https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/conservation-agriculture

[39] http://report.ipcc.ch/sr15/pdf/sr15_spm_final.pdf

[40] What Works Scotland (a joint initiative between Glasgow and Edinburgh Universities, Scottish Government, and the ESRC) http://whatworksscotland.ac.uk/topics/place-based-approaches/

[41] https://www.gov.scot/publications/place-principle-introduction/