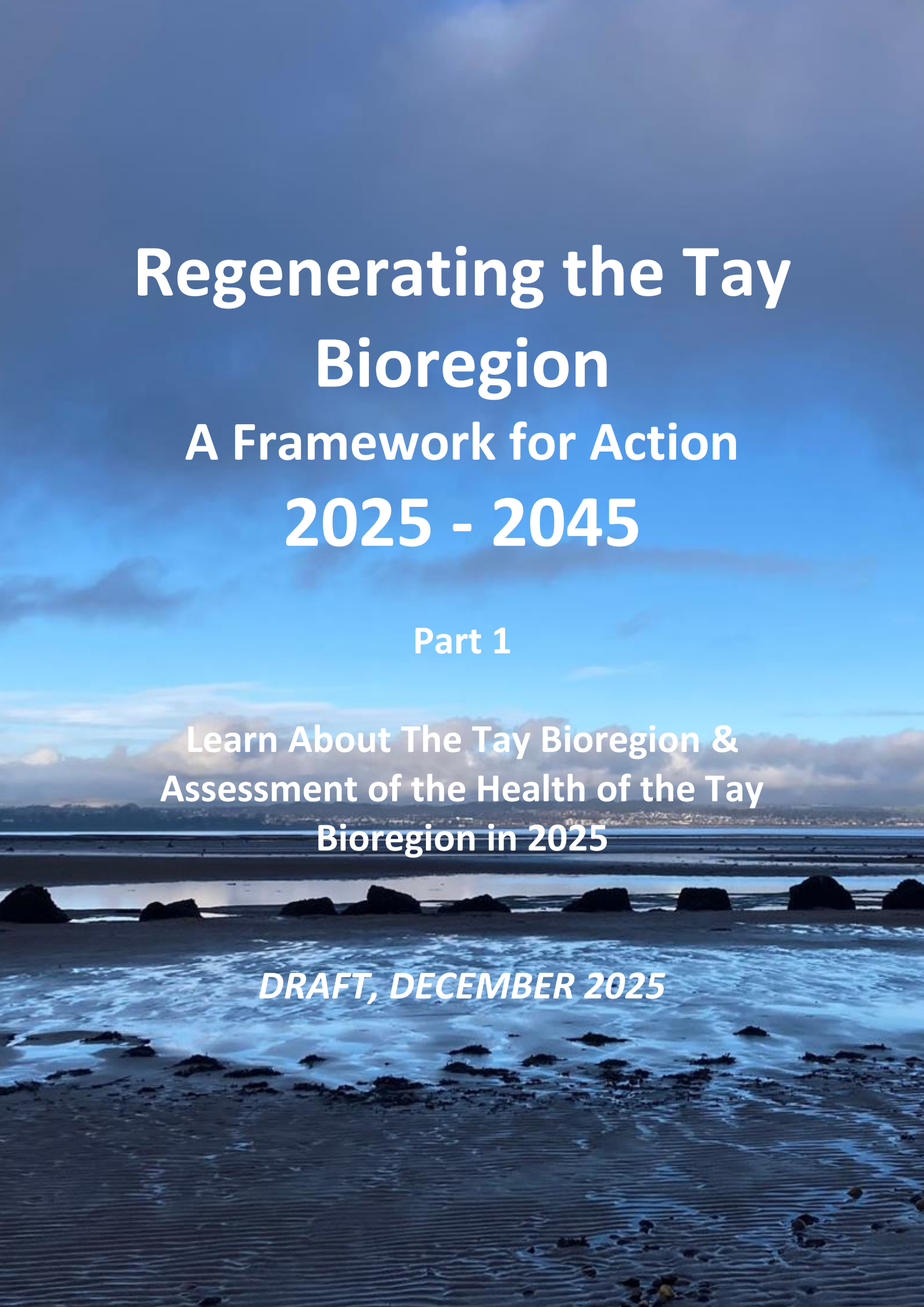

Regenerating the Tay Bioregion

A Framework for Action

2025 - 2045

Part 1

Learn About The Tay Bioregion & Assessment of the Health of the Tay Bioregion in 2025

DRAFT, DECEMBER 2025

Bioregioning is a place-based biophysical[1] and cultural response to the planetary crises[2] we are facing. It re-invigorates and restores how we humans think about our presence on this planet and how we act, because it challenges us to see a geographic area – our place – through its natural systems instead of the infrastructure humans have designed – turning shires and cities into biomes and watersheds.

Through this work we aim to create opportunities for the people of the Tay Bioregion to re-perceive their interdependence with the natural world and take the urgent action needed to bring human and biotic communities back into a healthy, balanced co-existence with each other.

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[1] Biophysics is an interdisciplinary science that applies the principles and methods of physics, chemistry, and mathematics to understand biological systems

[2] the interconnected challenge of climate change, biodiversity loss, and pollution that threatens ecosystems, human health, and the planet's future

Part 1: Learn About The Tay Bioregion & Assessment of the Health of the Tay Bioregion in 2025

Part 2: Opportunity Analysis & Strategic Directions

Part 3: Governance, Collaboration & Finance

Part 1

Learn About The Tay Bioregion
&
Assessment of the Health of the Tay Bioregion in 2025

Contents

4. Assessment of the Health of the Tay Bioregion in 2025

A Bioregional Health approach ties human health and well-being to the health of the ecosystems and communities in which people live. It emphasises place-based, ecological, and cultural relationships that support health in sustainable and regenerative ways.

Human, ecological, economic, and cultural systems are seen as interconnected, and health outcomes are understood as emergent properties of the dynamic interactions within these systems. Achieving bioregional health - meaning communities and ecosystems that are resilient, able to adapt to change, and capable of thriving - requires approaches that are rooted in the specific characteristics of a place, respectful of local cultures, and committed to fairness and equity.

These approaches must be supported by inclusive processes that engage community participation and guided by long-term, regenerative ways of thinking that restore and sustain natural and social systems."

It is through this system's thinking perspective that the following assessment has been made.

4.1 Land

4.1.1 Assessment of land degradation issues

Soils

From a bioregional perspective, soil is not merely a physical substrate or a chemical medium - it is the living, breathing foundation of local ecosystems and human communities. It is the skin of the Earth, shaped over millennia by the climatic, geological, and biological processes specific to a place. In the Tay Bioregion, soil carries the memory of the land - its weather, water, vegetation, wildlife, and the people who have lived in reciprocity with it.

Soils are central to the ecological identity of the Tay Bioregion. They underpin the vitality of forests, farmlands, wetlands, and rivers, providing the conditions necessary for food sovereignty and biodiversity to flourish. They regulate the region’s microclimates, absorb and store rainwater, and cycle nutrients that sustain life - not only for humans but for the full web of other-than-human beings.

The soils of Scotland are slow-forming and fragile. It can take centuries to develop just a few centimetres of fertile soil, yet humans and climate can degrade or destroy this living layer very quickly. This fragility highlights the urgent need to protect and regenerate soils through place-specific knowledge and care. Although specific data for the Tay Bioregion is limited, national figures show that soil degradation - including erosion, compaction, and loss of organic matter -

costs Scotland an estimated £125 million annually[3], not including the cascading ecological and cultural consequences.

A bioregional lens also urges us to see the deeper ecological role of soils in regulating climate and supporting biogeochemical cycles. Healthy soils are crucial carbon sinks. In Scotland, around 80% of peatland soils - a globally significant carbon store - are currently degraded. The Tay Bioregion contains more than 121,000 hectares of deep peatland, which if fully restored, could become a cornerstone of regional climate resilience. Protecting these peaty soils is not only a matter of carbon accounting; it is a commitment to restoring a keystone ecosystem unique to this place. Soil erosion is another key challenge in the Tay Bioregion, especially in intensively farmed areas. The loss of topsoil due to wind and water - exacerbated by climate change and unsustainable agricultural practices - threatens the fertility of the land and degrades nearby water systems. Similarly, soil compaction caused by heavy machinery and overgrazing restricts root growth, reduces biodiversity, and contributes to surface water runoff and downstream flooding.

Soils, when viewed through a bioregional lens, are not static. They are dynamic communities of microbial life, fungi, insects, and organic matter, all of which interact with plant roots, groundwater, and seasonal cycles. Soil health is inseparable from landscape health. Declines in organic matter - now a widespread concern across Scotland - diminish soil's ability to retain water, cycle nutrients, and support resilient ecosystems.

In the Tay Bioregion, responding to these challenges means restoring relationships between people and place. It means grounding land use in the ecological patterns and limits of local soils. It means cultivating a culture of stewardship that sees soil not just as a resource, but as a relative - integral to the health of our watersheds, food systems, and communities.

Land use

Land is essential for human and biotic life, but the human demands on its use are increasing and human-driven climate change and biodiversity loss require urgent changes in how land is used, managed and inhabited.

In Scotland, including in the Tay Bioregion, land use lies at the heart of interconnected environmental, economic, and social challenges. Much of the land is dominated by commercial forestry (primarily Sitka spruce[4]), intensive livestock farming, or sporting estates. These uses reduce biodiversity, store less carbon than natural ecosystems, and often prioritize profit over ecology.

Scotland also has one of the most concentrated land ownership patterns in the Global North. A small number of individuals or corporations control vast tracts, restricting community access, stalling land reform, and limiting democratic input into land decisions[5].

Around 25% of Europe's peatlands are in Scotland, but many are degraded through drainage, overgrazing, and burning. While burning can encourage fresh vegetation for grazing and game, degraded peatlands release carbon instead of storing it, exacerbating climate change. Urban

[3] See The Risks to Scotland's Soils - a scoping report

[4] Data shows that Sitka spruce covers 28,374 hectares, which is about 45% of all conifer woodland in Tayside.

[5] See this Community Land Scotland link.

expansion and infrastructure developments further threaten peri-urban green spaces, leading to biodiversity loss and fewer opportunities for people to access nature.

Restoration efforts, like rewilding or species reintroduction, may conflict with traditional land uses or community interests if not designed inclusively. This raises critical questions around who benefits from which environmental initiatives or interventions.

Butterflies, including the rare Northern Brown Argus, (BL) in restoring meadows at Wester Tulloch Curran in 2025, photo Clare Cooper

Currently, the way land is used is impacting the health of the Bioregion in the following ways:

- Damaged peatlands and intensive agriculture are major greenhouse gas sources, which trap heat in the atmosphere and contribute to climate change.
- Habitat simplification from grazing and non-native forests, field enlargement, removal of hedgerows and monoculture cropping all harm native species, reduce biodiversity and are contributing to the population decline of pollinators, birds, and rare plants. This leads to reducing ecosystem functions like soil health and water purification.[6]

Social inequity can arise as a result of land profits bypassing local communities or conservation activities that displace traditional land-based jobs. However, ecosystem restoration and regenerative land management practices have the potential to bring new types of jobs to the bioregion.

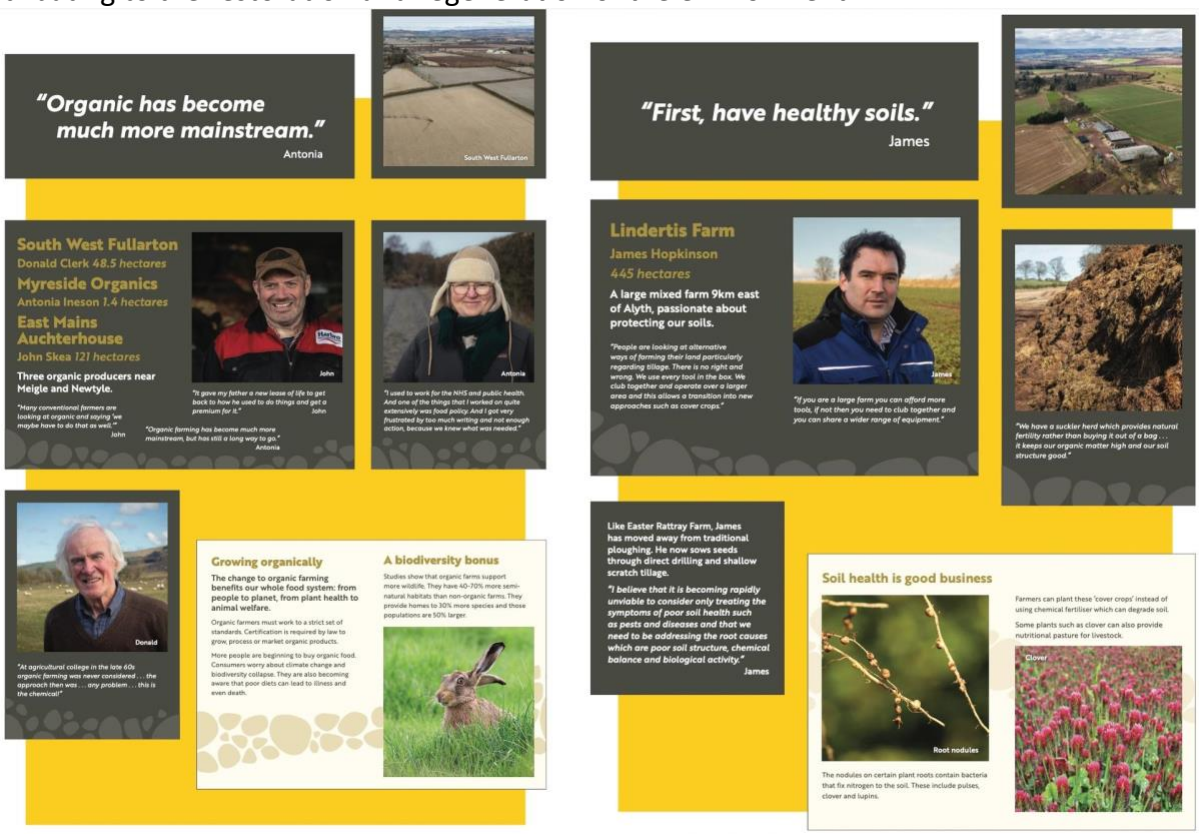
Responding to these challenges requires land use changes to be generated through a holistic systems approach, not by sector, e.g. agriculture or forestry, if they are to result in balanced ecological, social and economic demands.

[6] See Scottish Biodiversity Strategy to 2045

4.1.2 Restoration and regeneration achievements to date

Bioregioning Tayside is actively mapping nature restoration across the Bioregion and is co-leading the River Ericht Catchment Restoration Initiative. This is one of four community-led landscape scale nature restoration projects in play across the Bioregion, the other three being the River Eden Sustainability Partnership, Wild Strathfillan and Dun Coillich. In Dundee, there are a number of organisations actively involved in nature restoration focusing on involving local people in creating wild-life friendly habitats, including Tayside Woodland Partnerships, Dighty Connect and Urban Releaf. There are a small number of inspirational projects led by private landowners such as Bamff Wildland, Wester Tulloch Curran and Glen Lochay Estate. A growing number of farmers are adopting agroecological practices.

There are also three active Farmer Clusters and potential interest in creating more. Perth & Kinross Countryside Trust operate the Nature Connections Partnership, which brings together landowners, land managers and communities to create and/or re-establish sustainable and resilient landscapes that deliver environmental and socio-economic benefits. Across the Bioregion, local people are involved in many different participatory science projects, all of which are contributing to the restoration and regeneration of the environment.



Part of a 2023 exhibition by the Cateran Ecomuseum, focusing on farmers in Strathmore who are in working regeneratively, photo Clare Cooper

The Bioregion also benefits from the presence of the James Hutton Institute, a well-respected and globally recognised research organisation delivering fundamental and applied science to drive the sustainable use of land and natural resources. The Institute has several major projects on in Agroecology and Soil Science, focusing on regenerative land use, agricultural innovation, climate change solutions, and food security.

4.1.3 Significant short- and long-term challenges and developments

Short term[7] challenges

The **lack of coherence across environmental, agricultural and planning policy** is hindering the systems approaches required for holistic landscape scale nature restoration.

There is a **dearth of dedicated legislative protection** for the environment in Scotland or where this does exist, laws are underutilised and enforcement poor often due to the large burden of proof required. For example, current laws focus on safeguarding water and air, with soils, despite their importance, are only indirectly addressed. New legislation could be developed to incentivise private landowner participation in nature restoration and create binding obligations to align nature restoration with biodiversity, land use and net-zero policies. New laws could formally enshrine landscape-scale restoration as a national priority, similar to the way climate targets have been legislated. New governance structures could be created which had community and stakeholder engagement mandated and further accountability mechanisms could be introduced adding to the new Ecocide (Prevention) (Scotland) Bill. Legal protection could also be given to restored landscapes and more restoration projects could be encouraged through streamlining regulation and reducing barriers.

Funding and economic viability are a huge challenge. Current public and philanthropic funding is insufficient, too short term for the scale of the problem and/or tied to government policies that are in flux. Current Nature Finance approaches are emergent. In Scotland and elsewhere, the focus is still on commodified carbon and biodiversity markets and siloed project funding – there are no Nature Finance Aggregation Platforms for example that could help smaller landowners join together to access private finance. Land for natural capital schemes remains low and continues to fall as there is growing scepticism over the finances and practical realities of carbon projects as currently designed. This current Nature Finance model risks fragmenting ecological value, externalising risk and engraining existing power dynamics that exclude communities. Similarly, community development finance approaches usually don't integrate well the different types of financial capital that want to flow into place-based regeneration.

Land ownership and land use conflicts are preventing scaling of landscape restoration. The Bioregion has a concentrated land ownership structure, with a few individuals and entities owning large areas[8]. This can slow collective action. Additionally, conflicts often arise between restoration goals and traditional land uses like grouse shooting, sheep farming, and forestry. More recently, renewable energy developments have caused concern for many local communities. Proposals for large onshore wind or ground-mounted solar is viewed by some as competing with farming, tourism/landscape values, biodiversity sites and peat/carbon-rich soils. Wind developments in particular raise landscape and cumulative-visual concerns; solar raises concerns over use of prime agricultural soils and temporary loss of grazing/arable land.

Community involvement in and benefit from landscape restoration needs building and strengthening. Currently, communities are sometimes overlooked or only lip-service is paid to consultation requirements, particularly when it comes to direct community benefits and involvement in decision-making. While some projects prioritise community engagement and

[7] In government and public policy circles, a "short term" time horizon is typically up to 5 years, sometimes 0–3 years depending on the area.

[8] See 3.4.4. above and Who Owns Scotland

benefits, such as the River Ericht Catchment Restoration Initiative and the River Eden Sustainability Partnership, others face challenges in effectively including local voices and ensuring equitable outcomes.[9]

People from Blairgowrie & Rattray playing the Strategy Game created especially for the River Ericht Catchment Restoration Initiative, which enables a shared vision for landscape management to develop, photos, Clare Cooper

Ecosystems are complex due to the intricate web of interactions between living organisms (biotic factors) and non-living components (abiotic factors), as well as the influence of human activities and ecological responses can be slow and non-linear. Restoration of degraded peatlands or woodlands for example can take decades for positive impacts to be seen. Furthermore, there is a lack of joined up data and baseline monitoring that is hampering decision making.

Long term challenges

Over the longer term, **changing climate conditions** may alter species distributions and threaten the resilience of restored ecosystems. And extreme weather events can damage peatlands, woodlands, and newly restored habitats.

Non-native species (e.g., rhododendron, Sitka spruce) and overgrazing by deer impede regeneration of native woodlands and bogs and long-term deer management is both politically and logistically difficult.

There are challenges relating to **scale and connectivity**. True landscape-scale restoration needs coordination across multiple landholdings, local authorities, and ecosystems and there is a lack of integrated, region-wide restoration strategies.

[9] For example, forestry/woodland strategies and large planting proposals show a pattern where online/formal consultations risk missing marginalised local voices and existing fund distribution and programme governance such as the National Nature Restoration Fund run by NatureScot can favour well-resourced actors unless funds deliberately build in equity-focused rules and local governance.

The challenges in relation to **cultural and economic shifts** need to be overcome. Sustaining restoration will require long-term behavioural change in how land is valued and used and rural economies will need to evolve to integrate ecotourism, renewable energy, and nature-based jobs.

Governance and institutional capacity will require significant investment to build the competencies, qualities and attributes needed to engage diverse stakeholders, resolve conflicts track outcomes, and ensure equitable sharing of resources. (See human communities' section below for more of an explanation about this challenge)

4.2 Water

4.2.1 Assessment of water degradation issues

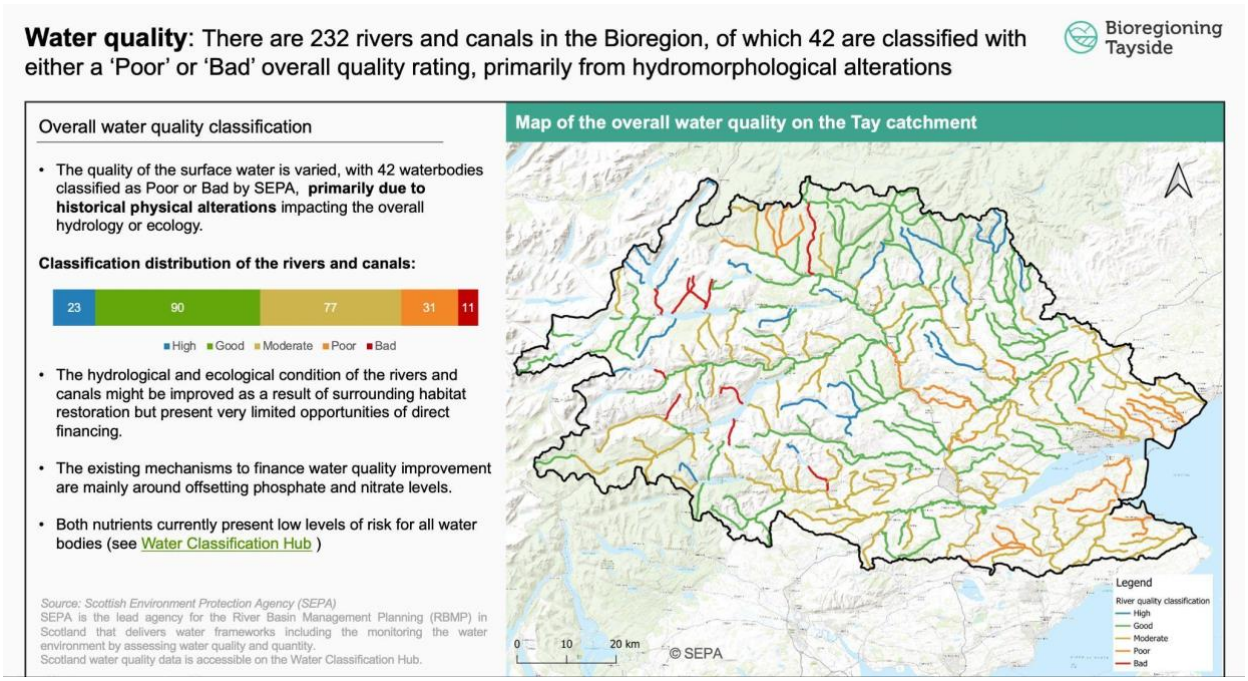
Tayside's rivers are contending with a complex mix of acute pollution events, chronic diffuse impacts, over-extraction amid drying trends, and inadequate wastewater infrastructure - all of which harm ecological health, biodiversity, fisheries, and public welfare.

As has been noted (see 3.3.4) the entire River Tay system is crucial for Wild Atlantic Salmon, with its diverse habitats supporting the full range of salmon life-history types found in Scotland. As one of the top salmon rivers in Scotland, the Tay consistently produces over 5,000 salmon annually, and its extensive catchment provides varied spawning and nursery grounds. Salmon plays a key role in the ecology of aquatic ecosystems and are an indicator of high environmental quality. They are also an important component of the rural economy, both through fisheries and wider nature tourism, employing 4,300 full-time equivalent jobs Scotland-wide and contributing £79.9m GVA to the economy.

While SEPA, Scottish Water, fisheries boards and trusts, and communities are tackling these issues through regulation, restoration, and awareness, long-term solutions will require coordinated policy, investment, and behavioural change. Current water degradation issues include:

Chemical & Pollution Incidents	**Aluminium sulphate spills** have repeatedly struck the River Farg (a tributary of the Earn and Tay), notably in 2014 and again in 2015 - 2016, leading to multiple fish kills (~4,900 fish) and visible milky discoloration, prompting multi-agency investigations and fines to Scottish Water. **Silt/diffuse pollution** from agriculture is especially problematic in the Eden and Isla catchments. Heavy rainfall can trigger brown cloudy runoff that "suffocates" salmon by clogging their gills. Historic landfill erosion near the River Ericht has also been linked to silt-laden flows harming migratory fish and impacting the local fishing economy
Diffuse Pollution & Land Use	**Agricultural runoff** carries fine sediments, fertilizers, manure, and agrochemicals into waterways, affecting fish spawning and invertebrate life. **Commercial forestry practices**, particularly dense conifer planting and

	historical ploughing, contribute to soil erosion, acidification of soils, and reduced summer flow - altering ecological balance. **Peatland drainage** accelerates runoff, lowers groundwater levels, dries bogs, and alters river flow regimes - worsening summer low flows and downstream flooding risk
Water Scarcity & Flow Reduction	In May 2025, SEPA classified the River Tay catchment as experiencing *Moderate water scarcity*. The River Tilt hit its **lowest flow in 34 years**, while the River Tay and other east-coast catchments remain unusually low after prolonged dry weather. These record low flows are stressing aquatic ecosystems and heightening competition for water among farmers, industries, and hydropower operations.
Sewage & Pharmaceutical Contamination	Across Scotland, **untreated sewage discharges** - including wet wipes, sanitary items, and condom debris - occur frequently, affecting rivers and beaches. Semi-regular overflow issues have been flagged in Tayside catchments. **Pharmaceutical residue** (e.g. ibuprofen, contraception hormones, antibiotics) has been detected in Tayside rivers above 'predicted no-effect' safety levels, raising serious concerns for wildlife and human health
Plastic & Marine Litter	Community surveys under the "Upstream Battle" campaign in 2021–22 revealed that over **3,000 pieces of litter** (predominantly cigarette butts, snack wrappers, wet wipes, period products) were found along the Tay and its tributaries - posing hazards to wildlife and marine ecosystems.



Graphic produced for Bioregioning Tayside by Palladium

In the Tay Estuary and coastlands of the Bioregion, water degradation concerns include:

Nutrient enrichment	(Eutrophication) from agricultural runoff (particularly from Fife and Perthshire), wastewater discharge, and diffuse pollution. This can cause algal blooms, oxygen depletion, and harm to aquatic life.
Microbial pollution	from a combination of sewer overflows, livestock access to waterways, and septic tanks can cause public health risks (especially for shellfish and recreational water use).
Sediment and turbidity issues	from riverbank erosion, dredging and storm events can affect water clarity, smothers benthic habitats, and can transport pollutants. Additionally, the Tay Estuary has naturally high sediment mobility, which can be exacerbated by land use changes upstream.
Chemical contaminants	from Historic industry (e.g. jute processing), urban runoff, pesticides can accumulate in sediments and biota, with risks to wildlife and food chains.
Climate and hydrological changes	from trends such as sea-level rise, increased rainfall variability, and temperature shifts influence salinity patterns, estuarine mixing, flood risks, and pollutant dispersion.

4.2.2 Restoration and regeneration achievements to date

The Scottish Environment Protection Agency (SEPA) has regulatory oversight via its implementation of the Water Framework Directive. It also leads Scotland's water monitoring programme, investigates and responds to pollution incidents and ensures that permits don't harm aquatic species or habitats, including freshwater pearl mussels, Atlantic salmon, or wetlands. The Scottish Invasive Species Initiative (SISI) has a non-native species control programme which works at catchment and landscape scale across the Bioregion with land owners, land managers and volunteers.

As previously summarised in 4.1, there are a number of community-led landscape scale nature restoration projects in play in the Bioregion who are aiming to positively impact water health at a catchment scale. Additionally, there have been other recent initiatives such as the sustainable urban drainage systems - SuDS Pond Enhancement & Tayside Ponds project led by Tayside Biodiversity Partnership and Perthshire Wildlife, which enhanced multiple SuDS ponds across Perth & Kinross through clearing invasive species, planting native wetland flora, adding amphibian ladders, and boosting invertebrate and amphibian habitats. There have been various community-led interventions in Dunkeld, at Lunan Burn and Clunie Loch and at Alt Eigheach, supported by Perth & Kinross Council, Nature Restoration Fund that have focused on riparian and riverbank restoration, and a partnership between Dundee City Council, Scottish Water, SEPA, and NatureScot aims to retrofit blue-green infrastructure and SuDS into St Mary's area such as better

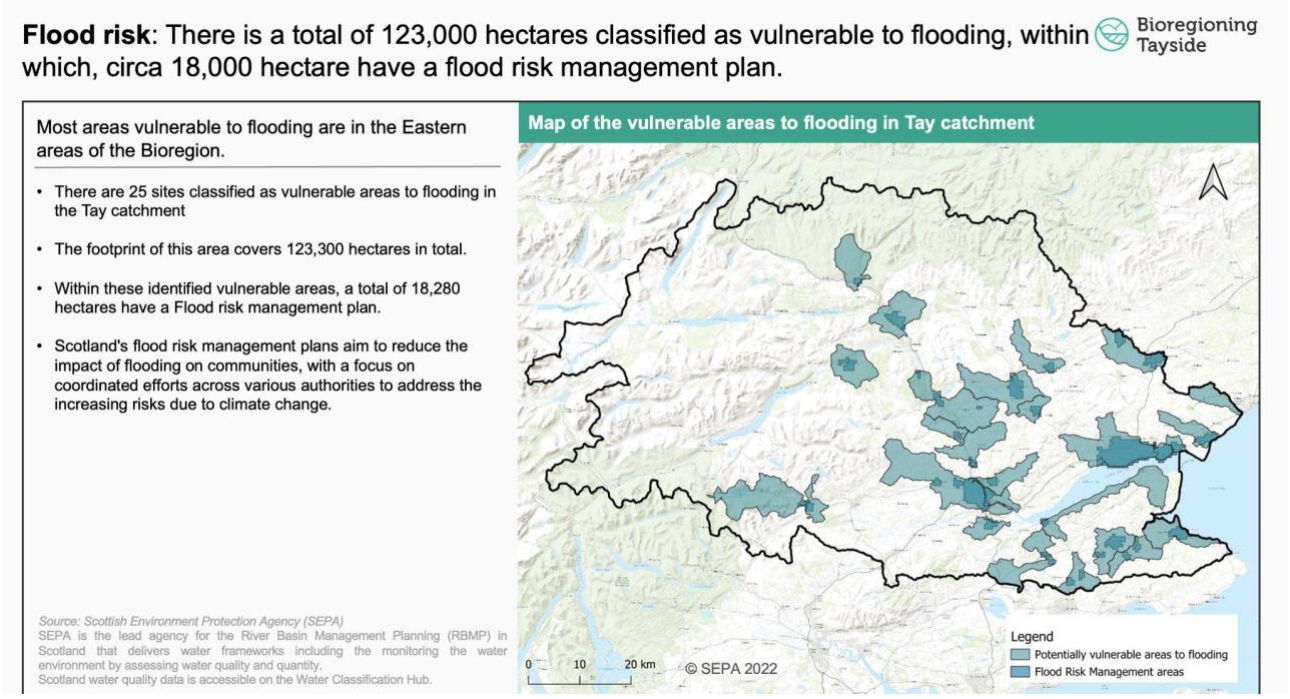
stormwater management, flood risk reduction, biodiversity enhancement, and improved community amenity.

A new Tay Catchment Salmon Alliance has been set up to attract new resources from a broader number of organisations to help restore habitats that Wild Atlantic Salmon depend on. The Cateran Ecomuseum has recently completed a community-led project investigating how the people of Strathmore managed their rivers, bogs and lochans in the past and how this knowledge might help local communities take better care of them now and in the future and the Tay Estuaries Forum brings together organisations and individuals with a common interest in the welfare and sustainable use of the Tay Estuary and adjacent coastline.

4.2.3 Significant short- and long-term challenges and developments

Short term challenges

The Bioregion has a significant agricultural base (livestock, arable farming), which contributes to nutrient pollution, especially nitrates and phosphates from fertilisers and animal waste entering water bodies. The Diffuse Pollution Priority Catchment (DPPC) work by SEPA (Scottish Environment Protection Agency) includes targeted advice and inspections to reduce diffuse pollution in key catchments.



Graphic produced for Bioregioning Tayside by Palladium

Growing urban areas (particularly around Dundee and Perth) can lead to increased surface runoff, sewage overflow, and contamination of local rivers and burns. Unitary authorities are promoting sustainable urban drainage systems (SuDS) to manage stormwater and reduce pressure on aging infrastructure.

More intense rainfall events are stressing existing flood defences and increasing sediment and pollutant loads in rivers. The Flood Risk Management Strategies for Tayside (led by SEPA and local

councils) include short-term projects like riverbank reinforcement and community flood alert systems.

Invasive Non-Native Species such as Himalayan Balsam, Japanese Knotweed, Giant Hogweed, American Mink and American Signal Crayfish are affecting river ecosystems and public safety. SISI, Local environmental groups and NatureScot (formerly Scottish Natural Heritage) are involved in monitoring and eradication programmes.

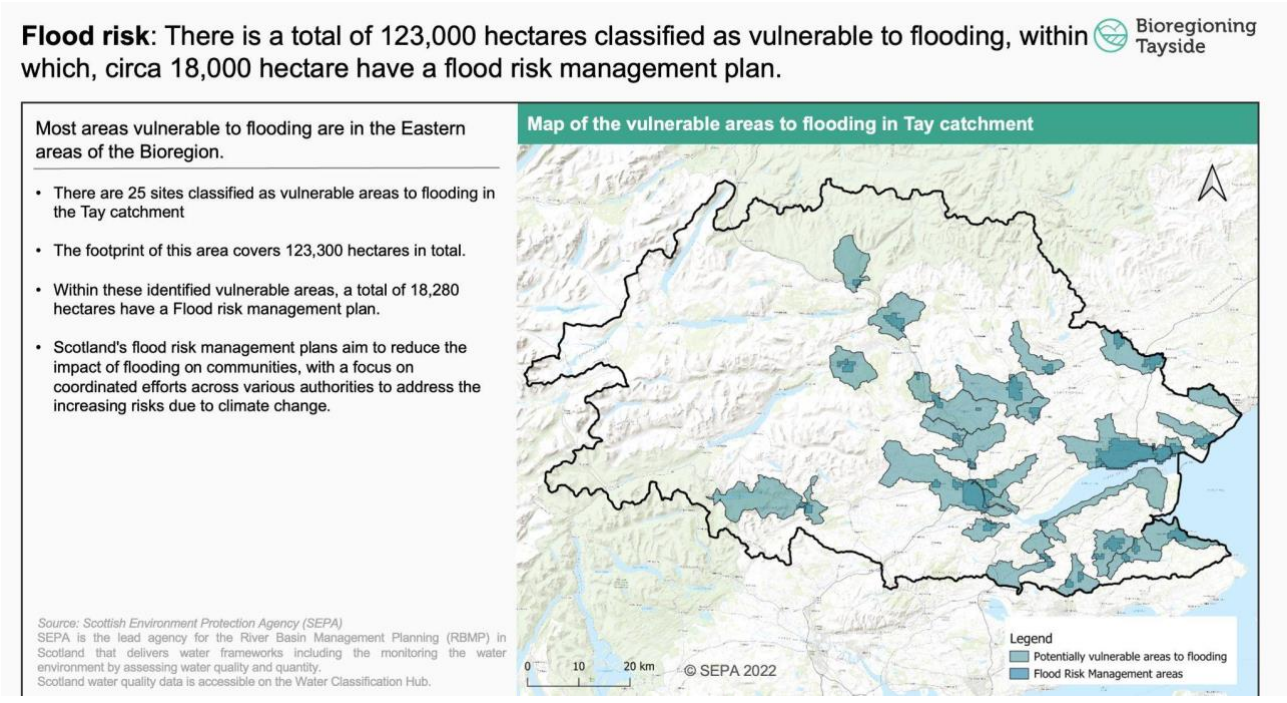
Long term challenges

Rising temperatures and altered precipitation patterns will continue to impact river flow regimes, water availability, and aquatic biodiversity across the Bioregion. Long-term water resource planning by Scottish Water includes climate resilience modelling, especially for drinking water sources and wastewater infrastructure.

Meeting evolving EU-derived **water quality standards** (like those under the Water Framework Directive, retained post-Brexit) remains a challenge due to historical pollution and land use pressures. Continued investment in catchment-based approaches and nature-based solutions, like wetland restoration, is central to improving ecological status.

Much of the water and wastewater infrastructure in the Bioregion is aging, with risks of leaks, overflows, and treatment failures. Scottish Water's Investment Programmes (e.g., 2021–2027) include major upgrades to water treatment plants and sewer networks in Tayside.

Coordinating landowners, farmers, conservation bodies, and local authorities is complex, especially across catchments like the Tay that span multiple council areas. Strengthening integrated water resource management through River Basin Management Plans and partnership catchment groups is essential but complex work.



Graphic produced for Bioregioning Tayside by Palladium

Long-term degradation of aquatic habitats threatens Wild Atlantic Salmon populations and other sensitive species. Rewilding efforts, riparian buffer zones, and barrier removal projects (e.g., fish pass installations) are being promoted.

4.3 Biotic communities

4.3.1 Assessment of Biotic degradation issues[10]

Upland ecosystem

Overgrazing by Deer and Sheep	Intense grazing by deer and sheep has fragmented and degraded montane habitats like dwarf shrub heath, willow scrub, herb-rich vegetation, and moss-heath. Grazing-tolerant species such as Mat grass now dominate, reducing grassland species diversity. Trampling from grazing animals threatens blanket bogs, high-altitude plants, water seepage zones, and sub-alpine calcareous grasslands. Ground-nesting bird nests and chicks are also at risk
Fragmentation of Habitat	Mountain willow populations are now small, isolated on inaccessible ledges, and vulnerable to landslides and rock-falls. With separate male and female plants - and females more common - natural regeneration is failing. Other rare montane species face similar risks and need long-term management. Windfarm routes and hill roads further fragment habitats.
Muirburn	Poorly managed muirburn followed by heavy grazing removes dwarf shrubs, turning heath into grassland prone to bracken colonisation. It can also lead to erosion and watercourse sedimentation.
Increasing Recreational Use	Rising numbers of hillwalkers, climbers, and cyclists damage fragile soils and vegetation, especially on wet paths and below cliffs with calcareous grassland. Path management can help prevent further erosion. People and dogs disturb ground-nesting birds like Dotterel, Golden Plover, and Dunlin, increasing predation risks and trampling of eggs or chicks - especially where walkers stray from paths.
Climate Change and Pollution	Montane areas are highly vulnerable to climate change, with temperatures projected to rise 1.4 - 3°C by 2050. Many species may not relocate successfully, leading to altered species distribution and potential loss of rare alpine plants. Acidification from sulphur and nitrogen compounds may disrupt soil nutrients and vegetation communities.
Unlocking Carbon	Grazing and development on peatlands damage hydrology and peatland species. Long-term bog drainage lowers water levels, dries peat, and hinders sphagnum regeneration. As peatlands lose their carbon-retaining ability, they release more carbon, contributing to climate change.
Lack of Knowledge	There is limited information on managing Tayside's montane areas and insufficient ecological data, especially for lower plants and invertebrates.
Afforestation	Non-native conifer planting negatively impacts species like Black Grouse and Curlew, though early-stage plantations can temporarily benefit some.

[10] These summaries have been drawn from the Tayside Local Biodiversity Plan 2016-2026

	Calcareous grasslands should be preserved for their flora and rare species like *Osmia inermis*, a rare mason bee.
Wildlife Crime	Scotland has seen a rise in wildlife crimes, including illegal snaring, badger baiting, deer and hare coursing, and bird poisoning.

The River Isla in Flood, photo Markus Stitz

Farmland ecosystem

Agricultural Intensification	Fertiliser, herbicide use, ploughing, and reseeding destroy calcareous and wet grasslands. Supplementary feeding enriches soils, promoting ruderals. Drainage alters flood regimes, nutrient levels, and lowers water tables. Unsustainable and carbon intensive farming practices cause major biodiversity loss, such as topsoil erosion from potato fields, reduced pollination for crops, and neglected field margins.
Overgrazing	Heavy grazing by sheep, cattle, and horses reduces species-richness and structural diversity, particularly tall herbs. Uncontrolled deer and rabbit populations worsen the problem in some areas.
Loss of Traditional Rural Buildings	Demolition or conversion destroys roosting and nesting sites for bats and birds. Restoration excludes them, and timber treatments or rodenticides can harm species like owls and Red Kites.
Habitat Fragmentation	Enlarged fields remove boundary features like hedges, treelines, and drystane dykes. Annual cutting degrades hedges, removing berries vital to birds. Spray drift and fertilisers harm bumblebee nests and ploughing near hedges weakens them. Dyke restoration is often unaffordable without grants.

Climate Change	Changing weather disrupts crop ripening and haymaking. Low temperatures delay ploughing and affect soft fruit. Shifts in ecosystems will pressure many species, some of which may have nowhere else to go.
Loss of Boundary Trees	Age, wind, and disease are reducing boundary trees. With few replacements, biodiversity loss worsens. These trees, including roadside and treeline hedges, are key for habitat connectivity.
Inappropriate Tree Planting	Open landscapes vital for breeding waders are harmed by tree planting, which removes habitat and creates a 'predator shadow' - birds avoid nesting near woodland due to real or perceived threats.

Woodland ecosystem

Invasive Species and Diseases	Non-native species like Himalayan Balsam, Japanese Knotweed, and Giant Hogweed suppress natural ground flora. Oak, a strong light-demander, struggles to regenerate under its own canopy when invasive species like Rhododendron and Sycamore (*Acer pseudoplatanus*) are present. Rhododendron heavily shades native shrubs, young trees, lichens, and bryophytes. Even native Bracken (*Pteridium aquilinum*) can inhibit young tree growth. Tree pathogens, including Ash dieback (*Hymenoscyphus fraxineus*) and *Phytophthora ramorum*, are spreading across Britain, making research and treatment a priority.
Climate Change	Bird species such as Black Grouse, Scottish Crossbill, and Pied Flycatcher are expected to be increasingly affected by climate change.
Silvicultural Systems	Declines in coppicing and increased grazing from domestic and wild animals have reduced the structural diversity of upland oakwoods. Early 20th-century timber removal significantly altered the composition of Tayside's upland oakwoods. Though the planting of non-native species like Douglas Fir is now historical, its impact continues.
Afforestation	Poorly planned afforestation and encroachment of trees, scrub, and bracken into non-woodland priority habitats can degrade those environments. Similarly, short-rotation coppice for biofuel must be carefully sited to avoid harming existing upland or woodland habitats.
Habitat Fragmentation	Woodland clearance for agriculture, housing, infrastructure, golf courses, and quarrying fragments habitats. Trees near developments risk removal due to perceived nuisance or damage risk, and current Tree Preservation Order systems are often inadequate. Spray drift, runoff, and the loss of connecting features like hedgerows further degrade woodlands. Large-scale planting should consider surrounding priority habitats and aim to link fragmented woodlands through forest or urban greenspace networks.
Lack of Management	Under-planting with conifers has contributed to a 40% decline in Scotland's oakwoods. Poor management, nearby land use changes (e.g., roads, quarrying, recreation), and a limited age structure hinder woodland health. In planted coniferous woods, a lack of species diversity and open areas makes them susceptible to pests, fire, and wind-throw.
Grazing Pressure	Overgrazing by livestock and deer can degrade ground flora and prevent natural regeneration. Species like Sycamore and Beech can exploit gaps,

	outcompeting native trees. In contrast, undergrazed wood pastures may convert to intensive grassland, threatening veteran trees.
Water Abstraction	In wet woodlands, drainage and excessive grazing degrade soil and flora. Water abstraction, eutrophication, and pollution further stress these ecosystems.
Recreational Impacts	Increased visitor activity can disturb birds, badgers, deer, and bats - especially during breeding or hibernation. Poorly managed paths for walking or biking may destroy ground cover and invertebrate habitats, but careful path design can mitigate these effects.

North American Signal Cray Fish on the River Ericht, an Invasive Non Native Species, photo Clare Cooper

Water and Wetland ecosystem

Acidification	occurs in areas lacking alkaline bedrock like limestone, which normally neutralises acids. It can result from acid rain (from sulphuric and nitric acids), livestock waste, and nitrogen fertilisers. Natural sources include nearby coniferous forests and acid rain from dissolved CO_2.
Toxic and Organic Pollution	comes from point or diffuse sources. Organic pollutants raise nutrient levels, often causing eutrophication and algal blooms that deplete oxygen. Species like *Slender Naiad* (*Najas flexilis*) are particularly vulnerable.

Drainage and Dredging	alter watercourses and surrounding habitats, displacing key species. Water Abstraction for farming or renewable energy can significantly lower water levels, threatening protected and priority species.
Sedimentation	while natural, is exacerbated by river works that destabilise banks. Excess sediment reduces river capacity and harms riparian zones, especially fish spawning grounds and Freshwater Pearl Mussels (*Margaritifera margaritifera*).
Climate Change	brings shifting weather patterns with widespread negative impacts on river temperatures and wetlands, endangering fish spawning and migration, especially of Wild Atlantic Salmon as well as other freshwater dependent species, making mitigation efforts critical.
Invasive Non-Native Species (INNS)	outcompete native species, disrupting ecological balance and threatening biodiversity.

Coastal and Marine

Erosion	Seaward dune edges are highly mobile unless artificially constrained. Most dune systems are not in equilibrium, and the Tayside coast generally shows net erosion. Some natural erosion helps regenerate dunes, but excessive erosion threatens their structure and biodiversity.
Development & Sea Defences	Older dune systems face ongoing development pressure, often leading to habitat loss. Many dunes have been converted into golf courses where fertilisers, herbicides, and irrigation alter the natural vegetation. Car and caravan parks increase access, trampling, and fires. Coastal defence structures hinder dune formation and reduce their natural dynamism. Offshore developments - like oil and gas platforms, marine turbines, and cable infrastructure - also impact coastal and marine ecosystems.
Climate Change	Rising sea levels and more frequent storms could lead to foreshore steepening, increasing wave impact on dunes. Invasive marine species may find it easier to spread. Elevated carbon dioxide levels are warming and acidifying oceans, affecting species' health, distribution, and interactions.
Recreation	Dune systems offer accessible spaces for walking, wildlife watching, and outdoor sports like golf. However, this leads to vegetation loss and exposes sand to erosion. Though rehabilitation is possible, natural diversity takes years to return. On the sea, boating, jet skiing, and irresponsible whale watching also add pressure to marine wildlife.
Grazing	Grazing helps maintain grassland and prevents scrub growth, but overgrazing can be harmful. Under grazing, more widespread, allows coarse grasses and scrub to dominate. Other pressures include nutrient runoff, marine pollution, bait digging, cable and pipeline installation, non-native species, dredging, shipping accidents, beam trawling, scallop dredging, and waste dumping.

4.3.2 Restoration and regeneration achievements to date

As previously summarised in 4.1 and 4.2 there are a number of community-led landscape scale nature restoration projects in play who are aiming to positively impact the Biotic communities of the Bioregion. In addition, the Unitary Authorities are required to report on their actions to further the conservation of biodiversity, as mandated by the Nature Conservation (Scotland) Act 2004 and the Wildlife and Natural Environment (Scotland) Act 2011. The latest of these can be viewed here for Angus, here for Perth & Kinross, here for Stirling and here for Dundee. Whilst these reports are based on political rather than ecological boundaries and tend to report primarily on individual projects rather than biogeographic units, they document a broad diversity of efforts by local people to improve ecological literacy and restore and regenerate the biodiversity on their doorstep. One project of note that epitomises Bioregional connectivity is the Strathmore B-Lines project run by Buglife aiming to restore 20 Hectares of grassland and nectar rich habitats to increase both the area and quality of pollinator-friendly wildflower habitat between Dunkeld and Montrose. The B-Line crosses some of the most agriculturally intensive land in Scotland and will connect fragmented habitat. This network will support the recovery of threatened species and allow movement across the landscape increasing adaptability and resilience to the impacts of climate change.

Hemp, now being grown in Tayside, is twice as effective as tree at absorbing and locking up carbon in its fibres, photo Clare Cooper

4.3.3 Significant short- and long-term challenges and developments

The regeneration of the Bioregion's Biotic communities involves a wide range of challenges and developments across short and long-term timeframes. These are shaped by ecological,

agricultural, policy, and community dimensions. Many are common to each of the key elements this strategy is documenting and have been highlighted in previous sections.

Short term challenges

- Habitat Fragmentation
- Invasive Non-Native Species (INNS)
- Agricultural Pressure
- Climate Change

Additionally, most regeneration efforts are under-resourced. Unitary authorities, NGOs and community-led organisations focusing on nature restoration generally lack adequate funding or staffing to implement biodiversity action plans effectively.

Long term challenges

- **Climate Change Escalation:** Increasing temperature, extreme weather events, and shifting species ranges may outpace habitat adaptation or regeneration.
- **Land Use Conflicts:** Balancing biodiversity goals with food production, forestry, renewable energy development (e.g., wind farms), and urban growth will be an ongoing and increasing tension.
- **Decline in Pollinators and Soil Health: There will be** long-term degradation of ecosystem services if biodiversity isn't restored across agricultural landscapes.
- **Cultural Disconnect from Nature:** Ongoing urbanisation and lifestyle changes risk reducing public support or understanding of biodiversity goals.
- **Biodiversity Funding Uncertainty:** Reliance on project-based funding creates instability in long-term planning and workforce continuity.

Many efforts are being made locally, regionally and nationally to respond to these challenges.

30x30, Nature Networks, The Scottish Biodiversity Strategy, National Planning Framework 4 are all emerging policy tools aligned with the Scottish Biodiversity Strategy, aiming to map and plan priority actions.

There are a growing number of community-led rewilding and habitat restoration efforts see Bioregioning Tayside's nature restoration project map.

There are a number of **Nature-based Solutions Pilots** underway to help improve biodiversity.

There are many participatory science projects collecting data and monitoring biodiversity and the potential for designing a new governance architecture for this is being explored by Bioregioning Tayside who are looking to pilot a Landscape Observatory for the Bioregion.

As previously referenced, the number of Landscape Scale regeneration projects is growing, including 30x30 and Nature Networks**,** which aim to restore large-scale ecological networks including peatland and native woodland.

The Scottish Government are planning to incentivise an Agroecological Transition which will encourage farmers to adopt biodiversity-friendly practices (e.g., hedgerow planting, regenerative agriculture, organic conversion).

Biodiversity regeneration is linked to national (Scottish) net-zero targets through the 'nature positive' by 2030 goal and ecosystem resilience planning is being developed at both national and local levels.

4.4. Human communities

Assessment of short- and long-term challenges

The human communities of the Bioregion face many interconnected challenges in responding effectively to the polycrisis. These span environmental, social, economic, and political dimensions:

4.4.1 Public Awareness & Behavioural Change

Whilst there is no specific survey data for the Bioregion, general awareness of climate change and biodiversity collapse in Scotland is high. Almost three quarters (72%) felt climate change is an immediate and urgent problem.[11] 52% of Scots say they "worry a lot about climate change in everyday life" and 71% consider the loss of species, habitats, and ecosystems "an immediate issue"[12]. However, there is a gap between concern and action. Many people are unsure what personal or collective actions are most impactful and there is little widespread understanding about the drivers of biodiversity loss, the interconnectedness of climate and biodiversity and the way our current high consumption economic model is fuelling them. High consumer lifestyles also facilitate resistance to change in areas such as meat consumption, car use, and energy use, slowing down efforts to meet emissions targets. Education at primary and secondary school about the polycrisis and its impacts is limited.

4.4.2 Governance

Current governance structures in the global north, which are used across all fields, including nature restoration, have grown out of the values of mercantile and consumer capitalist worldviews that have shaped human culture over the last 4-600 years. Top down, extractivist, elitist and inequitable, these organising structures and processes are incapable of enabling the generative and generational values and systems shift required for long term nature restoration that enables humans to better co-exist in balance with other than human life.

Today, in Scotland, there are a number of ways that national, regional, and local governance structures inadvertently impede or delay effective action on climate change, biodiversity loss and their impacts. These barriers stem from issues of fragmentation, underfunding, not understanding or recognising the level of risk, policy conflict and lack of enforcement, among others:

[11] See Scottish Climate Survey 2024: main findings.

[12] See this NatureScot Opinion Survey.

National Level	**Policy conflict:** Net-zero ambitions clash with fossil fuel support and misaligned agricultural subsidies. **Slow implementation:** Delays in key legislation (e.g., Biodiversity Strategy, Land Reform) stall progress. **Centralised control**: Power and resources are concentrated at national levels, limiting local action. **Funding gaps**: Ambitious goals lack sufficient investment, especially for nature-based solutions.
Regional Level	**Economic Growth Priorities Over Ecological Limits** **Tay Cities Region Deal (£700m+ investment) focuses heavily on economic growth, infrastructure, and innovation** without sufficient integration of biodiversity or climate objectives. **Regional growth frameworks can often entrench car dependency, urban sprawl, and carbon-intensive development.**
	Underpowered Environmental Agencies **NatureScot and SEPA often lack the regulatory teeth, staffing, or funding** to enforce biodiversity protections or climate resilience in regional planning. **Environmental assessments can be treated as box-ticking** rather than substantial constraints on harmful developments.
	Fragmentation and Lack of Coordination **The Unitary councils within Tayside often operate independently from each other**, leading to piecemeal climate and biodiversity actions without strategic regional integration, although this is now changing with initiatives such as Climate Ready Tayside. **Different political leaderships and priorities can slow unified action**.
	Resource and Capacity Constraints **Unitary Councils often lack staff, funding, and technical expertise** to deliver meaningful climate adaptation, biodiversity enhancement, or enforcement of nature policies. **Many councils rely on external funding** (e.g., Scottish Government's Climate Action Towns fund), which is often short-term and project specific.
	Planning System Weaknesses **Development planning often prioritises housing or commercial needs over ecological protection** (e.g., greenbelt loss). Local plans may include climate and biodiversity language but lack statutory force or monitoring. Unitary Councils have limited power to compel or incentivise private landowners to manage land for climate and nature. **Many policies and decision-making processes do not support or prioritise e.g. adaptation action**
Local Level (Community Councils & Community	Community Councils (CCs) and Community Development Trusts (CDTs) in Scotland play important roles in local democracy and grassroots development. However, they face several structural, financial, and practical challenges that can limit their effectiveness:

Development Trusts)	**Limited Powers and Influence (CCs)** **Advisory Role Only**: CCs have no statutory powers. They can express views on local issues (e.g., planning applications) but are not decision-makers. **Perceived Powerlessness**: Many residents and even members see CCs as symbolic and/or toothless, which can lead to disengagement.
	Volunteer Fatigue and Recruitment Difficulties **Aging Membership**: Many CCs and CDTs rely on older, retired volunteers who often have more time, which can limit long-term sustainability. **Low Engagement**: Recruitment of younger or more diverse members is difficult, often due to lack of awareness or perceived irrelevance. **Burnout**: A small number of active individuals often carry the bulk of the workload, leading to volunteer burnout.
	Funding Challenges **Limited Core Funding**: CCs receive small grants from local authorities and sometimes windfarms, often insufficient for meaningful projects. CDTs often depend on external grants. **Funding Uncertainty**: CDTs often face funding cycles that are short-term and competitive, making long-term planning difficult. **Lack of Capacity to Fundraise**: Smaller or newer organisations may lack the skills or time to apply for complex grants or fulfil grant reporting requirements.
	Bureaucracy and Governance Burdens **Complex Regulations**: CDTs, particularly if they are SCIOs (Scottish Charitable Incorporated Organisations), must comply with strict governance rules, which can be overwhelming for volunteers. **Administrative Load**: Financial reporting, health & safety, and project monitoring can require professional-level skills not always available locally.
	Inequality Between Communities **Capacity Gap**: Wealthier or more urban communities may have more resources and skilled volunteers than deprived or rural areas. **Digital Divide**: Some rural communities struggle with connectivity and/or digital literacy, limiting engagement and participation.
	Relationship with Unitary Authorities **Inconsistency**: Support from local councils varies greatly across Scotland, ranging from strong partnerships to minimal or adversarial relationships. **Tensions Over Decision-Making**: Local authorities may not always act on the recommendations of CCs or may dominate discussions with CDTs
	Community Engagement and Representation

	Low Public Awareness: Many people are unaware of their local CC or CDT, or don't understand their role. **Democratic Legitimacy**: Turnout for CC elections is often very low, which can weaken their credibility. **Inclusivity Issues**: Some councils and trusts struggle to reflect the diversity of their communities, particularly ethnic minorities, young people, and tenants.
	Project Delivery Challenges : Over-Reliance on One or Two Projects: Many CDTs focus heavily on a flagship project (like owning a community building or wind turbine), which can expose them to financial risk if it fails. **Asset Transfer Difficulties**: Acquiring public land or buildings through asset transfer can be slow, complex, and costly.
	Potential for Far-Right Influence: There are concerns that far-right groups may seek to gain legitimacy by infiltrating community councils. This is a serious concern, as it could undermine the democratic legitimacy of community councils and potentially lead to the promotion of harmful ideologies.

4.4.3 Cross-Cutting Structural Issues

Monitoring & data gaps	Fragmentation and lack of robust local and regional data hampers effective biodiversity action.
Land ownership	Concentrated land control impedes coordinated restoration or rewilding.
Climate impacts	Flooding, erosion, and extreme weather already affecting vulnerable ecosystems and infrastructure.
Agriculture	Current practices (e.g., sheep grazing) damage peatlands; reform is politically sensitive.
Rural depopulation	Aging, shrinking populations in remote areas make implementation difficult.

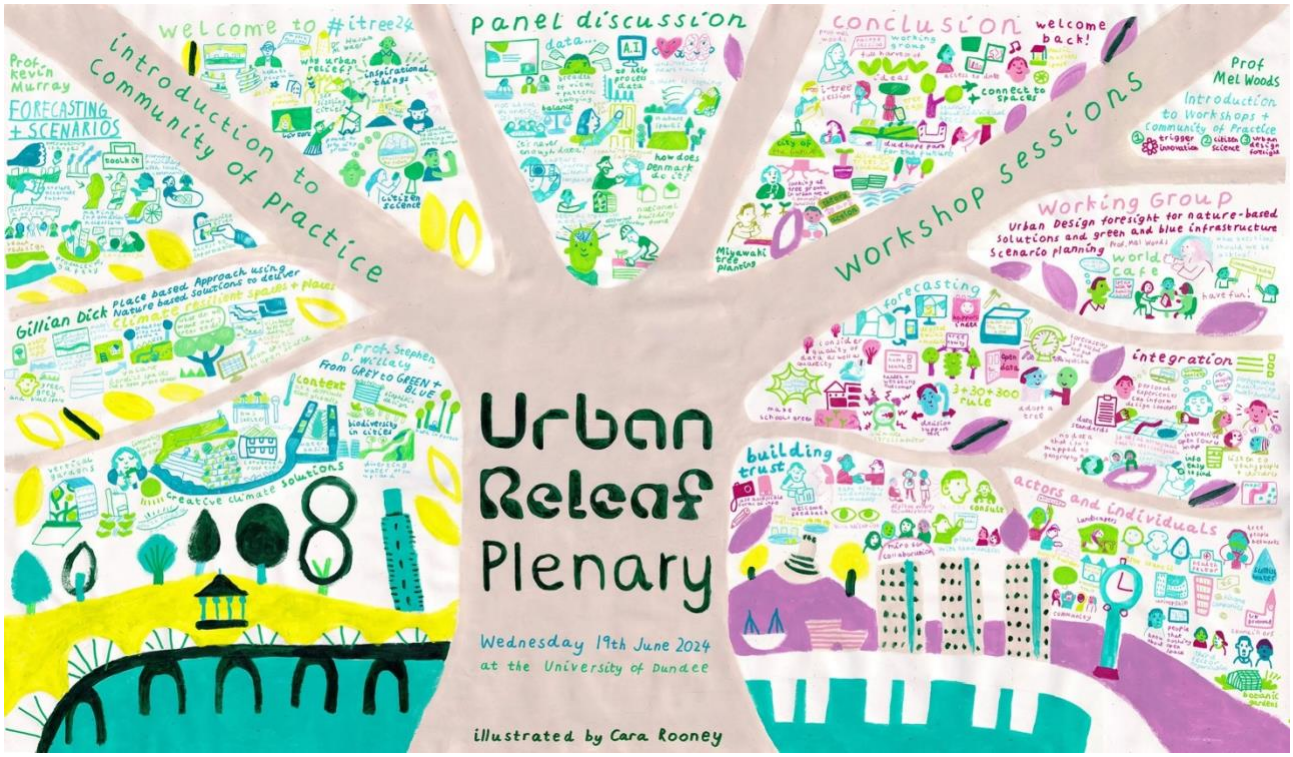
4.4.4 Rural Community Challenges

Short-Term Issues	**Housing crisis**: Affordable homes are scarce, inflated by second homes and tourism demand. **Youth outmigration**: Lack of housing and work opportunities drives younger generations away. **Transport**: Poor public transport and high fuel costs isolate residents. **Aging & services**: Older populations need better care, transport, and heating. **Digital divide**: Weak broadband and mobile signal hinder remote work and education. **Economic strain**: Farming faces ecological and market pressures; energy transition stirs local opposition. **Health & wellbeing**: Staff shortages and social isolation affect mental and physical health.

Long-Term Risks	**Net-zero upgrades**: Retrofitting old homes is expensive and difficult. **Land reform tensions**: Efforts to democratise land face opposition and red tape. **Community sustainability**: Without improved services and opportunities, depopulation will continue.

4.4.5 Urban Community Challenges (Dundee as Key Example)

Social and Economic Inequality	**Poverty**: High child poverty and food/fuel insecurity affect much of Dundee. **Fuel poverty**: Poor housing insulation worsens energy costs. **Substance abuse**: Scotland's highest drug death rate is in Dundee. **Mental health**: Demand for services has surged post-COVID.
Youth, Education & Community	**Education inequity**: Poverty impacts attainment; university financial struggles risk jobs and morale. **Youth disengagement**: Social unrest signals deeper alienation.
Infrastructure & Services	**Transport issues**: Bus services are unreliable, especially at night. **Housing shortfall**: Affordability and availability are declining. **City centre decline**: Retail shift and high street vacancies weaken community hubs. **Climate readiness**: Adaptation plans are early-stage and underfunded. **Energy inefficiency**: Many homes lack insulation; poor communities bear the brunt.



Urban Releaf, Dundee aims to use citizen science to map and improve the City's green spaces, illustration Cara Rooney

4.4.6 Future Challenges Across the Region

Economic Stability	**University risk**: Dundee University's potential decline due to financial troubles could impact the region's economy and innovation. **Skills gap**: Life sciences and digital sectors need targeted upskilling. **AI:** Displacement of jobs
Infrastructure & Inclusion	**Transport upgrades**: Better road links and expanded public transit needed. **Affordable housing**: Key to retaining families and growing communities. **Health system reform**: Community care models need scaling to relieve NHS strain. **Mental health support**: Continued investment and stigma reduction essential. **AI:** Risk of reinforcing systemic biases.
Environmental Planning	**Climate adaptation**: Urban plans must integrate resilience to flooding, heatwaves, etc. **Home retrofits**: Large-scale energy efficiency programs critical to meeting net-zero goals.

Regional Growth Gaps

Under performance	**Dundee's unemployment is high**, growth lags behind national averages.
Persistent inequality	Despite "inclusive growth" rhetoric, **disparities remain entrenched**.
Delivery risks	**Inflation, delayed approvals, and capacity** limits threaten regional deal success.
Governance needs	**Stronger regional institutions and clearer coordination are essential.**
Digital inclusion	**Gaps in rural broadband and 5G** limit access and growth.
AI	**Risk of widening rural/urban divide.**
A strategy for 'Thriving Within Limits' is still forming	A cohesive environmental action plan is still nascent.

Undernourished Culture

Art, culture, and spirituality ground bioregioning in the human heart and soul, not just in maps and policies. They create the inspirational, imaginative, emotional and ethical scaffolding for communities to reinhabit their places in regenerative, meaningful ways.

In the Tay Bioregion, many longstanding rural cultural practices remain strong, such as agricultural shows, traditional dancing and community theatre, especially musicals. Food and drink events and festivals of various kinds are also very much part of the rural and urban cultural life of the region, although largely generated as a visitor attractor rather than a celebration of key moments in the seasonal year and a way to build community and social interaction, as they were in past times. The 'regeneration through culture' narrative has enabled significant investment in capital infrastructure in both Perth and Dundee, but in both rural and urban areas artists and arts organisations remain overextended and undercapitalised'

V&A Dundee, photo Wikimedia Commons

Key drivers for this fragility are:

Funding and Financial Sustainability	**Significant capital spends on flagship cultural buildings in main urban centres** (V&A Dundee, proposed Eden project, new Perth Museum[13]), **but day-to- day operating funding has not kept pace** **Difficulties in generating sustainable income** from ticket sales, commissions, or donations. **Cuts to local authority budgets** affecting arts provision and support especially in rural areas. **Reliance on volatile public funding** (e.g., Creative Scotland, local councils) which is often limited or uncertain
Access to Space and Infrastructure	**Lack of affordable, accessible rehearsal, studio, and performance spaces** for artists and creative practitioners of all kinds. **Pressures from rising property costs** or regeneration (especially in urban areas like Dundee). **Rural cultural venues and libraries being closed** by Unitary Authorities[14]
Audience Development and Engagement	**Reaching diverse or disengaged audiences**, including younger people, minorities, and low-income communities. **Few arts education or creative opportunities in schools'** limits future artist and audience development. **Cost of living crisis** is leading to decreased attendance at many arts events.

[13] See this report here in the Museum Journal.

[14] See this report here from the Museums Journal.

Visibility and Promotion	**Difficulty getting coverage** in national media or gaining recognition beyond the local region. **Limited marketing budgets** or expertise in digital promotion.
Rise in secularism	**As in much of the western world, interest in mainstream Christian religions is dwindling** because of the dominance of scientific materialism, changing demographics and social values and a cultural shift away from organised religion. Many Church of Scotland Kirks, once key hubs of community life are being closed and sold.

Continued Urban Rural Disconnection

A disconnection from place	**The urban populations of the Bioregion often live with little awareness of the ecological systems (e.g., watersheds, foodsheds, climate patterns) that sustain them**. Urban and rural areas are treated as separate subsystems (economically, socially, politically), yet they are deeply interdependent. Cities cannot survive without the ecosystem services and resources from rural lands, yet these flows are rarely coordinated holistically.
Loss of feedback loops	**Bioregioning values direct relationships between people and their environment**. When cities are distant from their bioregional context, their impacts - such as pollution or overextraction - are externalized to rural areas, breaking natural feedback mechanisms that might otherwise regulate behaviour.
Cultural fragmentation	**Rural communities often preserve traditional ecological knowledge and practices tied to land stewardship**. As urbanisation dominates culture, these lifeways can be undervalued or lost.
Resource and power imbalances	**Urban areas often hold economic and political power**, while rural areas are exploited for resources without adequate reinvestment or local control.
Leverage points ignored	**Opportunities for transformation (e.g., integrating rural stewardship with urban planning, decentralising resource systems) are overlooked** due to siloed thinking and governance.

4.4.7 Response initiatives underway

To respond effectively to the complex, interwoven crises described - climate change, biodiversity loss, social inequality, governance dysfunction, and community disempowerment - we must adopt a bioregional and systems-based approach that foregrounds place, human-biotic interdependence, and systemic transformation.

Reframing the Problem: Seeing the Whole System

From a systems thinking perspective, the polycrisis is not a series of isolated challenges but a network of reinforcing feedback loops - economic systems drive ecological degradation, which weakens social cohesion, which in turn impedes effective governance and adaptive capacity. Addressing individual symptoms in isolation (e.g., housing, flooding, education) without tackling root causes and system interdependencies will not yield lasting change.

Examples of initiatives that are exemplifying this

SPOTLIGHT: **Climate Ready Tayside (Regional Adaptation Partnership)** is a new partnership bringing together public, private and community organisations to prepare people and places for a thriving future, in our changing climate. It is embedding a systems approach by looking at regional scale adaptation via multi-stakeholder collaboration, holistic stakeholder engagement and inclusive governance, undertaking cross sector risk and vulnerability assessments, building leadership and shared learning and integrating nature-based and community-led solutions.

SPOTLIGHT: Aberfeldy Healthiest Town is a community-driven initiative dedicated to improving physical, mental, social and environmental wellbeing for everyone in the town of Aberfeldy. Inspired by the Blue Zones approach, their work aims to create a place where it's easy for everyone to live a healthy, fulfilling life.

Bioregional Stewardship: Grounding Solutions in Place

A **bioregional lens** reframes governance, development, and adaptation within the unique ecological, cultural, and economic realities of the region. Rather than applying generic top-down policies, it emphasizes:

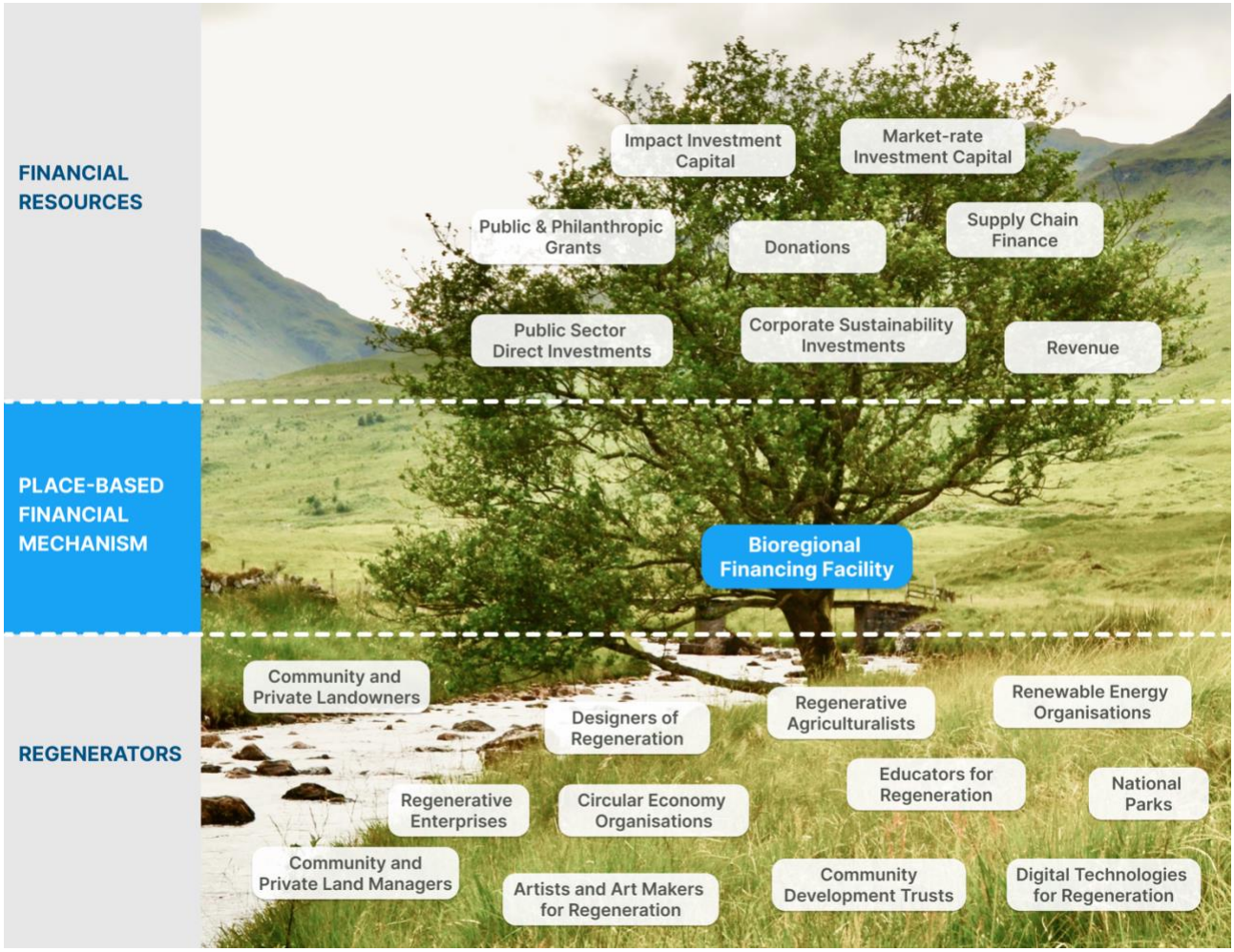
- **Ecological literacy** at all levels (schools, communities, planning processes).
- **Land-based identity** and stewardship, linking people's wellbeing with local ecosystems.
- **Living within ecological limits**: Shifting economic priorities from GDP growth to biocapacity, regeneration, common wealth (in the true meaning of the word) and sufficiency.

Examples of initiatives that are exemplifying this

SPOTLIGHT: **Comrie Croft** is a farm, reimagined for the 21st Century, comprising 231 acres of wild woods, flower meadows, a market garden and repurposed farm buildings. The Croft describes itself as a family of twelve collaborating nature-based micro-enterprises employing over forty local people. Five of these businesses are owner managed. Comrie Croft Ltd - the mothership in the family - is a certified B-Corp owned by fifty local people, employees, family and friends.

SPOTLIGHT: Dundee Eco-Schools: Eco Schools is a global programme designed to encourage a whole school approach to Learning for Sustainability, encouraging young people to engage in their environment by allowing them the opportunity to actively protect it. As part of the Dundee Climate Action Plan, the City are actively increasing participation in the Eco Schools programme through improved local support and engagement.

SPOTLIGHT: Bioregioning Tayside's Bioregional Financing Facility (BFF): See Part 3 of the Framework For Action for further detail on the proposed new governance structure for the Tay Bioregion. BFF's are a new layer in the global financial architecture that stewards financial resources to support strategically coordinated portfolios of regenerative projects and organisations working to shift systems.



The architecture of a Bioregional Finance Facility, graphic Dark Matter Labs

Transforming Governance: From Extractive to Regenerative

Governance structures rooted in extractivist logic that privilege territorial control and hierarchical authority need to evolve toward **distributed, polycentric systems** that honour ecological boundaries, reflect local knowledge and empower communities.

This involves:

- **Decentralising power** and enabling communities to make place-based decisions.
- **Reforming funding models** to support long-term, integrated and regenerative outcomes.
- **Embedding systems thinking in policymaking**, to reduce fragmentation and policy contradiction.
- Investing in Augmented and Assistive AI that supports wise action in the service of life

Regional structures (like City Deals) must be redesigned to serve **ecological resilience** and **community wellbeing**, not just economic growth.

Examples of initiatives that are exemplifying this

SPOTLIGHT: Local Place Plans are community-led plans that outline how land should be developed and used within a specific area. Introduced by the Planning (Scotland) Act 2019, these plans empower communities to actively shape the future of their places by expressing their aspirations

for development and land use. Once registered with the local council, LPPs are taken into account during the preparation of the local development plan. See Blairgowrie & Rattray's Local Place Plan as an example.

Empowering Local Communities as System Actors

Community Councils and Development Trusts need to be supported not as token stakeholders but as **core agents in systems change**:

- Build **long-term capacity**, not just project-based support.
- Increase **democratic legitimacy** and representation.
- Foster **inter-community learning** and regional coordination for shared ecosystem challenges.
- Address **inequities in digital, financial, and technical resources** to ensure all communities can participate meaningfully.

Examples of initiatives that are exemplifying this

SPOTLIGHT: Strathmore Resilience Alliance, a new network made up of community resilience groups from the towns and villages of Alyth (Development Trust), Eassie Nevay and Kirkinch (Community Hall), Blairgowrie & Rattray (Community Council), Meigle & Ardler (Development Trust) and Kettins (Community Hub) who share learning and support.

SPOTLIGHT: Transition Dundee is a community-led social enterprise on a mission to help make Dundee a more sustainable, healthy and happy place to live, enabling future generations and the environment to flourish. They do this through various climate-focussed projects, building knowledge, awareness & community.

Culture Shift Through Education and Participation

A just transition requires a **cultural transformation**, which starts with:

- **Education for systems thinking** and ecological citizenship at all levels.
- **Narratives of interdependence** and regeneration replacing consumerist norms.
- Support for **culture and heritage work** that connects people to place.

Public awareness must evolve into **deep ecological understanding** and agency to act, individually and collectively.

Examples of initiatives that are exemplifying this?

SPOTLIGHT: Climate Café's, an initiative which began in the Tay Bioregion and which is now spreading across the world, are open, inclusive spaces for people to get together to talk and act on climate change. They are community led, informal spaces where everyone is welcome to join the conversation and get involved, creating a space to bring people together from across communities, work places and campuses to focus on solutions. Many people find them inspiring and positive spaces to connect with others. There are currently around 15 Climate Cafe's in the Bioregion.

SPOTLIGHT: The Cateran Ecomuseum is a 'museum without walls' set across 1,000 sq. km's of eastern Perthshire and western Angus. It tells the story of this part of Bioregion across 6,000 years

of human history and 400 million years of geological history. Made and managed by the local community, in addition to offering 24 pre-designed (mostly) walking and cycling itineraries, from 2021 - 2024 it ran a ground breaking programme that linked heritage to climate action. Called the 'Museum of Rapid Transition', the programme aimed to showcase the huge, currently under-utilised potential that our heritage has to help people build more regenerative and resilient lifestyles and mobilise climate action - "Not only are they a knowledge & learning resource which can help contextualise what is happening, they are a participative force which can bring people together, challenge the status quo and, create spaces both physically and in our minds to imagine that anything is possible."

Scenes from The Awakening, a special multimedia landscape scale art commission for Glasgow's COP26, where local communities gathered in Glenshee for a symbolic ceremony to awaken the giant Finn mac Cumhaill, closely linked with the Glen. At this event, a Pictish war horn, the Carnyx, was sounded three times - the signal Scottish giant Lore tells us will awaken the giant to come to our aid, Photos Dylan Drummond.

SPOTLIGHT: Bioregioning Tayside's Communities Monitoring Landscape Change work, which aims to chart how communities in Tayside can help monitor landscape change through community science practices.

Catalysing Regenerative Economies

Economic systems must shift from extractive growth toward **regenerative local economies** grounded in the region's ecological capacity. This means:

- Localising food systems and supporting agroecology.
- Restoring land and watersheds through **community-led rewilding and land reform**.
- Developing **inclusive, low-carbon industries** tailored to local skills and needs (e.g., repair economies, renewable energy cooperatives).

Examples of initiatives that are exemplifying this

SPOTLIGHT: **The James Hutton Institute's new New Crop Innovation Centre** located at Invergowrie, will futureproof crop production and enhance food security for the UK and beyond. The CIC is home to the Advanced Plant Growth Centre (APGC) and the International Barley Hub (IBH), which were created in partnership with the University of Dundee Plant Sciences Division. The Centre offers a unique combination of world leading science and state of the art facilities for field, farm and lab that deliver technological and digital innovation focussed on future proofing crop production, enhancing food and drink security, managing our natural resources sustainably and supporting thriving rural communities in Scotland and across the globe.

SPOTLIGHT: Feeding Tayside Through The Climate Crisis is a programme of work co-ordinated by Bioregioning Tayside that aims to support food systems transformation in the Tay Bioregion. Begun in 2023, it has identified and is taking action on:

- the goals and vision needed in Tayside
- the enabling conditions for triggering systemic social tipping points (where behaviour change spreads quickly from a minority to a majority)
- the positive/reinforcing behaviours throughout society we will need to activate
- the interventions that will drive behaviour change
- the actors who can accelerate or hamper the change we need

SPOTLIGHT: The River Ericht Catchment Restoration Initiative is a landscape-scale nature restoration initiative in the heart of Tayside, Scotland. Working alongside landowners, farmers, businesses, communities, educational institutions, and relevant statutory bodies, our aim is to sequester carbon, increase biodiversity, improve water quality, mitigate extreme weather and save the Salmon, enabling the lives and livelihoods of all those that depend on the waters of the Ericht to thrive now and in the future.

SPOTLIGHT: Bell Street Green Travel Hub Dundee is a new green travel facility which will be operated by Angus Cycle Hub CIC and designed to help support people to change travel habits for the future. A bike and wheeled sports skill park, regional bike reuse centre and cycle lending scheme will all be available to the public. Planned facilities and programmes will include:

- Bike and Wheeled Sports Skills Park: Indoor modular cycle training space and pump track for bicycles, BMX, scooters, adaptive bikes, and early years cycling education.
- Regional Bike Reuse Centre: Refurbishment, sale and redistribution of up to 4,000 bikes annually through existing recycling agreements.
- Public Bike Library & Leasing Scheme: Affordable subscription model for residents, students, visitors and low-income users.
- Cycle Shop & Servicing: Retail and repair services to support local cycling and generate income to make the project sustainable.
- Secure Public Cycle Storage and Amenities: 150+ secure bike spaces.
- Cargo Bike and Ebike Hire: Low-carbon urban logistics and mobility options.

SPOTLIGHT: Perthshire Artisans is a curated platform promoting local, ethical small creative businesses and offering peer mentoring and support.

Integrated Action Across Scales

Bioregional governance works by aligning **top-down support with bottom-up initiative**, through nested systems:

- National governments must **enable local action**, not overrule or under-resource it.

- Regional entities must act as **integrators** - weaving ecological, social, and economic threads into cohesive strategies.
- Communities must be **empowered as stewards**, not recipients of distant policies.

Cross-scale coordination and **feedback mechanisms** (e.g., participatory monitoring, adaptive learning) are vital.

Examples of initiatives that are exemplifying this

SPOTLIGHT: Bioregioning Tayside is a new platform which is bringing people in Tayside together to build community resilience in the face of:

- global heating – with major implications for survival of life as we know it,
- a sixth mass extinction of plants and animals driven by us, which is collapsing biodiversity and threatening the food webs we depend on
- a broken economic model – which is fuelling the climate crisis and biodiversity collapse and resulting in increasing social injustice and mental ill health

This first draft of Part 1 of the Framework For Action For The Tay Bioregion was completed in December 2025. It marks the first iteration of a Bioregional approach to regenerating the Tay Bioregion.

Parts 2 and 3 are still in development.

Each part is being offered as a living framework - dynamic, evolving, and responsive to new knowledge and changing conditions.

We are now actively seeking responses to Part 1 from a wide range of communities of interest and place in Bioregion.

Please contact us on bioregioningtayside@gmail.com if you would like to share your views.