Adaptation Scotland

supporting climate change resilience

# Climate adaptation finance

## INSIGHTS AND OPPORTUNITIES FOR SCOTLAND

SEPTEMBER 2023

**This document was produced by:**

Jonny Casey
Senior Climate Resilience Manager
Sniffer

**With support from:**

Ben Connor
Head of Climate Ready Placemaking
Sniffer

**Acknowledgements**

Thank you to all the key informant interviewees for their time, generosity, and support. Thank you to Kit England for reviewing and providing helpful insights.

Adaptation Scotland provides advice and support to help organisations, businesses and communities in Scotland prepare for, and build resilience to, the impacts of climate change.

Contact us:

- adaptationscotland@sniffer.org.uk
- http://www.adaptationscotland.org.uk/
- @Adaptationscot

The Adaptation Scotland Programme is funded by the Scottish Government and delivered by Sniffer.
Sniffer is a registered charity delivering knowledge based solutions to resilience and sustainability issues.

**Sniffer**, Edinburgh Climate Change Institute, High School Yards, Infirmary Street, Edinburgh, EH1 1LZ
**T:** 0131 651 4674 **E:** info@sniffer.org.uk **W:** www.sniffer.org.uk **:** @SnifferScotland

# Executive Summary

### Overview

Adapting to climate change has been identified as a critical priority in Scotland at both the national and local levels, as reflected in policies and strategies across the country. However, in two recent reports, the UK Committee on Climate Change (CCC) has found that action on adaptation in Scotland has faltered (CCC, 2022), and across the UK there are insufficient mechanisms for creating 'bankable' adaptation projects with readily monetizable outcomes (CCC, 2023).

This report builds on barriers identified in the Adaptation Scotland Guide to Climate Adaptation Finance, to identify opportunities for stakeholders in Scotland to address those barriers, and unlock finance for scalable, inclusive adaptation. This report is informed by a series of semi-structured interviews with key informants, alongside a review of relevant literature, news stories, and blogs.

The report highlights that much can be learned from the nature finance sector, where there is innovation in market-based approaches to financing action. These emerging markets are underpinned by clear policy and regulatory signals and grant support for market development and investment readiness to crowd in private finance. Opportunities exist to maximise synergies between nature finance and adaptation outcomes, but adaptation responses extend beyond nature-based approaches, so will require their own distinct market development and business models.

# Opportunities for overcoming barriers to financing adaptation and mobilising private finance

### Ambition and vision for a well-adapted Scotland

By providing clarity of expectations at a national, local, and/or sectoral level, the Scottish Government could help to mobilise investment in critical areas and provide a pathway towards a well-adapted Scotland.

### Quantification of adaptation finance need

A quantification of the adaptation finance needed to deliver on national adaptation outcomes would provide a market signal as to the scale of the challenge, and the opportunity it presents, including an assessment of costs for early action versus delayed action in different sectors and/or regions. This analysis could also be informed by utilising data reported in TCFD-aligned climate risk disclosures, creating a positive feedback loop of data and decision-making.

### Develop high integrity, values-led adaptation markets

The development of adaptation market codes and standards to determine and measure adaptation outcomes is understood as a precondition to market development by key informants. This would allow adaptation outcomes to be formally integrated into project business models, and develop new revenue streams that incentivise adaptation action. This may provide incentives and benchmarking for investors and project developers, an develop trusted and comparable data.

### Mainstreaming adaptation in existing market codes

Mainstreaming adaptation into existing market codes and standards for net-zero and nature recovery focused projects could ensure adaptation outcomes are more likely to be identified and monetised in projects, potentially lead to greater prioritisation of adaptation outcomes in non-

adaptation focused initiatives, and be less likely to lead to maladaptation where climate adaptation considerations have been insufficiently addressed.

**Grant funds for project development**

Grant funding for project development can help crowd-in adaptation investment. Provision of technical assistance alongside the funding helps to take a project from a concept to an investable business model, and may also provide a level of confidence to potential private finance providers. To maximise adaptation finance opportunities, existing project innovation and development schemes could integrate a focus on measuring and delivering adaptation outcomes.

**Blended finance to facilitate private investment**

Strategic use of public finance can be used to facilitate private investment and finance for adaptation action. This has been demonstrated conceptually through the Craigleith Retail Park case study, where the use of partially-returnable public funding from Scottish Water could be used to encourage and facilitate co-investment of returnable finance from the asset owners.

**Open data platforms and common metrics**

Addressing data gaps and information asymmetries will be important in closing the adaptation finance gap. A new, coordinated approach to data management may help to overcome concerns of outcome and delivery uncertainty, of comparability between different projects and investments, the ability to benchmark effectiveness, and of revenue predictability. A public data platform could also support businesses in Scotland to develop better informed climate risk analyses and transition plans.

**Project delivery innovation**

Focusing on the ability to deliver multiple benefits and monetise several revenue streams – for example from voluntary carbon markets, eco-tourism, sale of products and services, and flood risk reduction – was seen as a crucial means of creating 'bankable' adaptation projects by key informants. While in some cases this will involve 'stacking' – developing separate markets for each outcome area – there is growing interest in the role of 'bundling' – monetising one aspect, but measuring impact on multiple areas. Project level insurance is one potential means of de-risking investment for all types of stakeholders, but particularly private sector finance providers.

**Regional adaptation planning**

Regional adaptation planning, led by local authorities, could provide an opportunity for coordinated investment analysis for strategic regional priorities. It could help to coalesce investment around projects that can deliver transformative adaptation and facilitate inclusive planning and governance.

**Knowledge management and information sharing**

There is an opportunity for an organisation or consortium of organisations to play a facilitating role in addressing some of the informational and technical barriers to adaptation finance in Scotland by developing a widely accessible knowledge management and information sharing platform. This could ensure that new approaches and innovative business models are more accessible and better understood by those working – or looking to work – on adaptation interventions in Scotland.

**Partnership brokering and collaboration support**

There is an opportunity for organisations across Scotland to take a lead on brokering new partnerships and collaborations, to accelerate action and help ensure all stakeholders are aware of

and/or engaged in new initiatives. This could also align with the knowledge management function set out above, and support community engagement objectives of the Scottish Government.

**Support for SMEs**

While the largest businesses in the UK now face mandatory requirements to disclose material climate risks, SMEs could be left behind in their capabilities to identify and respond to physical climate risks. Providing targeted support to this crucial but highly heterogeneous group of businesses could help to nurture increased demand for adaptation investment, help create stronger businesses cases for adaptation initiatives, and encourage greater collaboration with communities and other local public and private sector organisations for collective climate adaptation actions.

# Contents

## 1. Purpose

This report builds on barriers identified in the Adaptation Scotland Guide to Climate Adaptation Finance (Murtagh, et al., 2021), to identify opportunities for stakeholders in Scotland to address those barriers, and unlock finance for scalable, inclusive adaptation. The report is informed by a series of semi-structured interviews with key informants, alongside a review of relevant literature, news stories, and blogs.

## 2. Background and context

Adapting to climate change has been identified as a critical priority in Scotland at both the national and local levels, as reflected in policies and strategies across the country. However, in two recent reports, the UK Committee on Climate Change (herein the CCC) has found that action on adaptation in Scotland has faltered (CCC, 2022), and that across the UK there are insufficient mechanisms for creating 'bankable' adaptation projects with readily monetizable outcomes (CCC, 2023).

There remains a significant adaptation finance gap globally, with existing financial flows estimated to be 90% lower than is required (UNEP, 2022). While there is not yet an official quantified adaptation finance gap for Scotland, recent analysis by the Climate Emergency Response Group (CERG) estimates an adaptation financing need in Scotland of £1.8 billion by 2030 (CERG, 2023), while the CCC has identified a UK-wide adaptation investment need of an additional £5-10 billion per year (CCC, 2023). The costs of delayed or no action will outweigh the costs of action now (COACCH, 2021).

Adaptation finance occupies a sub-set of climate finance, which also includes finance for greenhouse gas (GHG) mitigation and loss and damage finance. Increasingly, climate adaptation is also identified as a sub-set of finance for the recovery of nature and biodiversity, and as a co-benefit arising from the implementation of both GHG mitigation and nature recovery projects.

Adaptation finance, and particularly the increasing role of private finance and innovative financial models, remains a nascent and rapidly evolving field of policy and practice within Scotland, across the UK, and beyond. Private finance is not yet being unlocked at scale, and the 'adaptation finance gap' continues to grow, both within Scotland and internationally. At the same time, constraints on public sector funding are reinforcing the importance of being able to access new sources of finance, and the role that public finance can play in mobilising and de-risking finance from other sources, including through blended finance mechanisms.

In 2021, the Adaptation Scotland programme commissioned the development of a Guide to Climate Adaptation Finance, informed by the programme's Climate Finance Working Group. The Guide identified a range of barriers to addressing the adaptation finance gap in Scotland (Murtagh, et al., 2021), which were further elaborated in the CCC's Investment for a Well Adapted UK report (2023).

This report explores the strategic opportunities for advancing climate adaptation finance in Scotland. It provides an overview of the emerging areas of innovation to overcome the barriers set out in Table 1, to mobilise significant private and public finance for adaptation in Scotland at scale. It also identifies key areas of action that can be taken by stakeholders across the public and private sectors to make a step-change in the viability and scale of adaptation action, to adequately respond to the climate risks faced by businesses and communities across the country.

*Table 1: Typology of barriers to adaptation investment*

| Barrier | Features |
|---|---|
| Market and financial | • Low or no revenues<br>• High economic but low financial return<br>• Underdeveloped markets<br>• Benefits only accrue far into the future |
| Informational | • Insufficient information on climate risks<br>• Lack of evidence of effectiveness<br>• Limited analysis of alternative options<br>• Poor understanding of adaptation |
| Technical | • Site and context specificity<br>• Unfamiliar technologies and designs<br>• Inadequate skills and capabilities<br>• Higher costs of emerging technologies |
| Bankability | • Project complexity<br>• Low delivery capacity<br>• Small size of project and/or investment<br>• High transaction costs |
| Policy and regulatory | • Insufficient or misaligned incentives<br>• Lack of cross-sector policy harmony<br>• Uncertain or under-developed policy<br>• Political reluctance to change status quo |
| Behavioural | • Low private sector willingness to pay<br>• Perception and legal requirements of public responsibilities to act<br>• Difficulty to comprehend chronic risks<br>• Competing priorities |

Adapted from: Murtagh *et al* (2021); Frontier Economics & Paul Watkiss (2022); CCC (2023).

## 3. Research approach

The report is informed by a series of semi-structured interviews with 19 key informants from across the finance sector, policy and decision-makers (public sector), project developers, and enabling entities. The key informants were identified through a selective sampling approach, building on existing connections of the Adaptation Scotland Finance Working Group and identification of other relevant organisations and individuals from the literature scan. Additional interviewees were also identified through the Scottish Nature Finance Pioneers group[1], convened and managed by the Scottish Wildlife Trust. A full list of interviewees is available in Annex 1.

Further to this, a semi-systematic scan of literature, news stories, and blogs published since the release of the Guide was undertaken. This scan identified material directly relating to Scotland, as well as relevant insights and innovation from elsewhere in the UK and globally that could be applicable to a Scottish context. In addition to adaptation finance, the scan of literature included the wider topics of non-adaptation specific climate finance, nature finance, biodiversity finance, and green finance[2].

[1] Scottish Nature Finance Pioneers, https://naturalcapitalscotland.com/project/ascottish-nature-finance-pioneers/

[2] Green finance is defined as any financial activity or investment that delivers sustainable outcomes and environmental benefits (APPG Sustainable Finance, 2023)

A workshop on mobilising private finance for flood resilience was held at the Scottish Flood Risk Management Conference in Perth in February 2023[3], with contributions from AECOM, Scottish Wildlife Trust, Forest Carbon, Tweed Forum, TreesAI, and NatureScot. Insights from discussions at this workshop are also considered in the findings and analysis in this report.

The analysis follows an inductive, qualitative research approach to identify emerging trends, ideas, and patterns in adaptation finance relevant to Scotland, and uses a thematic analysis approach to identify key insights for future work in catalysing greater adaptation finance investment from across private, public, and philanthropic sources.

Key themes from the literature scan and key informant interviews were identified against the following thematic categories in Table 2:

*Table 2: Key themes in literature scan and key informant interviews*

| | |
|---|---|
| Policy and regulations | Emerging trends and opportunities |
| Synergies with net-zero and nature finance | Incentives for private investment in adaptation |
| Stakeholder needs | Enabling activities to mobilise adaptation finance |

The report concludes by setting out a range of strategic priorities and actions for stakeholders in Scotland to help scale the contribution of private finance (investors and outcome buyers) to climate adaptation and to facilitate inclusive, place-based adaptation approaches.

# 4. Current landscape of adaptation finance in Scotland

## 4.1 Status of the adaptation finance market in Scotland

Within the literature and among key informants, adaptation is rarely identified as a stand-alone finance and investment stream. This makes tracking adaptation finance flows – as distinct from other categories – very challenging, as also identified by the G7 Adaptation & Resilience Investors Collaborative (CPI, 2022). Moreover, this can act to minimise the importance of adaptation actions and may increase the risk of maladaptation if finance is not explicitly targeted at adaptation outcomes.

Key informants struggled to identify specific adaptation finance initiatives and objectives, stating a lack of strong demonstrator business cases and in some cases a lack of understanding of what climate adaptation action is expected to look like in practice. Two interviewees (one from the finance sector, one from an enabling entity) understood climate adaptation to mean adapting to regulations regarding GHG emissions, rather than adapting to projected climate hazards.

There is currently no dedicated platform for knowledge management and information sharing on climate adaptation finance for Scotland. While three key informants highlighted the Scottish Nature Finance Pioneers group as a go-to resource and network, this is dedicated to nature finance, not specifically climate adaptation. Other key informants were not able to identify a specific means they use of seeking up-to-date and relevant information on adaptation finance, other than word of mouth and social media.

Key informants from the finance sector stated that they believed adaptation outcomes will inherently be a sub-set of net-zero and nature related projects, in part because there is no

[3] Funding and Finance Workshop, FRM Conference 2023, https://vimeo.com/807887433

established market for most adaptation outcomes, and in part because many of the benefits do not deliver direct private returns on investment. However, other key informants noted the opportunity and need to create codified adaptation outcome markets in Scotland through standardised measurement approaches and performance metrics, and innovations in project business models. There is therefore a need to consider both how adaptation outcomes can be integrated into existing and emerging markets for nature recovery and carbon, and to develop markets for adaptation outcomes.

The perceived lack of a distinct market for adaptation finance among key informants in the finance sector is reflected by the fact there are many existing and emerging policy measures to address net-zero and nature related markets, but there are currently no targeted finance policies for mobilising private adaptation finance. Recent analysis by the Green Finance Institute and Oxford University suggests that the core issue holding back greater investment and financing of adaptation in the UK is a lack of targeted policy to support, incentivise or require the private sector and households to invest in adaptation, and to support monetisation of adaptation benefits (Ranger, et al., 2023).

Table 3 sets out a non-exhaustive list of relevant recent developments in policy, regulation, and funding related to climate and nature finance in the UK which have potential links to climate adaptation, and the barriers to financing adaptation and related issues they could address.

*Table 3: Recent policy, regulation, and funding developments*

| Policy, regulation, or fund | Jurisdiction | Barriers addressed |
|---|---|---|
| UK Green Finance Strategy (2023) | UK (primarily England) | • Policy<br>• Market and financial |
| UK Nature Markets Framework | UK-wide | • Policy<br>• Market and financial |
| BSI Nature Investment Standards (in development) | UK-wide | • Technical<br>• Policy |
| Global Biodiversity Framework | Global (signed by UK government) | • Behavioural<br>• Market and financial |
| Interim Principles for Responsible Investment in Natural Capital | Scotland | • Market and financial<br>• Behavioural |
| Responsible Natural Capital and Carbon Management Protocol | Scotland | • Policy<br>• Behavioural |
| Woodland Water Code (in development) | UK-wide | • Technical<br>• Informational |
| Saltmarsh Carbon Code (in development) | UK-wide | • Technical<br>• Informational |
| Agroforestry Carbon Code (in development) | UK-wide | • Technical<br>• Informational |
| FIRNS (Facility for Investment Ready Nature in Scotland) | Scotland | • Bankability<br>• Informational |
| NEIRF (natural environment investment readiness fund) | England | • Bankability |
| Biodiversity Net Gain | England | • Technical<br>• Policy |
| National Planning Framework 4 | Scotland | • Policy |
| CivTech Challenge | Scotland | • Informational<br>• Technical |
| Flood Resilience Strategy (in development | Scotland | • Policy |
| Riverwoods | Scotland | • Bankability<br>• Informational |
| SCCAP3 (in development) | Scotland | • Policy |
| 3rd Land Use Strategy | Scotland | • Policy<br>• Behavioural |
| Agriculture Bill (in development) | Scotland | • Policy<br>• Market and financial |
| Land Reform Bill (in development) | Scotland | • Policy |
| Biodiversity Strategy (in development) | Scotland | • Policy<br>• Market and financial |
| Water Stewardship Standard (in development) | England | • Policy<br>• Behavioural |
| Sustainability Disclosure Requirements Framework (includes ISSB/TCFD reporting) | UK-wide | • Market and financial<br>• Policy<br>• Informational |
| UK Green Taxonomy (in development) | UK-wide | • Market and financial |
| Transition Plan Taskforce guidance (in development) | UK-wide | • Policy<br>• Informational |

List of policies informed by Reed *et al*, (2023); BSI (2023a)

## 4.2 Market innovation

### 4.2.1 Increased investor interest in nature finance

Much can be learned from the nature and biodiversity finance markets, where there is significant momentum and innovation. These markets are underpinned by clear policy and regulatory signals and increasing government spending nationally, at both the UK and Scottish government levels, to support market development and support investment readiness to crowd in private finance.

This reflects the increasing focus on nature recovery and the use of nature-based solutions to deliver a wide range of public good and private benefits both in the UK and globally (Young, et al., 2022) (UNEP, 2022a) (UNEP, 2023). The immediacy of the challenge, along with increased scientific and journalistic reporting in recent years of the worrying state of nature and biodiversity in Scotland and beyond, has helped to raise the issue up the political and economic agenda.

Recent analysis shows the UK is one of the most nature-depleted countries globally (Natural History Museum, 2022), while Scotland has witnessed a decrease in abundance of 49% of all species, driven in part by climate change (Walton, et al., 2019). With only a narrow window of opportunity to act, this is driving increased attention to nature regeneration and conservation in Scotland and across the UK (The People's Plan for Nature, 2023).

When posing the research question, "*what does adaptation finance mean to you*", the majority of interviewees discussed the financing of activities related to nature restoration, which may also deliver positive adaptation co-benefits. Furthermore, discussions in most interviews became focused around nature-based solutions, even when other types of adaptation actions were raised. As one key informant from a project developer stated,

> *"We don't talk about adaptation finance, we talk about financing nature recovery, it's more evocative"*.

While interviewees highlighted the potential for adaptation co-benefits to be realised from nature-focused activities, such as those set out in Table 4, they also noted that these outcomes are rarely monitored or monetised in nature projects they are involved in. Practitioners highlighted their assumptions of positive benefits for outcomes such as flood risk mitigation, cooling effects on water bodies, and increased ecosystem resilience to acute climatic shocks from a variety of project types. But monetising these outcomes and driving greater investment is constrained by insufficient measures to quantify these outcomes.

*Table 4: Indicative list of adaptation co-benefits from nature projects*

| | |
|---|---|
| Storm water management | Urban cooling |
| River water cooling | Wind erosion control |
| Drought management | Protection of buildings and infrastructure |
| Wildfire prevention | New business opportunities |
| Reduced risk of tidal inundation | Food security |
| Flood resilience | Reduced pest and disease pressure |
| Soil stabilisation | Improved livestock welfare |

Informed by: Chausson *et al*, (2020); Donatti *et al*, (2020) Fedele & Donatti, (2021); Kapos *et al*, (2019); Tye, Pool & Lomeli, (2022); Mant, Rees & Garnett (2022).

### 4.2.2 Nascent regulatory innovation

There is an emerging regulatory environment for nature finance in Scotland, which interviewees identified as helping to drive innovation and investment. The Interim Principles for Responsible Investment in Natural Capital (Scottish Government, 2022) help to 'set the scene' and provide the over-arching basis for values-led, high integrity markets for natural capital, nature recovery, and associated outcomes. Although high-level and still at an interim stage, some interviewees noted that they provide a market signal of the regulatory focus of the Scottish Government and provide a starting point for values-led engagement between project developers and the private sector. As noted by a key informant from a public sector body,

> *"We cannot wait until things are perfect. We need to work together; we have to get on with it and act now."*

At an international level, the agreement on nature and biodiversity recovery and protection at the COP15 meeting of the Convention on Biological Diversity (CBD) in Montreal in December 2022[4], along with the introduction of the Taskforce on Nature-related Financial Disclosures (TNFD)[5], has further focused the attention of governments and private sector organisations on the need to increase finance and action for nature recovery, both domestically and worldwide.

The UK Government has recently published its Nature Markets Framework, which sets out to establish rules and governance arrangements for public-private partnerships, the roles of stacking and bundling monetizable outcomes, and set standards for viable projects (HM Government, 2023a).

Alongside this, the UK Government has tasked the British Standards Institute (BSI) to develop a suite of nature investment standards, which sets out to *"boost market confidence and increase private sector investment into nature recovery"*, in collaboration with devolved administrations including Scotland (BSI, 2023). But in a recent update to the process, the BSI has indicated that integrating outcomes related to flood management and water quality, for example, "*are not currently recommended for priority standards as they were deemed less ready due to the lack of evidence*" (BSI, 2023a). This suggests a gap in codifying and monetising adaptation co-benefits from nature projects – highlighted by two enabling entity key informants as "vital" for mobilising private investment for adaptation – may need to be addressed through other mechanisms.

### 4.2.3 Values-led market building

The focus from the Scottish Government to develop high integrity, values-led markets for carbon and nature – such as those set out in the Interim Principles for Responsible Investment in Natural Capital – had mixed perceptions among key informant interviewees. Two interviewees engaged in international finance markets, particularly voluntary carbon markets, noted the challenge of competition from other countries that are also seeking such an approach as a potential differentiator, in particular countries in the global south, such as Kenya. They highlighted the typically lower cost per unit for voluntary carbon credits in the global south compared to Scotland, and in a free trading market environment, this may pose a challenge to identifying buyers of such credits in Scotland.

On the other side of this debate, key informants from project developers and enabling entities highlighted the added value of both the additional benefits which are often bundled into carbon

[4] UN Biodiversity Conference (COP15), https://www.unep.org/un-biodiversity-conference-cop-15
[5] TNFD, https://tnfd.global/

credits in Scotland – including in some cases adaptation outcomes related to flood risk mitigation – as well as issues of "national pride", buyers increasingly focused on stronger connections with local communities, the perception of credibility and transparency of information in Scotland, and in some cases (for locally-based carbon credit and/or outcome buyers) the potential to derive direct and indirect benefits from local projects.

Policies and regulations for governing nature and biodiversity finance are emerging in Scotland and the UK more widely. The Scottish Government is currently consulting on legislation for Community Wealth Building (Scottish Government, 2023), which can,

> *"play a key role in a just transition to a net zero, circular, nature-positive economy and in rebuilding natural capital including through actions such as sustainable procurement, a focus on fair and green jobs, green investment decisions and recognising the ecological value of land".*

Establishing these 'rules of the market' is an important step to helping create a more enabling environment for private investment in both nature and adaptation. But currently, codes and standards vary in their approach to ensuring market integrity. Some approaches do not have transparent or standardised approaches to measurement, reporting and verification or review approaches on a case-by-case basis (Reed, McCarthy, Jensen, & Rudman, 2023).

#### 4.2.4 Land use and management

Scotland's Land Use Strategy notes that we will not be able to adapt to climate change without changes to the way we use, manage, and live on our land. Climate change will have significant impacts on the functioning of land and nature in Scotland, and implications for land use and management to address the interlinked climate and nature crises.

One of the major challenges of utilising land use changes to deliver climate and nature outcomes is the tensions of land ownership, control, and governance in Scotland. While the Interim Principles for Responsible Investment in Natural Capital urge a focus on "engagement and collaboration", "land rights and responsibilities", and delivering "public, private and community benefit" (Scottish Government, 2022), experiences to date of some projects seeking to maximise carbon sequestration revenues have not always met these expectations (Zamuruieva, et al., 2023).

Increased demands for land in Scotland to deliver a range of climate and environmental benefits, including adaptation and carbon sequestration, are driving up land prices (Scottish Land Commisssion, 2023). This risks locking out community ownership and minimising opportunities for inclusive, place-based adaptation action.

#### 4.2.5 Public and private initiatives for market innovation

Support for innovation in nature finance arrangements was seen by key informants as particularly helpful. Support through innovation programmes such as FIRNS (The Facility for Investment Ready Nature in Scotland) will enable public, private, and third-sector partners to test out new approaches to mobilise private finance for nature restoration (NatureScot, 2023). By combining initial grant funding for business case development with technical assistance to take projects from a concept stage to 'investment ready' stage, initiatives such as FIRNS may help to address the financing barrier of an insufficient pipeline of investment-ready projects that may achieve adaptation outcomes.

Support through the CivTech Challenge funding scheme in Scotland is looking to address both critical information gaps – such as data management on the state of natural ecosystems – and support the development of innovative financial products such as 'biodiversity tokens' to increase private investment and financing of nature-based solutions (CivTech, 2023).

Similar moves are being made by private companies in Scotland, such as AECOM's Natural Capital Lab near Loch Ness, which aims to develop new tools and methodologies for assessing and monitoring ecosystem services from nature restoration actions, which may ultimately help to create more robust methods for monetising ecosystem services (AECOM, 2023).

The recent commercial loan of over £20 million by Triodos Bank to Oxygen Conservation for a multi-faceted low-carbon, climate-resilient nature regeneration project in two large estates in Scotland – believed to be the UK's largest ever nature-based commercial debt deal (Triodos, 2023) – demonstrates both the increased interest in this field as well as the emergence of viable business models that do not require grant capital to succeed.

There is also emerging project and market innovation to deliver climate resilience for freshwater environments. In Scotland, the Riverwoods Investment Readiness Pioneers initiative – led by the Scottish Wildlife Trust – aims to create a 'nature super network' through the regeneration waterways and riparian woodlands across Scotland to deliver natural flood management, biodiversity gains, carbon sequestration, and cooling of waterbodies (Riverwoods, 2023).

Moreover, the UK Government has tasked the Forestry Commission with developing a new Woodland Water Code (HM Government, 2023a). This aims to develop a common, measurable approach to creating markets for improvements in water quality from riparian tree planting (HM Government, 2021). Together with the Biodiversity Net Gain[6] legislation (HM Government, 2023), this marks a move to coordinating markets for nature-related outcomes from the UK Government.

In England, the Rivers Trust is developing the Replenish scheme, supported by the DEFRA-led Natural Environment Investment Readiness Fund (Rivers Trust, 2022). Replenish will establish a Water Stewardship Standard which includes a focus on climate resilience and aims to attract private investment for 'water offsets' in water-scarce or depleted areas.

#### 4.2.6 International context

Other governments are also looking to overcome barriers to scaling up adaptation finance, such as the US and EU setting out clear commitments on financing. The US Government has committed over $0.5 billion to support innovative coastal resilience and adaptation solutions, such as building natural infrastructure, preparing for community-led relocation, and protecting coastal natural resources, part of a wider package of over $50 billion investment in climate adaptation, which aims to leverage significant volumes of private finance (Biden-Harris Administration, 2023).

In the EU, the Adaptation Strategy and Mission aims to mobilise significant public and private sector funds to close the adaptation finance gap. The associated Pathways2Resilience programme aims to improve the evidence base and enabling environment for adaptation, including by supporting regions to develop 'Adaptation Investment Plans' that will translate strategies into bankable projects and programmes (Horizon Europe, 2023).

[6] The UK Government Biodiversity Net Gain legislation does not apply to Scotland.

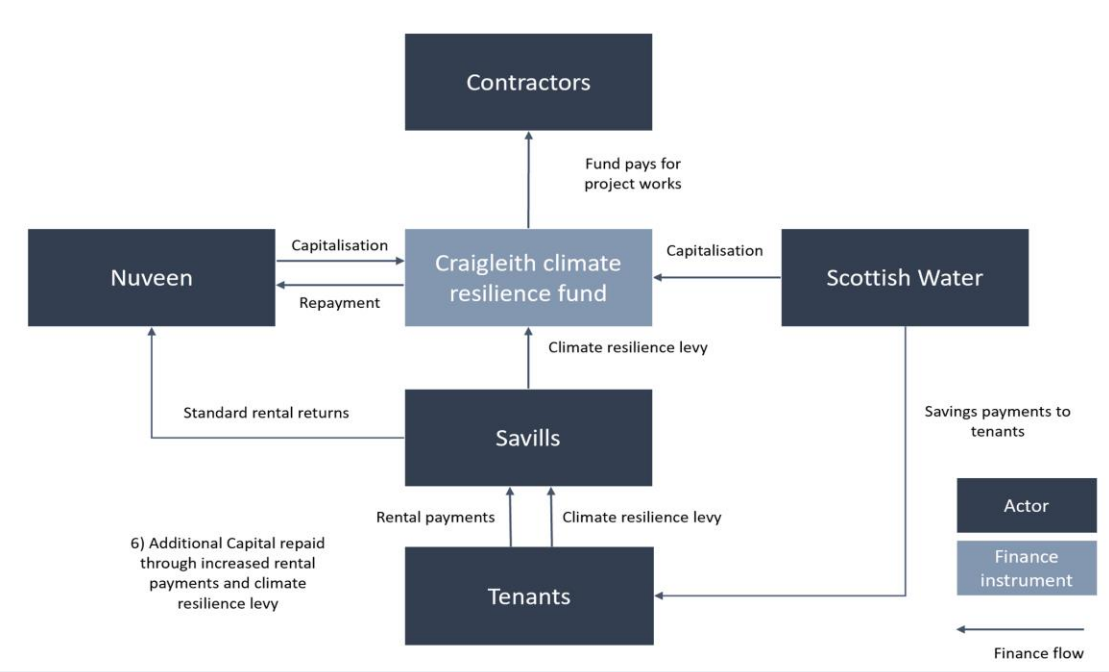
## CASE STUDY IN FINANCE INNOVATION: CRAIGLEITH RETAIL PARK

Craigleith Retail Park in Edinburgh has suffered from surface flooding, standing water, and degeneration of the car park in recent years. A 'partner ecosystem' of Sniffer, Scottish Water, Royal Botanic Gardens Edinburgh, Hydro Nation, Green Action Trust, City of Edinburgh Council, SEPA and NatureScot supported site owner Nuveen to explore the economic and financial case for a retrofit of nature-based solutions (NbS) at the site. This project, supported by analysis from Paul Watkiss Associates (England, Watkiss, & Hunt, 2023), developed a blended finance business model for the proposed work, reducing current and future flood risk whilst increasing property values, footfall, biodiversity and air quality.

The analysis of monetizable revenues found these to be modest, with the biggest benefits being the potential uplift in rental value of the retail park, followed by the potential savings from water entering the drainage system, though these benefits are uncertain. A set of wider economic benefits were considered, that included carbon benefits and ecosystem service value. These were found to be lower, and in many cases, it would be difficult to monetise these benefits, due to the small size of the scheme.

In the proposed model, public and private capital from Scottish Water and Nuveen is blended to invest in the scheme, with revenue streams created from higher rental value of the units, and reduced pressure on the drainage systems to repay the private investment. If implemented, the scheme would have a positive Net Present Value over a 30 year investment period. Although the project has not yet been taken forward, the work has proven the financial viability for blended finance for urban NbS, and laid the foundations for further roll out of similar NbS projects in privately-owned assets.

*Figure 1: Proposed blending finance model for Craigleith Retail Park project*



## 4.3 Evidence of adaptation as a primary focus of climate finance

### 4.3.1 Mixed appetite for adaptation focused finance

Opportunities exist to maximise synergies between nature finance and adaptation outcomes, but adaptation responses extend beyond nature-based approaches, so will require their own distinct market development and business models. However, the research identified a mixed appetite for adaptation as a primary focus of investment.

The perceived lack of immediate business need or opportunities is the main limitation, with key informant interviewees stating that they saw mature markets for more immediately monetizable outcomes – particularly the voluntary carbon and renewable energy markets – as demonstrating a clearer business case for private investment, a clearer regulatory environment to develop a public-private partnership, and the greater drive among private sector partners to address net-zero commitments.

Uncertainty of outcomes from adaptation projects, in particular nature-based adaptation initiatives, was highlighted by key informants from all four types of organisations. Working with nature is inherently less predictable than working with engineered infrastructure solutions. Interviewees from finance and project development organisations suggested that the immaturity of some adaptation and nature-based solutions means there is not yet the level of comparable performance data to make informed investment decisions, which can act as a barrier to mobilising investment.

An analysis of climate adaptation investment opportunities in Australia by Climate-KIC found no viable examples or opportunities in the country. An alternative approach to creating viable business models the authors developed was to combine projects of different types, with different risk and return characteristics to minimise transaction costs and maximise benefits, particularly where projects are implemented within a common landscape (Mortimer, Whelan, & Lee, 2020).

Key informants from financial institutions and enabling entities also noted how aggregating smaller projects into a single investment portfolio can achieve similar results. But analysis undertaken for the Craigleith Retail Park project notes the challenges of achieving aggregation of adaptation investments due to the high transaction costs and variable outcomes of site-specific adaptation interventions (England, Watkiss, & Hunt, 2023).

Meanwhile, interviewees engaged in nature and agriculture related projects highlighted the challenges faced by farmers who wish to engage in such projects, noting the challenge of uncertainty of the risks they may face due to climate change, with one project developer noting,

> *"Farmers are being told to dig bore holes or invest in water-saving technologies now, without knowing if they will ever really need those or face such severe droughts. When they're told that they might face drought in 20 years, that's not a financial motivation for them to invest."*

### 4.3.2 Delivery constraints

In many adaptation investments, the benefits and potential revenues that can be generated are realised over a long time period, sometimes several decades. This can create a challenge to typical commercial investment and financing models that operate on shorter timeframes of 3-7 years. Bridging the finance gap between these front-loaded costs and back-loaded revenues has been

highlighted as the area of greatest need to scale up the implementation of adaptation projects and nature-based solutions (Convergence, 2022) (NFU, 2023).

Interviewees from finance and project development organisations suggested that the relative immaturity of adaptation projects, and more broadly nature-based solutions, means there is not yet the level of comparable performance data to make informed investment decisions, which ultimately gives greater weight to more predictable and proven infrastructure solutions and a focus towards more mature markets for GHG mitigation. This suggests that despite the perception of some key informants that adaptation outcomes will only be a sub-set of outcomes from net-zero and nature projects, there is still latent demand for investment in adaptation-specific initiatives.

The costs and practicalities of developing sufficient, trustworthy, and transparent monitoring, reporting, and verification (MRV) systems for both carbon and non-carbon outcomes were highlighted by key informants as a particular barrier to unlocking investment in smaller scale projects and projects which aim to develop new types of revenue streams.

This challenge has also been highlighted in the Craigleith Retail Park case study, where the ability to model and then monitor the peak flow surges to the sewer drainage system has proven extremely difficult, with insufficient baseline data and no existing mechanism or model for ongoing outcome verification (England, Watkiss, & Hunt, 2023).

Project delivery risk was highlighted by finance sector and policy-maker interviewees as a key consideration in determining business case viability, as well as a core consideration for the insurance sector, particularly in relation to flood resilience outcomes. Moreover, the opportunity to use insurance products as a delivery risk reduction mechanism (i.e. insuring against contracted benefit delivery) was noted by an interviewee from a public sector body, as well as in the new UK Nature Markets Framework.

## 3.4 Climate risk disclosure as a market catalyst

The move to mandatory climate risk disclosures for large and listed companies across the UK is raising awareness among private sector organisations, particularly financial institutions, of the climate change risks posed to their assets and operations. The Taskforce for Climate-related Financial Disclosures (TCFD) framework reporting has been integrated into the Sustainability Disclosure Requirements (SDR) Framework in the UK, and large and listed companies facing mandatory disclosure are currently in their first reporting cycle (HM Government, 2023b).

Key informants from enabling entities and policy-making organisations shared an expectation that the increased transparency and visibility of material risks to the underlying financial state of businesses will shine a spotlight on the need for effective and timely climate adaptation action. This is also reflected in the Craigleith Retail Park project, where both the asset owner, Nuveen, and its parent company, TIAA, have increased their focus on understanding and responding to material business risks arising from the physical impacts of climate change (England, Watkiss, & Hunt, 2023).

The visibility of this disclosure information is expected to lead to increased pressure from finance providers, shareholders, staff, clients, customers and the wider public for businesses with identified material risks to develop adequate plans to minimise their exposure and sensitivity to climate risks. Key informants noted the potential for this to encourage businesses to look beyond the expectation that public finance and actions will be sufficient to respond to the material risks they face and encourage private investment, as well as encouraging investment in addressing systemic risks.

Regulations are also starting to integrate climate risk management and adaptation planning as a fundamental component of licencing agreements, such as those set out recently by the Environment Agency in England, which require detailed climate risk assessments and adaptation plans (HM Government, 2023c).

Furthermore, the Transition Plan Taskforce (TPT) has begun its second phase of work, which will now look at how climate adaptation, nature recovery, and just transition issues can be incorporated into transition plan standards (HM Government, 2023b). The expectation is that transition plan reporting will become a requirement for businesses alongside climate risk disclosures and GHG emissions reporting. Consequently, there will be increased expectation and pressure on businesses to set out credible adaptation plans, and thus drive greater investment into adaptation actions.

Similar work is underway to integrate adaptation into the UK Green Taxonomy, with those working on the issue through the Green Technical Advisory Group (GTAG) noting that adaptation considerations and definitions were largely lacking from the EU Green Taxonomy (GFI, 2023).

The combination of these reporting frameworks may create new incentives for businesses in Scotland to engage in partnerships to address climate risks. Nonetheless, the CCC reports that there is "*little to no evidence that [SDR reporting] is yet driving any significant increase in levels of private investment in climate adaptation*" (CCC, 2023). While this may be true at the time of that publication in January 2023, very few mandatory full disclosures have yet been made as companies are in their first reporting cycle. Therefore, it is reasonable to suggest that such an effect may be identified in the coming years.

There is a concern that the asset-level reporting focus of risks under the TCFD framework may lead to only asset-level adaptation responses from businesses. This incremental adaptation activity may address the specific risk the business faces, but it may not lead to more transformative adaptation that benefits wider society.

## 5. Opportunities for developing adaptation finance in Scotland

Based on the findings above, a range of opportunities have been identified to help address the barriers to adaptation finance, to stimulate the demand for investing in adaptation in Scotland, and to accelerate the pace and scale of adaptation finance, particularly from private sources. The insights from the interviewees and literature of the opportunities to address the barriers to adaptation finance, are summarised in Table 5 and explored in more detail in the following report sections. These opportunities could be addressed by a range of actors, including Scottish and UK Governments, other public sector bodies, research institutes, investors and businesses, philanthropic funders and community and third sector organisations.

*Table 5: Summary of opportunities*

| Approaches | Barriers addressed |
|---|---|
| Vision of a well-adapted Scotland | • Behavioural<br>• Policy |
| Quantification of adaptation finance | • Behavioural<br>• Policy and regulatory |
| Develop high-integrity, values-led adaptation markets and codes | • Market and financial<br>• Policy |
| Mainstream adaptation in existing market codes | • Market and financial<br>• Policy and regulatory |
| Grant funds for project innovation | • Bankability<br>• Informational<br>• Behavioural |
| Blended finance models | • Bankability<br>• Market and financial<br>• Behavioural |
| Open data platforms | • Informational |
| Develop common adaptation metrics and MRV standards | • Technical<br>• Informational |
| Project delivery innovation | • Bankability<br>• Technical<br>• Behavioural<br>• Market and financial |
| Knowledge management and information sharing | • Informational |
| Partnership brokering | • Behavioural<br>• Informational<br>• Market and financial |
| SME support | • Informational<br>• Technical<br>• Behavioural |

## 5.1 Policy drivers of an enabling environment for adaptation finance

There are a number of an opportunities to align policy approaches to support the achievement of the opportunities identified from the research set out below. This includes the development of the Scottish Government's Third Scottish Climate Change Adaptation Programme (herein SCCAP3), as well as policies in the water, agriculture and other land use sectors in Scotland that can support the creation of more enabling environment for adaptation finance.

### 5.1.1 Ambition and vision

A clear vision of what a well-adapted Scotland would look like, and the level of ambition expected by all actors across public, private, and third sector organisations, was highlighted by key informant interviewees, as well as the CCC (CCC, 2023), as a critical step in mobilising greater investment in climate adaptation from both the private and public sector.

### 5.1.2 Quantification of adaptation finance need

A quantification of the adaptation finance needed to deliver on national adaptation outcomes would provide a market signal as to the scale of the challenge, and the opportunity it presents, including an assessment of costs for early action versus delayed action in different sectors and/or regions. This

analysis could also be informed by utilising data reported in TCFD-aligned climate risk disclosures, creating a positive feedback loop of data and decision-making.

A good example of quantifying adaptation finance needs is the Technology Needs Assessment process, such as that of Antigua and Barbuda. This follows the methodology from the Copenhagen Climate Change Centre, which has supported more than 60 countries to undertake similar climate technology needs assessments since 2009. This identifies a number of specific adaptation projects and technologies, with associated public and private investment needs for each (Government of Antigua and Barbuda and UNEP Copenhagen Climate Centre, 2022).

Such an analysis could provide the Scottish Government, local authorities, and businesses with a clear picture of the need, the expected contributions from different sectors. It could also provide an opportunity for prioritisation of initiatives to address adaptation finance gaps.

#### 5.1.3 Develop high integrity, values-led adaptation markets

The importance of developing strong codes and standards for green finance outcomes was prioritised by a majority of respondents to the UK Green Finance Review Survey as a key way to develop new markets (Finance Earth & Heritage Fund, 2022). The development of adaptation market codes to determine and measure adaptation outcomes is understood as a precondition to market development by key informants. This would allow adaptation outcomes to be formally integrated into project business models, and develop new revenue streams that incentivise adaptation action.

Developing market codes would enable a 'market' to develop around a common set of measurable and agreed outcomes, provide incentives and benchmarking for investors and project developers, develop quantifiable and comparable data, and develop trust in the monitoring and verification systems. They may also support the Scottish Government's aim of having "high integrity, values led" finance markets, which allow coordination towards wider national priorities.

There is an opportunity for Scotland to stay at the forefront of innovation and integrity in natural capital and carbon markets, and to continue to position itself as a pioneer on climate adaptation and nature. Standards for high quality, high integrity adaptation markets could give Scotland first-mover advantage at a time when adaptation action may be under the spotlight through TCFD and transition plan reporting.

#### 5.1.4 Mainstreaming adaptation in existing market codes

Recognising the perception of finance sector key informants that adaptation finance may best be addressed as a sub-set of other areas of finance and adaptation outcomes derived as positive co-benefits of other interventions, integrating measurement of adaptation outcomes into existing and emerging nature and carbon market standards and codes could unlock opportunities for financing adaptation in existing market systems.

Existing codes do not fully capture all possible benefits[7], therefore project developers and enabling entities could encourage the integration of adaptation considerations into existing codes and standards for voluntary carbon markets, nature and biodiversity markets, for example the Interim Principles for Responsive Investment in Natural Capital in Scotland, or the Peatland Carbon Code[8] at the UK level.

[7] See discussion in Section 4.2.2, and further discussion in (Reed, McCarthy, Jensen, & Rudman, 2023).
[8] IUCN Peatland Carbon Code UK, https://www.iucn-uk-peatlandprogramme.org/peatland-code-0

'Mainstreaming' adaptation in this way could ensure adaptation outcomes are more likely to be identified and monetised in projects, potentially lead to greater prioritisation of adaptation outcomes in non-adaptation focused initiatives, and be less likely to lead to maladaptation where climate adaptation considerations have been insufficiently addressed.

A positive example of this being undertaken at a national level is in Canada, where the Standards Council of Canada has co-produced with Manifest Climate a 'Guide for Integrating Climate Change Adaptation Considerations into Canadian Standards' (Standards Council of Canada & Manifest Climate, 2021).

## 5.2 Innovations for mobilising private adaptation finance

### 5.2.1 Grant funds for project innovation

Grant funding for project development, focused on investment readiness, provided through programmes like FIRNS and others set out in Section 4, can support innovation and crowd in adaptation investment. The technical assistance they provide helps to take a project from a concept to an investable business model, and may also provide a level of confidence to potential private finance providers. To maximise adaptation finance opportunities, existing project innovation schemes could integrate a focus on measuring and delivering adaptation outcomes, following the 'adaptation mainstreaming' approach.

### 5.2.2 Blended finance to facilitate private investment

Strategic use of public finance can be used to facilitate private investment and finance for adaptation action. This has been demonstrated conceptually through the Craigleith Retail Park case study, where the use of partially-returnable public funding from Scottish Water could be used to encourage and facilitate co-investment of returnable finance from asset owners, Nuveen.

Nonetheless, it remains to be seen if a similar approach could be successful in mobilising private finance for adaptation interventions implemented beyond a specific asset level for more transformative, landscape-level collective adaptation action. Broadly, similar innovations in project financing are required to bridge the gap between front-loaded costs and back-loaded revenues. This includes the long-term financing of site maintenance. Innovative approaches to this are emerging, such as CreditNature's Nature Impact Token approach, which aims to release sequential 'editions' of verified tokens at different stages of ecosystem recovery (CreditNature, 2022).

### 5.2.3 Open data platforms and common metrics

Addressing data gaps and information asymmetries will be important in closing the adaptation finance gap. A new, coordinated approach to data management could help to overcome concerns of outcome and delivery uncertainty, of comparability between different projects and investments, the ability to benchmark effectiveness, and of revenue predictability.

This could include a national level initiative for developing a FAIR Data[9] approach (Wilkinson, et al., 2016) (CABI, 2022) for climate adaptation and nature-based solutions in Scotland, and for local risk data and climate projections. A public data platform could also support businesses in Scotland to develop better informed climate risk analyses and transition plans, and create a more enabling environment for adaptation investment. Ongoing work by Dark Matter Labs and Lucidminds is exploring open data approaches for adaptation outcomes and common datasets for regional flood

[9] FAIR stands for "findability, accessibility, interoperability, and reusability" of data.

resilience planning as part of their Trees As Infrastructure (TreesAI) project in Glasgow city region (Conte, Treger, & Koulouri, 2023).

Key informants suggested industry bodies in Scotland could pave the way in developing commonly agreed metrics, standards, and 'look-up tables' for blue-green infrastructure and other types of adaptation approaches. In addition, the 'outcome lag' should be factored into the business modela of adaptation projects. This could increase confidence in the deliverability of adaptation projects, help create comparable business models and revenue calculations, and ultimately lower transaction costs for new projects.

#### 5.2.4 Project delivery innovation

There is clear interest among key informants in demonstrating the potential adaptation co-benefits of mitigation and nature recovery initiatives. But this is not routinely and systematically being developed at the project initiation stage, meaning opportunities for identifying and developing a clearer business case for stacking or bundling monetizable adaptation outcomes is being missed. Valuing ecosystem services remains challenging and there are a range of divergent approaches.

Focusing on the ability to deliver multiple benefits and monetise several revenue streams – for example from voluntary carbon markets, eco-tourism, sale of products and services, and flood risk reduction – is seen as a crucial means of creating 'bankable' adaptation projects by key informants. While in some cases this will involve 'stacking' – developing separate markets for each outcome area – there is growing interest in the role of 'bundling' – monetising one aspect, but measuring impact on multiple areas.

An innovative example of bundling is the Wilder Carbon Standard, which aims to demonstrate biodiversity gains from certified carbon credit schemes (Wilder Carbon, 2023). Recent analysis has shown that globally, bundling is able to generate revenues 30% higher than standard carbon credits (Lou, Hultman, Patwardhan, & Qiu, 2022) (Hurley, Grandemange, Hume, & O'Halloran, 2023).

Project level insurance is one potential means of de-risking investment for all types of stakeholders, but particularly private sector finance providers (Jarzabkowski, et al., 2019). The ability to insure a project against an agreed suite of deliverable metrics could be particularly helpful for nature-based projects, where the uncertainties of dealing with nature and the risks from unexpected shocks, extreme weather events, and pests and diseases could otherwise deter finance providers.

### 5.3 Collaboration and support services

#### 5.3.1 Regional adaptation planning

Regional adaptation planning, led by local authorities, provides an opportunity for coordinated investment analysis for strategic regional priorities. It can help to coalesce investment around projects that can deliver transformative adaptation and facilitate inclusive planning and governance (Granberg, Bosomworth, Moloney, Kristianssen, & Funfgeld, 2019).

Regions in Scotland can learn from the progress made in the Climate Ready Clyde initiative, which developed a resource mobilisation plan alongside its regional adaptation strategy and action plan (Climate Ready Clyde, 2021), as well as Nepal's community-led Local Adaptation Planning approach, which 'downscaled' the National Adaptation Plan for locally-prioritised action (Watts, 2013).

Regional approaches to adaptation planning and investment prioritisation can particularly help to overcome barriers to investment and drive transformational adaptation through three key means:

- Minimising costs of adaptation action – this may be through shared use of infrastructure, materials, or financing; or by reducing transaction costs (UNEP-CCC & TEC, 2022).
- Maximising outcomes and co-benefits – many adaptation interventions are more effective when applied at scale in a coordinated manner, compared to smaller, fragmented actions (Chausson, et al., 2020).
- Improved monitoring, reporting, verification, and evaluation – it can be easier to assess changes in climate vulnerability and resilience at a regional scale from the implementation of a suite of coordinated adaptation interventions, compared to assessing the impact of a single project at a smaller scale in a specific locality (Werners, Wise, Butler, Totin, & Vincent, 2021).

### 5.3.2 Knowledge management and information sharing

There is an opportunity for an organisation or consortium of organisations to play a facilitating role in addressing some of the informational and technical barriers to adaptation finance in Scotland by developing a widely accessible knowledge management and information sharing platform. This could ensure that new approaches and innovative business models are more accessible and better understood by those working – or looking to work – on adaptation interventions in Scotland.

Recent analysis of over 50 adaptation finance initiatives found that national and regional platforms, and those that develop their own resources, have greater engagement and traction among members. It also identified, similar to this study, that investment-grade data on adaptation solutions and a better understanding of nature-based solutions are two critical knowledge gaps that knowledge management platforms could address (Casey, 2022). Industry specific initiatives, such as in agriculture, infrastructure, and energy, could also help to overcome informational and technical barriers to adaptation finance in Scotland.

### 5.3.3 Partnership brokering and collaboration support

A challenge to developing successful adaptation initiatives and business models in Scotland is identifying the right partners to engage and work with. This is also crucial for achieving equitable outcomes and adherence to the responsible investment principles of inclusion and fairness. There is an opportunity therefore for organisations across Scotland to take a lead on brokering these new partnerships and collaborations, to accelerate action and help ensure all stakeholders are aware of and/or engaged in new initiatives. This could also align with the knowledge management function.

### 5.3.4 Support for SMEs

While the largest businesses in the UK now face mandatory requirements to disclose material climate risks, SMEs could be left behind in their capabilities to identify and respond to physical climate risks (Klein & Mikaelsson, 2023). Given SMEs account for over 99% of businesses and 56% of private sector employment in Scotland (Scottish Government, 2022a), providing targeted support to this crucial but highly heterogeneous group of businesses could help to nurture increased demand for adaptation investment, help create stronger businesses cases for adaptation initiatives, and encourage greater collaboration with communities and public and private sector organisations.

Targeted support for SMEs and low-income households is particularly required, as they currently lack the support and capacity to adequately identify climate risks and invest in sufficient responses and retrofit premises (Klein & Mikaelsson, 2023) (Manifest Climate, 2023). Actions could involve grant and subsidy schemes alongside the provision of technical assistance for SMEs to determine climate vulnerabilities. This could help to develop industry skills for adaptation solutions, stimulating the growth, maturity, and scale of these markets.

# References


AECOM. (2023). *Natural Capital Laboratory*. Retrieved 04 26, 2023, from https://aecom.com/uk/natural-capital-laboratory/

APPG Sustainable Finance. (2023). *Introductory Guide to Green Finance.* Retrieved from https://appgsusfin.org/introductory-guide-to-green-finance/

Biden-Harris Administration. (2023, June 19). Retrieved from The White House: https://www.whitehouse.gov/briefing-room/statements-releases/2023/06/19/fact-sheet-biden-harris-administration-makes-historic-investments-to-build-community-climate-resilience/

BSI. (2023). *The Nature Investment Standards Programme*. Retrieved April 28, 2023, from https://www.bsigroup.com/en-GB/about-bsi/uk-national-standards-body/sustainability-and-climate-action/nature-investment/

BSI. (2023a). *A high-integrity standards framework for UK nature markets - Nature Investment Standards (NIS) programme: an update following BSI's initial discovery stage.* BSI. Retrieved from https://www.bsigroup.com/en-gb/about-bsi/uk-national-standards-body/sustainability-and-climate-action/nature-investment/a-high-integrity-standards-framework-for-uk-nature-markets/

CABI. (2022). CABI Data Sharing Toolkit. Wallingford, UK. Retrieved April 30, 2023, from https://www.datasharingtoolkit.org/

Casey, J. P. (2022). *Climate finance mobilization initiatives – Promoting climate adaptation in agriculture.* Wallingford, UK: CABI. Retrieved from https://www.casaprogramme.com/evidence-details/?pan=20228400018

CCC. (2022). *Is Scotland climate ready? 2022 Report to Scottish Parliament.* Retrieved from https://www.theccc.org.uk/publication/is-scotland-climate-ready-2022-report-to-scottish-parliament/

CCC. (2023). *Investment for a well-adapted UK.* Retrieved from https://www.theccc.org.uk/publication/investment-for-a-well-adapted-uk/

CERG. (2023). *Briefing Paper: Enabling local authorities to unlock private finance.* Retrieved from https://cerg.scot/wp-content/uploads/2023/08/CERG-Briefing-Paper-Local-Authorities.pdf

Chausson, A., Turner, B., Seddon, D., Chabaneix, N., Girardin, C. A., Kapos, V., . . . Seddon, N. (2020, November). Mapping the effectiveness of nature-based solutions for climate change adaptation. *Global Change Biology, 26*(11), 6134-6155. doi:https://doi.org/10.1111/gcb.15310

CivTech. (2023). *CivTech*. Retrieved 04 26, 2023, from https://www.civtech.scot/

Climate Ready Clyde. (2021). *Glasgow City Region Climate Adaptation Strategy and Action Plan.* Retrieved from http://climatereadyclyde.org.uk/adaptation-strategy-and-action-plan/

COACCH. (2021). *The Economic Costs of Climate Change in Europe: Policy Summary Europe.* Retrieved from https://www.coacch.eu/wp-content/uploads/2018/03/Policy-brief-Policy-maker-EUROPE-final.pdf

Conte, C., Treger, C., & Koulouri, K. (2023). *TreesAI: Unlocking system barriers to finance Nature-based Solutions.* Retrieved from https://provocations.darkmatterlabs.org/treesai-unlocking-system-barriers-to-finance-nature-based-solutions-398e9d618623

Convergence. (2022). *State of Blended Finance 2022: Climate Edition.* Retrieved from https://www.convergence.finance/resource/state-of-blended-finance-2022/view

CPI. (2022). *G7 Progress Report: Adaptation & Resilience Investors Collaborative.* Retrieved from https://assets.bii.co.uk/wp-content/uploads/2022/06/23091631/G7-Progress-Report-June-2022-Final.pdf

CreditNature. (2022). *Nature Impact Tokens*. Retrieved from CreditNature: https://creditnature.com/nature-impact-tokens/

Donatti, C., Harvey, C., Hole, D., Panfil, S., & Schurman, H. (2020). Indicators to measure the climate change adaptation outcomes of ecosystem-based adaptation. *Climatic Change, 158*, 413–433. doi:https://doi.org/10.1007/s10584-019-02565-9

England, K., Watkiss, P., & Hunt, A. (2023). *Adaptation Finance Case Study 2023: Finance Model for Craigleith Retail Park Demonstrator.* Retrieved from Forthcoming

Fedele, G., & Donatti, C. (2021). *Nature-based Solutions for Adaptation.* Retrieved from Conservation International: https://www.conservation.org/docs/default-source/publication-pdfs/nbs-for-adaptation-fact-sheet-web.pdf?Status=Master&sfvrsn=23c4209_2

Finance Earth & Heritage Fund. (2022, March). *UK Green Finance Review: Opportunities for Growing Investment in Preserving our Natural Heritage and Supporting Nature Recovery.* Retrieved from https://www.heritagefund.org.uk/sites/default/files/media/attachments/Finance-Earth-UK-Green-Finance-Review-Heritage-Fund-February-2022.pdf

Frontier Economics and Paul Watkiss Associates. (2022). *Barriers to Financing Adaptation Actions in the UK.* Retrieved from https://www.theccc.org.uk/publication/barriers-to-financing-adaptation-actions-in-the-uk-frontier-economics-paul-watkiss-associates/

GFI. (2021). *The Finance Gap for UK Nature.* Retrieved from /https://www.greenfinanceinstitute.co.uk/wp-content/uploads/2021/10/The-Finance-Gap-for-UK-Nature-13102021.pdf

GFI. (2023, February). *Green Technical Advisory Group (GTAG)*. Retrieved April 29, 2023, from https://www.greenfinanceinstitute.co.uk/programmes/uk-green-taxonomy-gtag/

Government of Antigua and Barbuda and UNEP Copenhagen Climate Centre. (2022). *Antigua and Barbuda Technology Needs Assessment - Technology Action Plan for Climate Change Adaptation.* Retrieved from https://tech-action.unepccc.org/wp-content/uploads/sites/2/2023/02/tap-antigua-barbuda-final.pdf

Granberg, M., Bosomworth, K., Moloney, S., Kristianssen, A.-C., & Funfgeld, H. (2019, December). Can Regional-Scale Governance and Planning Support Transformative Adaptation? A Study of Two Places. *Sustainability, 11*(24). doi:https://doi.org/10.3390/su11246978

HM Government. (2021, May 18). *Nature for people, climate and wildlife.* Retrieved May 15, 2023, from https://www.gov.uk/government/publications/nature-for-people-climate-and-wildlife/nature-for-people-climate-and-wildlife

HM Government. (2023, May 2). *Biodiversity Net Gain.* Retrieved May 15, 2023, from https://www.gov.uk/government/collections/biodiversity-net-gain

HM Government. (2023a). *Nature Markets Framework.* Retrieved from https://www.gov.uk/government/publications/nature-markets

HM Government. (2023b). *Mobilising green investment: 2023 green finance strategy.* Retrieved from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1149690/mobilising-green-investment-2023-green-finance-strategy.pdf

HM Government. (2023c, April 3). *Climate change: risk assessment and adaptation planning in your management system*. Retrieved from Environment Agency: https://www.gov.uk/guidance/climate-change-risk-assessment-and-adaptation-planning-in-your-management-system

Horizon Europe. (2023). *Pathways2Resilience*. Retrieved August 31, 2023, from Pathways2Resilience: https://www.pathways2resilience.eu/

Hurley, G., Grandemange, Y., Hume, A., & O'Halloran, F. (2023). *Mobilising Private Investment in Natural Capital.* Retrieved from https://www.gov.scot/publications/mobilising-private-investment-natural-capital/

Jarzabkowski, P., Chalkias, K., Clarke, D., Iyahen, E., Stadtmueller, D., & Zwick, A. (2019). *Insurance for Climate Adaptation: Opportunities and Limitations.* Centre for Disaster Protection. Retrieved from https://www.disasterprotection.org/publications-centre/insurance-for-climate-adaptation-opportunities-and-limitations

Kapos, V., Wicander, S., Salvaterra, T., Dawkins, K., & Hicks, C. (2019). *The role of the natural environment in adaptation.* Global Commission on Adaptation. Retrieved from https://gca.org/wp-content/uploads/2020/12/RoleofNaturalEnvironmentinAdaptation_V2.pdf

Klein, R. J., & Mikaelsson, M. A. (2023). *The Role of Businesses in Climate Adaptation.* SEI. Retrieved from https://globalchallenges.org/policy-discussion-brief-the-role-of-businesses-in-climate-adaptation/

Lou, J., Hultman, N., Patwardhan, A., & Qiu, Y. L. (2022). Integrating sustainability into climate finance by quantifying the co-benefits and market impact of carbon projects. *Communications Earth & Environment, 3*(137). doi:https://doi.org/10.1038/s43247-022-00468-9

Manifest Climate. (2023, April 20). *Medium-sized businesses must seize the opportunity to become climate leaders*. Retrieved May 17, 2023, from Capital Monitor: https://capitalmonitor.ai/partner-content/medium-sized-businesses-climate-leaders/

Mant, A., Rees, L., & Garnett, E.-R. (2022). *Innovation Insights: Nature-based Solutions & Climate Resilience.* UKGBC. Retrieved from https://ukgbc.org/resources/innovation-insights-nature-based-solutions-climate-resilience/

Mitchenall, T. (2023, May 9). *The 'who pays?' debate around ESG monitoring and reporting rages on*. Retrieved May 16, 2023, from New Private Markets: https://www.newprivatemarkets.com/the-who-pays-debate-around-esg-monitoring-and-reporting-rages-on

Mortimer, G., Whelan, B., & Lee, C. (2020). *Adaptation Finance: Emerging approaches to solve the climate adaptation finance gap.* Climate-KIC Australia. Retrieved from https://climate-kic.org.au/work/projects-programs/adaptation-finance/

Murtagh, E., Watkiss, P., Khosla, S., Beswick, A., England, K., Connor, B., . . . Robinson, P. (2021). *A Guide to Climate Adaptation Finance.* Edinburgh, UK: Adaptation Scotland. Retrieved from

https://www.adaptationscotland.org.uk/application/files/9016/6255/4638/A_Guide_to_Adaptation_Climate_Finance.pdf

Natural History Museum. (2022). *Biodiversity Trends Explorer.* Retrieved from https://www.nhm.ac.uk/press-office/press-releases/natural-history-museum-reveals-the-world-has-crashed-through-the.html

NatureScot. (2023, February 17). *FIRNS - The Facility for Investment ready Nature in Scotland*. Retrieved May 15, 2023, from https://www.nature.scot/funding-and-projects/firns-facility-investment-ready-nature-scotland

NFU. (2023, May 18). Financing nature based solutions in agriculture. Online: BSI. Retrieved from https://global.gotowebinar.com/join/2521677572465823839/171535159

Ranger, N., Bremmer, C., Brown, K., England, K., Frankhauser, F., Holmes, I., & Howard Boyd, E. (2023). *Mission Climate Ready: Unleashing finance and investment for a prosperous Climate Ready economy.* Oxford: Oxford University. Retrieved from https://www.smithschool.ox.ac.uk/sites/default/files/2023-07/Mission-Climate-Ready-Unleashing-finance-and-investment-REPORT_1.pdf

Reed, M. S., McCarthy, J. M., Jensen, E. A., & Rudman, H. (2023, May 12). Governing high-integrity ecosystem markets. doi:https://doi.org/10.31223/X5ZH3D

Rivers Trust. (2022, May 31). *New opportunities to invest in nature as The Rivers Trust receives £180,000 in funding*. Retrieved from https://theriverstrust.org/about-us/news/new-opportunities-to-invest-in-nature-neirf

Riverwoods. (2023, April 3). *Riverwoods Investment Readiness Pioneers*. Retrieved April 29, 2023, from https://www.riverwoods.org.uk/project/riverwoods-investment-readiness-pioneers/

Scottish Government. (2019). *Second Scottish Climate Adaptation Programme 2019-2024.* Retrieved from https://www.gov.scot/binaries/content/documents/govscot/publications/strategy-plan/2019/09/climate-ready-scotland-second-scottish-climate-change-adaptation-programme-2019-2024/documents/climate-ready-scotland-second-scottish-climate-change-adaptation-prog

Scottish Government. (2022, March 31). Interim Principles for Responsible Investment in Natural Capital. Retrieved from https://www.gov.scot/publications/interim-principles-for-responsible-investment-in-natural-capital/

Scottish Government. (2022a). *Businesses in Scotland: 2022.* Retrieved from https://www.gov.scot/publications/businesses-in-scotland-2022/

Scottish Government. (2023). *Community Wealth Building Consultation.* Retrieved from https://www.gov.scot/binaries/content/documents/govscot/publications/consultation-paper/2023/01/building-community-wealth-scotland-consultation-paper/documents/building-community-wealth-scotland-consultation-paper/building-community-wealth-scotland-consul

Scottish Land Commisssion. (2023). *Scotland's Rural Land Market: Review of 2022 Insights.* Retrieved from https://www.landcommission.gov.scot/downloads/646b052f67ad2_Summary%20of%20Rural%20Land%20Markets%20Insights%20report%202023.pdf

Standards Council of Canada & Manifest Climate. (2021). *Guide for Integrating Climate Change Adaptation Considerations into Canadian Standards.* Retrieved from

https://www.manifestclimate.com/wp-content/uploads/2021/05/SCC_Climate_Change_Guide_EN.pdf

The People's Plan for Nature. (2023). *The People's Plan for Nature: Report on outcomes of a RAPID democracy process.* Retrieved from https://wild-isles.cdn.prismic.io/wild-isles/6d07f66b-312c-4b4c-9f1e-b8b11370af32_PPFN-Report-Final+%28new%29.pdf

Triodos. (2023, April 13). *Oxygen Conservation and Triodos Bank UK announce landmark conservation-focused debt package*. Retrieved April 30, 2023, from https://www.triodos.co.uk/press-releases/2023/oxygen-conservation-and-triodos-bank-uk-announce-landmark-conservation-focused-commercial-debt-package

Tye, S., Pool, J.-R., & Lomeli, L. (2022). *The Potential For Nature-Based Solutions Initiatives to Incorporate and Scale Climate Adaptation.* WRI. doi:https://doi.org/10.46830/wriwp.21.00036

UNEP. (2022). *Adaptation Gap Report 2022.* Retrieved from https://www.unep.org/resources/adaptation-gap-report-2022

UNEP. (2022a). *State of Finance for Nature. Time to act: Doubling investment by 2025 and eliminating nature-negative finance flows.* Retrieved from https://www.unep.org/resources/report/state-finance-nature-2022

UNEP. (2023). *State of Finance for Nature in Cities 2023.* Retrieved from https://www.greenfinanceplatform.org/research/state-finance-nature-cities-2023

UNEP-CCC & TEC. (2022). *Climate Technology Progress Report 2022.* Copenhagen: UNEP. Retrieved from https://tech-action.unepccc.org/wp-content/uploads/sites/2/2023/05/the-climate-technology-progress-report-2022-web.pdf

Walton, P., Eaton, M., Stanbury, A., Hayhow, D., Brand, A., Brooks, S., . . . Wormald, K. (2019). *The State of Nature: Scotland 2019.* The State of Nature Partnership. Retrieved from https://www.nature.scot/doc/state-nature-scotland-report-2019

Watts, R. (2013). *Linking National and Local Adaptation Planning: Lessons from Nepal.* IDS. Retrieved from https://www.ids.ac.uk/download.php?file=files/dmfile/LHcasestudy03-NepalLAPA.pdf

Werners, S. E., Wise, R. M., Butler, J. R., Totin, E., & Vincent, K. (2021, February). Adaptation pathways: A review of approaches and a learning framework. *Environmental Science & Policy, 116*, 266-275. doi:https://doi.org/10.1016/j.envsci.2020.11.003

Wilder Carbon. (2023, April 17). *Wilder Carbon Standard for Nature and Climate Version 2*. Retrieved from Wilder Carbon: https://www.wildercarbon.com/publications/wilder-carbon-standard-for-nature-and-climate-version/

Wilkinson, M. D., Dumontier, M., Aalbergsberg, I. J., Appleton, G., Axton, M., Baak, A., . . . Mons, B. (2016, March 15). The FAIR Guiding Principles for scientific data management and stewardship. *Scientific Data, 3*(160018). doi:https://doi.org/10.1038/sdata.2016.18

Young, D., Aboobakar, A., Curtis, T., Draisey, Z., Fitton, R., Grundman, L., . . . Twining, S. (2022). *Financing Nature Recovery UK.* Retrieved from https://irp.cdn-website.com/82b242bb/files/uploaded/FINAL%20Financing%20UK%20Nature%20Recovery%20Final%20Report%20ONLINE%20VERSION.pdf

Zamuruieva, I., Payne, C., Wolstenholme, R., Connor, B., Cameron-Smith, A., & Beswick, A. (2023). *Land use and climate change adaptation in Scotland: insights.* Retrieved from *Forthcoming*

## Annex 1 - Interviewees

| Name | Organisation | Organisation type |
|---|---|---|
| Craig Love | Scottish National Investment Bank | Finance |
| Samuel Lampert | Mirova Investments | Finance |
| Alastair Ross | Association of British Insurers | Finance |
| Helen Avery | Green Finance Institute | Enabling entity |
| Ingrid Holmes | | |
| Sandie-Gene Muir | | |
| Charlie Endsor | | |
| Blanche de Biolley | | |
| Sneha Thayil | Convergence: Blended Finance | Enabling entity |
| Sumalee Khosla | UNEP-FI | Enabling entity |
| Peter Robinson | AECOM | Project developer |
| Ruchir Shah | Scottish Wildlife Trust | Project developer |
| Paul Jepson | CreditNature | Project developer |
| Katie Spooner | Environment Agency | Policy & decision-maker |
| Bill Donovan | | |
| Kate Dowen | Scottish Government – Natural Capital team | Policy & decision-maker |
| Brendan Freeman | The Climate Change Committee | Policy & decision-maker |
| Patrick Jean-Martel | NatureScot | Policy & decision-maker |
| Catherine Preston | SEPA | Policy & decision-maker |

Additional insights provided by members of AECOM, Scottish Wildlife Trust, Forest Carbon, Tweed Forum, TreesAI, and NatureScot at the Scottish Flood Risk Management Conference 2023.

Adaptation Scotland provides advice and support to help organisations, businesses and communities in Scotland prepare for, and build resilience to, the impacts of climate change.

Contact us:

- adaptationscotland@sniffer.org.uk
- http://www.adaptationscotland.org.uk/
- @Adaptationscot

The Adaptation Scotland Programme is funded by the Scottish Government and delivered by Sniffer.
Sniffer is a registered charity delivering knowledge based solutions to resilience and sustainability issues.

sniffer
knowledge brokers
for a resilient Scotland

Adaptation Scotland
supporting climate change resilience

**Sniffer**, Edinburgh Climate Change Institute, High School Yards, Infirmary Street, Edinburgh, EH1 1LZ
**T:** 0131 650 5326 **E:** info@sniffer.org.uk **W:** www.sniffer.org.uk : @SnifferScotland