# Appraising Key Stakeholders and Institutions Relevant to Catchment-based Nature-based Solutions (NbS) in Scotland

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## 1.1 Executive Summary

Nature-based Solutions are a dominant concept in natural resource management, and offer the potential to transform nature and how it is managed, by focusing on delivering multiple societal benefits. However, achieving the transformative potential of NbS is challenging. Tackling this challenges depend on carefully (re)appraising who is involved in NbS, and how they are involved.

This study therefore presents a stakeholder analysis of six cases of catchment-based NbS in Scotland, selecting cases that conform with established definitions of NbS at both more strategic and operational levels. We explore not only the attributes of those involved but how they are involved (their roles) and consider some other groups that may be under-involved.

Our findings suggest that current NbS practices are still dominated by organisations traditionally associated with environmental management – environmental NGOs and public sector agencies. Local authorities are involved to some extent, but not so often key influences over NbS conceptualisation and delivery. A small set of these actors are involved in multiple NbS cases and multiple key roles in planning and implementing NbS. There is also a set of actors with expertise in community engagement and other aspects of procedure and partnership working. Promisingly, therefore, communities are often involved in NbS, but appear to often be only consulted or involved only in certain activities, rather than as key stakeholders shaping NbS.

For-profit private sector actors are relatively rarely involved, which resonates with previous studies of catchment working. Identifying opportunities to deepen their involvement may require more

catchment and project-specific analyses of beneficiaries, to identify which ecosystem goods and services are appropriate for motivating the involvement of for-profit actors.

By carefully choosing cases to represent a range of NbS practices, and enriched by our pre-existing expertise in catchment working and NbS, we consider these cases offer insights that are generalisable to other cases, though testing this would be useful challenge for other research. It would be particularly interesting to test if there are different patterns of stakeholder engagement associated with or entailed by different levels of intervention; and by NbS with different focal issues.

Whilst there are many research needs and gaps, there are also clear opportunities to broaden stakeholder engagement by those currently focused on NbS. There are opportunities to strengthen the agency of local authorities, communities and for-profit actors, though each group may require distinct interventions to unlock their involvement and support for NbS.

For actors working to enable specific NbS, this study provides a useful guide and further reading on stakeholder analysis.

## 1.2 Background to this report

This report corresponds with Milestone (M4a) "Report on key stakeholders and institutions relevant to NbS in Scotland" arising from a stakeholder analysis due March 2023, carried out as part of WP4 of project 'AiM NbS'. AiM NbS is a project which focuses on enabling catchment-based NbS in Scotland. It is Project JHI-D2-2 funded by the Scottish Government Strategic Research Programme.

More information about how and why we carried out the stakeholder analysis is provided in the following sections. For more information about the rationale for WP4, which explores opportunities and barriers to mainstreaming NbS in Scotland, visit www.hutton.ac.uk/research/projects/scaling-and-mainstreaming-nature-based-solutions. For more information about the wider AiM NbS project, please visit https://www.hutton.ac.uk/research/projects/achieving-multi-purpose-nature-based-solutions

## 1.3 Acronyms used in this report

| | |
|---|---|
| CSGN | Central Scotland Green Network |
| NbS | Nature-Based Solution |
| RSPB | Royal Society for the Protection of Birds |
| SEPA | Scottish Environment Protection Agency |
| SRUC | Scotland's Rural College |
| SSE | Scottish and Southern Electricity |
| SWT | Scottish Wildlife Trust |

# Contents

# 2 Introduction

Natural resource management is increasingly framed in terms of Nature-based Solutions (NbS) – i.e. managing nature for multiple societal benefits (IUCN, 2020). The concept is widely endorsed and also relates to pre-existing practices such as integrated catchment management (Nesshöver et al., 2017). However, implementing transformative NbS at scale remains challenging.

In order to understand more about NbS and appraise how it can be better enabled, we need to understand who is and should be involved in NbS. Stakeholder engagement is generally agreed to be essential for improving environmental management (e.g. Juárez-Bourke & Blackstock, 2021) – and also for NbS (Ferreira et al., 2020). The active support and involvement of multiple stakeholder groups will be needed to achieve NbS at scale (Schröter et al., 2022), what is sometimes referred to as mainstreaming.

The aim of this report is to analyse existing patterns of stakeholder engagement in catchment-related NbS in Scotland, where NbS is endorsed, including by key actors responsible for natural resource management (Pakeman et al., 2021).

## 2.1 What is NbS?

There are many definitions and versions of NbS currently in use (Short et al., 2019). Our definition of NbS is rooted in the internationally-discussed and accepted IUCN definition as:

> *"actions to protect, sustainably manage, and restore natural or modified ecosystems, which address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits." (IUCN, 2016)*

Most definitions, including IUCN's, emphasise that actions should aim to tackle multiple problems – both societal and environmental - and ideally multiple goals within those categories. The definition leaves open a wide range of potentially-relevant examples and initiatives – ranging in the degree of stakeholder groups and types of interventions required (Eggermont et al., 2015). Achieving such a vision is generally thought to imply transformative change in how society relates to and manages nature (Palomo, 2021).

NbS can be carried in any part of socio-ecological systems, but the potential for catchment-based NbS is worth of attention and the focus of this report. Catchment management has increasingly been framed in terms of the challenges of working holistically, inclusively and systemically, even whilst terrestrial natural resource management was still mainly conceived in terms of designating areas for endangered habitats and species. Therefore, working in catchment settings may – arguably – offer the best prospects for achieving NbS, since those catchments with a history of partnership or similar working, have stakeholders who already have some experience of collaboration for multiple aims. Catchment-NbS is often oriented around achieving natural flood management (e.g. Brillinger, 2021; Raška et al., 2022; Turkelboom et al., 2021) or in the wider catchment peatland restoration for carbon sequestration. As a result, current examples linked to catchment-based NbS sometimes look similar to activities organised to support hydrological and ecological restoration – for example, restoring river meanders may offer multiple societal benefits (Addy et al., 2016). However, managing nature for people, as per NbS, will not always lead to the same mix of activities, and both implies – and enables – involvement from more societal groups (Waylen et al., 2022). In principle there are a wide range of ecosystem services generated by catchments that could provide the basis for NbS, and attention should be balanced across the urban and rural parts of catchment systems (e.g. Lerner & Holt, 2012).

What is not usually defined is what scale or scope of actions 'count' as NbS. Here the point about delivering multiple benefits provides guidance. Logically, very small-scale site-specific interventions or one type are unlikely to deliver significant changes in ecosystem service delivery. But as long as

significant changes in more than ecosystem service are anticipated, that is sufficient: potentially intensive intervention on small site or issue could deliver multiple benefits and count as NbS – this is often the case for urban-oriented initiatives, which are sometimes labelled as Blue-Green Infrastructure (Green et al., 2016). Such an initiative may be commissioned by or linked to an initiative that is broader in its spatial or temporal scope. This highlights that NbS may potentially have a multi-levelled nature. In this project we therefore do not define NbS as having a single 'correct' scale, but note that there tend to be more strategic level NbS (which could include catchment-level concepts) and more project-level NbS (which could include a more specific suite of interventions specific to a particular subset of challenges, place or time). The project level is similar to what others such as Margerum (2008) calls the 'operational level'.

In summary, to 'count' as catchment-based NbS, as a minimum an initiative seek to tackle more than one societal challenge, with the involvement of more than one partner, framed in terms of the catchment system. This leaves open NbS to be conceptualised and delivered and multiple and potentially interlinked levels and scales. The most transformative NbS may involve many and varied initiatives across various parts of the catchment system, delivered by and benefiting many stakeholder groups.

## 2.2 What is stakeholder engagement[1]?

The term 'stakeholder' is used to describe any actor that has a stake in an issue. This can encompass both those who have influence over an issue or intervention – directly or indirectly – as well as those affected by an issue or intervention – whether positively or negatively. Whilst this can be used at differentiate the roles of individual people – which may be relevant e,g. when considering the land-owners local to a small site - it is also and more commonly applied to identify societal groups and organisations – all referred to here as 'actors'.

Stakeholder involvement can help improve the design of interventions such as NbS, as well as improve societal buy-in to NbS, and for some is also a normative aim in its own right (Blackstock & Richards, 2007). However, improving societal engagement is a challenge for most NbS. Building stronger relationships with society, so that multiple groups are relevant to their conceptualisation and implementation is essential (Nelson et al., 2020). Identifying who benefits or loses from alternative interventions can both the design of NbS, and practicalities of relationships and conflict management. This entails a close and deliberate scrutiny of who is and who could be involved in NbS – a stakeholder analysis.

There is large literature on stakeholder analysis that offers guidance on what issues to look for, and how to collect data (Reed et al., 2009). Table 1 below lists some key authors and the issues that they highlight should be considered (Hermans & Thissen, 2009). We describe more information about how we carried out our stakeholder analysis in section 4.

*Table 1 Key Actor attributes to describe, based on our review of literature on stakeholder and actor analysis*

| Actor attributes | References |
|---|---|
| Identifier (name) | (Jepsen & Eskerod, 2009) |
| Type of actor (e.g. public/ private etc) | (Avelino & Wittmayer, 2016; Reed et al., 2009; Zingraff-Hamed et al., 2020) |
| Overall vision/mission (the type of future they intend to bring about) | (Brouwer et al., 2012; Chevalier, 2001; Grimble & Wellard, 1997; Hermans, 2005; Poolman et al., 2010; Raum, 2018) |

[1] Note this document does not differentiate between involvement, engagement and representation. Engagement can have connotations of top-down organisers who later 'reach out' to engage others, however, it is a common term in the academic literature so is the term mostly used here.

| | |
|---|---|
| Primary role/ type of involvement in NbS initiative | (Hermans, 2008; Raum, 2018; Reed et al., 2009; Wittmayer et al., 2017; Zingraff-Hamed et al., 2020) |
| Knowledge and expertise | (Brouwer et al., 2012; Chevalier, 2001; Grimble & Wellard, 1997; Poolman et al., 2010; Reed et al., 2009; Spangenberg et al., 2015; Zingraff-Hamed et al., 2020) |
| Scale intentions (desired scale of impact) | (Grimble & Wellard, 1997; Grimble et al., 1994; Poolman et al., 2010; Raum, 2018) |

We recognise here that involvement and engagement in NbS is not a binary 'in or out' classification. It is likely to change over time and/or according to stage/aspect of NbS process. It is therefore necessary not only to describe stakeholders in terms of their own attributes, but also to understand the role that they already playing in achieving (or blocking) change (Wittmayer et al., 2017). As Ballesteros and Dickey-Collas (2023) noted in work on science-policy interfaces, *"stakeholder roles are defined by the process rather than by their profile"* and we also note that process is reciprocally defied by the stakeholders activities. These roles may change over term, or may be different for different initiatives. For example, an actor that is very superficially or peripherally involved will have little influence on the core conceptualisation and direction of a NbS initiative; yet may have very great influence over a different initiative. In short, better understanding of exactly how stakeholders are, or are not, involved in NbS is essential.

# 3 Case studies analysed by this study

To allow an in-depth analysis of stakeholders involved in NbS – yet also permit some exploration of the range of practices in Scotland – we selected six cases of catchment-based NbS in Scotland. We carefully selected these 6 cases to give us insight into the range of NbS practices across Scotland.

We used our pre-existing expertise and searched online to find any ongoing cases which we identified as conforming with the concept of NbS, even if they described themselves using other labels such as integrated catchment management. In other words, we considered any potential cases that met the following criteria:

- Primary focus on freshwater or catchment related interventions;
- Framed around delivering socio-economic benefits/ tackling societal challenges (e.g. flood prevention/impact, water quality improvements, health and wellbeing);
- Providing co-benefits, or multiple benefits, rather than solely focusing on tackling one problem.

Additionally, we chose a mix of cases that offered potential contrasts in terms of:

- Projects of differing phases – seeking to encompass both relatively new or emerging NbS versus more established initiatives, either ongoing or completed;
    a. For this reason we selected Riverwoods, as a relatively new initiative, whereas the Tweed is a more long-established initiative.
- Projects encompassing differing land uses and both urban and rural settings;
    a. For this reason we selected CSGN, which encompasses a variety of areas of high population density, in contrast to the more rurally-focused Tweed initiative.

Lastly, and relatedly, we chose projects that varied in their scope from strategic/steering level through to project-based level – with – as discussed in the introduction, the minimum scope being

something aiming to deliver a mixture of benefits typically through a mixture of biophysical interventions (e.g. re-meandering, habitat creation, planting).

- Recognising the links between strategic and project level – and the impossibility of selecting a single 'right' level for analysing NbS we purposefully chose project-level initiatives that were connected to more strategic level initiatives.
    a. For this reason we choose more specific initiatives such as the Eddleston project – which a distinct set of activities planned for that sub-catchment, as well as its 'parent' the Tweed Forum Initiative.
- This related to projects of differing geographic scope, ranging from national to site-based initiatives, but we note that project-level NbS is not always about a specific site, but can be more about a specific subset of actions
    a. For example, see the Raingardens case below, which is about delivering a particular multi-benefit intervention in sites across the whole CSGN; whereas the Eddleston is an example of a site-specific initiative at a smaller spatial scale than the Tweed.

The six cases analysed are Riverwoods (new, strategic level), Tweed (established, project level related to Tweed), Eddleston (established, project-level), Central Scotland Green Network (CSGN, established, steering level), 10k Raingardens (moderately established, project level related to CSGN) and Seven Lochs (moderately established, project level related to CSGN).

There is no compendium of all NbS cases in Scotland nor any typology of NbS cases. However, we consider that our six cases of catchment NbS are likely to highlight patterns of stakeholder involvement and activity that are shared by other cases in Scotland. In particular, the working arrangements and ambitions of the Tweed Forum may have similarities with other landscape and catchment-based partnerships {Waylen, 2020}. Other types urban-based NbS may share more with CSGN –for examples place-making initiatives and the plans made by community improvement groups - albeit the CSGN is at a much larger scale than most initiatives. Riverwoods is perhaps relatively unusual in that it focuses on a specific broad type of habitat to intervene in, unbounded by any specific landscape or place.  Below we describe each of these in more detail.

### 3.1 Riverwoods, strategic-level NbS

Riverwoods was initiated by the Scottish Wildlife Trust in 2019. It aims to create a network of sites of riverbank woodlands and healthy rivers across the whole of Scotland. This is expected to deliver a range of benefits such as flood protection, improved water quality and salmon fisheries, whilst tackling the challenges of climate change and biodiversity loss. There is a strong focus on knowledge sharing and understanding knowledge gaps, supporting practical actions by land managers, showcasing good practice and exploring novel forms of financing for riparian restoration at scale. It has developed an explicit strategy designed to engage actors with a range of interests and capacities (e.g. traditional restoration managers, those seeking to increase awareness of on the connections between biodiversity and climate change and those seeking solutions to socioeconomic challenge linked the environment, such as impacts of flooding and soil erosion and shrinking fisheries). From inception 3-4 years ago, it is now at the point where applications for support are being received and assessed to identify projects for support to consider different socio-economic benefits of interventions and for accessing alternative sources of finance (particularly private finance). Because Riverwoods is a relatively new initiative, it does not yet have any more specific initiatives relating to a subset of goals or sites. It does not explicitly use the NbS terminology itself but its aim closely aligns with the IUCN definition.

The Riverwoods website, whose webpages and linked documents provided material for our analysis, is https://www.riverwoods.org.uk/

### 3.2 Tweed Forum Catchment Management Plan, strategic-level NbS

The Tweed Forum was established in 1991 to support integrated catchment management. It emerged from informal group of actors but now employs a number of staff to coordinate funding and partnership work. It works strategically to influence policy (e.g. working with SEPA on implementing the EU Water Framework Directive in the cross boundary Solway-Tweed catchment) and at the project level to deliver environmental improvements. The highlighted benefits of its activities include water quality, resources, and ecological improvements. Project-level initiatives includes a series of interventions in and around the Eddleston water (see following example), Till Restoration (SSSI enhancement), access and tourism (Destination Tweed), involvement in the South Scotland RLUP, work with windfarms on a Borders Wading Bird initiative, the Biodiversity Offsetting project (Langhope Rig). The Tweed Forum does not solely or primarily frame their work in terms of NbS but the term is used within in some of its more recent webpages[2].

The Tweed Forum website is https://tweedforum.org/

### 3.3 Eddleston Water, project-level NbS, related to Tweed

The Eddleston Water project was formally established in 2009 with funding from the Scottish Government as part of their programme to explore the potential contribution that natural flood management (NFM) could make to addressing increasing concerns of flooding and habitat degradation whilst sustaining local farming livelihoods and practices across the catchment (Rouillard & Spray, 2017). Working with landowners and people living in the local area interventions undertaken so far include re-meandering the river channel, tree planting, natural leaky barriers and reinstating wetland features. The project has entailed a monitoring programme to understand biophysical outcomes and co-benefits alongside flood risk management (i.e amenity, biodiversity and ecology, carbon sequestration, education, flows in watercourse, water quality and pollution) through numerous scientific studies undertaken. Within the natural flood management community in Scotland the Eddleston Water project is now considered an important demonstration site. Similar to the 'parent' Tweed initiative, NbS is not in the title of the initiative, but it has described itself in these terms[3].

The Eddleston Water project webpage is https://tweedforum.org/our-work/projects/the-eddleston-water-project/

### 3.4 Central Scotland Green Network (CSGN), strategic-level NbS

The Central Scotland Green Network (CSGN) was established in 2009 with the impetus of the Scottish Government to support its National Planning Framework. It encompasses an area just under 10,000 square kilometres and many urban and suburban areas, including some areas of deprivation. Coordinated by the Green Action Trust (formerly the Central Scotland Green Network Trust) the initiative aims to support, link up and build on existing partnerships and programmes with the objective of developing a network of connected green-blue spaces, increasing access to quality spaces to improve the social, physical, cultural, and environmental wellbeing of central Scotland for the people who live and work in the region. Interventions range from improving derelict land, creating woodland and wetland features, raingardens (see below) and other nature-based solutions to increase climate resilience, improving rural and urban landscapes with a strong focus on

[2] https://tweedforum.org/news/tweed-forum-celebrates-30-years/
[3] https://tweedforum.org/news/tweed-forum-shortlisted-for-2021-nature-of-scotland-awards/

disadvantaged places creating paths and cycle ways to help tackle health inequalities, alongside improvements to the physical environment and biodiversity benefits. It is one of the largest projects of its kind in Europe. Its description of itself explicating cites a goal of delivering nature-based solutions[4].

The CSGN website is https://centralscotlandgreennetwork.org/

### 3.5 Seven Lochs Wetland Park, project-level NbS linked to CSGN

This initiative focused on creating an urban park 5 km east of Glasgow City Centre spanning the boundary of Glasgow City Council and North Lanarkshire Council. It was initiated by the Glasgow and Clyde Valley Green Network Partnership in 2008 and now led by the Seven Lochs Partnership. Those actors identified it as aligning with the CSGN, and are also key actors in the CSGN Glasgow and Clyde region, but its creation very slightly predates that of CSGN so this case should not be seen as something wholly driven by CSGN. It is located in an area of high development pressure and regeneration need, the 16sq km site encircles seven lochs, 2 SSSI's, 5 local nature reserves and a country park as well as a various heritage features. According to its masterplan[5], it aims to demonstrate how a developing a wetland park within a wider green network, can help instigate more sustainable communities, protect and enhance heritage and natural heritage, provide new opportunities for leisure, recreation and tourism, and establish the area as an attractive place to live, work and visit. This entailed a holistic approach to hydrology to develop nature-based solutions to manage flood risk, adapt and help mitigate climate change impacts, improving water quality across the site, increasing access and engagement with the natural environment (leisure and employment), extending such socio-economic benefits into surrounding communities for enhanced health and quality of life. Interventions included habitat enhancement and creation in addition to footpaths, cycleways and boardwalks (Ravagnan et al., 2022). The Seven Lochs Wetland Park is Scotland's largest urban heritage and nature park with work on-going to continue to enhance the site further. This includes linking it with the wider CSGN (see above).

The Seven Loch websites are https://www.gcvgreennetwork.gov.uk/case-studies/seven-lochs and https://www.sevenlochs.org/index.aspx?articleid=22252

### 3.6 10k Raingardens for Scotland Campaign, project-level NbS linked to CSGN

The 10K raingardens campaign commenced in 2014, inspired by raingarden development in Melbourne, Philadelphia and Portland, and is led by the Green Action Trust. It is highlighted as a core initiative within the CSGN (see above), although the geographic remit of the campaign is national. The campaign explicitly frames its work in terms of NbS, and Raingardens are defined as NbS that involve areas of planting designed to slow down and hold on to rainfall, slowly releasing it[6]. Raingardens can vary in scale and may include sustainable urban drainage for individual properties however a core focus is placed on integrated approaches (not just a single intervention for a single plot) i.e. bringing together multiple interventions to deliver multiple shared benefits within neighbourhoods. Such interventions can include; basins, bog gardens, filter strips; green roofs; green walls; inground raingardens (planted swales); permeable paving; ponds; rain garden planters; aesthetic features such as rain chains; trees; wetlands. Raingardens also differ from more traditionally recognised green infrastructure in so far as there is an explicit focus on place and

[4] https://centralscotlandgreennetwork.org/about/

[5] https://issuu.com/gcvgreennetworkpartnership/docs/120815145940-b9e507d9d9614bb4bc64dbc593e1b47e

[6] https://centralscotlandgreennetwork.org/wp-content/uploads/2021/10/10000-Raingardens-Case-Study-1-1-2.pdf

wellbeing benefits. The aim is to establish raingardens across communities and embed this as a standard approach to deal with surface water management, flood alleviation and greenspace creation, helping to improve climate resilience for communities, new developments and businesses. In 2019 funding was obtained to run a pilot to co- design and deliver raingardens in an area of Glasgow City which was hosting COP26. In addition to demonstration projects, existing raingardens are being mapped, evidence gathered on their effectiveness and guidance documents developed to support their use.

The 10k Raingarden website is https://www.10kraingardens.scot/

# 4 Methodology used for Stakeholder analysis

This qualitative desk-based study examined publicly-accessible website content and linked reports (Raum et al., 2021) to assess the actors involved in NbS, their attributes and relationship to 6 cases of NbS initiatives in Scotland described in section 3. The following sections 4.1 to 4.3 provide further detail on how we searched, what information we sought and how we analysed it. We also considered what other actors could be hypothetically involved, based on catchment management beneficiaries – as described in section 4.4.

This work was carried out in October-February 2023. It offers a snapshot in time of actor involvements and roles, which will evolve over time.

## 4.1 Data collection, management and analysis

Materials used for data collection were web-based (publicly available) documents (i.e reports, initiative and organisational webpages, plans).

Data collection involved two steps. Firstly, the different actors actively involved in an initiative were identified by examining initiative webpages. Secondly, data was gathered on the different attributes of each actor and their relationship to each initiative. (Relationships between initiatives and actors are often multidirectional, however for the purpose of this study the focus was on understanding the role or contribution each actor provided to an initiative rather than vice versa.) This involved examining the webpages (and documents found within these) of each actor (e.g. 'about us' sections of websites) and searching for content that directly related to each case.

Data was stored in an excel and research memos were created to explore the data and inductively (and thus iteratively) describe and code the data. The analytical process involved two steps. Firstly, summaries of the analytical categories (actors attributes and roles) were summarised, and any patterns within these categories described. Secondly, patterns between analytical categories were explored. Both steps involved querying the coded data within excel using filter and sort functions in excel, matrix techniques and the development of analytical memos. From this process conceptual categories and sub-categories were identified to support confident understanding of patterns of involvement – and under involvement – in current NbS practices.

Data collection, coding and analysis was undertaken by EC and KM, with regular dialogue between all authors to agree each stage of the research process and to cross check for consistency. This discussion of emergent patterns was also enriched by 'reality check' against other similar initiatives based on general knowledge of catchment management in Scotland and beyond. This team approach also supported a more reflexive process, for example during analysis team members explored the data and proposed potential conceptual categories and sub-categories, which were then collectively tested and refined (Alvesson & Sköldberg, 2018).

## 4.2 Describing involved actors' attributes

A starting point for our work is the arguments that a range of actors should - and must - be involved in order to achieve NbS (see section 2.2). To know if a full diversity of actors have been engaged, this requires us to identify actors' attributes. We therefore sought out information on actors' sectors, scale of operation, topic focus and expertise.

### 4.2.1 Actor attribute: sectors

The call for cross-sectoral involvement is commonly made (e.g. Malekpour et al., 2021) but it is challenging define and categorise what constitutes a "sector". A typical distinction is made between the public sector (i.e. actors working to develop and implement government objectives and state obligations), and private sector (i.e. businesses working for profit) and also third sector (i.e. charities working for social purposes), and also sometimes community groups (e.g. Macdonald, 2011). However, the distinctions between these groups can often break down in practice. For example, should a Fisheries Board with statutory status, but enabled and focused on with riparian owners, be classified as public or private? Additionally, finer distinctions between categories may seem relevant and necessary - as discussed for private sector actors in (Waylen et al., 2020).

For this work, we are particularly conscious of the arguments that NbS should not and cannot be achieved without broadening citizen involvement and support (Seddon et al., 2021); and therefore our sectoral distinction should treat separately residents or communities of place. Additionally, academic and researcher groups do not easily fit into any of these groups. To respond to these insights, for this report we have created a working typology of seven types of actor, in Table *2* below, used to analyse existing stakeholder representation in NbS. The boundaries between categories may blur - and number of categories could be even further elaborated - and in the final sections (page 30) we return to reflect on the key actor sectors that it may be helpful to distinguish for enabling NbS.

Table 2 Categorisation of actor sectors for involvement in NbS.

| Actor sector | Description |
|---|---|
| Public | Encompasses local authorities, national government, agencies, statutory bodies and regulators. Any state owned administrative organisations responsible for implementing public policy. |
| Non-profit | Encompasses NGOs charitable trusts and foundations. Any entity with a charitable purpose and delivering public benefits (i.e. not creating benefits for private individuals) |
| Networks | Encompasses multi-stakeholder networks, associations, platforms, partnerships. Any entity that represents and develops the views of multiple stakeholders, working for a shared goal, sometimes organised around a specific sector. |
| For-profit | Encompasses small, medium and large scale market orientated businesses. Owned by private individuals (and may have shareholders) seeking financial gain (profit) from the provision of goods and services. |
| Research | Encompasses research institutes and universities. Producers of scientific or academic knowledge. |
| Community | Encompasses community groups and community interest companies. Any constituted (semi-formalised or formalised) community group and organisations linked to a specific place. This group also encompasses engaging with citizens on a more individual basis, e.g. by reference to resident, householders. |

### 4.2.2 Actor attribute: scales of operation

In addition to varying in their sectoral role, actors vary in the geographical remit of their objectives. Some are obviously very local in their operational objectives – for example, a group representing a community of place – whereas others may work at supra-national scales – for example, a large multinational company with a factory within Scotland.

Table 3 Categorisation of scale of actors' objectives

| Scale of actor operational objectives | Description |
|---|---|
| Supra-national | An organisation whose work and objectives are not confined specifically to Scotland – encompassing for example rUK, or further afield. |
| National | Seeking to work across Scotland |
| Sub-national | Seeking impact at the scale of a single or multiple catchment / local authority area or landscape. |
| Local | A community or neighbourhood of a specific place, including even a concern only with an individual property |

### 4.2.3 Actor attribute: topic focus

Actors identified as being involved in NbS have different types of core topics or subject interests, that are inherent to their operational goals (see Table 4 below). These topics are one aspect to explain actors' motivations (in combination with other attributes, such as their sector – see above section 4.2.1, page 11) and also their expertises and resources. An actor from any sector (see Table 2) may have an interest in any of these categories, although the delivery of goals considered public goods tends to be associated more with public sector and third sector actors.

*Table 4 Typology of core topic focus by actors involved in NbS. One actor may have more than interest type, but not usually many.*

| Actor topic focus | Description |
|---|---|
| **Nature conservation** | Restored natural ecosystem structures, functions and processes, including enhancing protected species, habitats etc. |
| **Social** | Healthier, more knowledgeable and skilled and/ or connected people, including a focus on specific marginalised social groups |
| **Environment** | Working to manage biophysical environment to reduce risks and support society e.g. to mitigate climate change, reduce waste, manage flooding etc. |
| **Natural amenity and recreation** | Working to enhance role of the environment to people's lives, e.g. through outdoor recreation, countryside management skills to improve accessible green spaces and use of green infrastructure |
| **Built infrastructure** | Construction of houses, other buildings and physical infrastructure (roads etc) including retrofitting etc. |
| **Place** | Working for improved experiences of people from one or more communities of place recognised as involving multiple social, economic, cultural and environmental dimensions |
| **Natural resources** | Sustainable economic exploitation of water (e.g. drinking water), forest and woodlands and land (e.g. farming) |

| | |
|---|---|
| **Financial** | Brokering private investment (e.g. matching nature projects with private investors seeking a return on investment). |
| **Unknown** | No clearly-stated vision of the future |

### 4.2.4 Actor attribute: expertise and capacities

We analysed actors' potential capacity to offer expertise on different issues. This is likely related to their core organisation purpose and remit (see previous section) but also the variety and scope of functions carried out by that organisation. We therefore exploring actors' organisational structures (e.g. staff, teams, departments) oriented to different topics.

We sought evidence of three broad types of expertise: relevant to NbS initiatives (Sowińska-Świerkosz & García, 2022). We sought these for each actor involved in NbS through review of their organisational webpages, and also any description of capacities used to support the NbS initiative within the initiative's webpages. It is important to note that the availability of expertise does not necessarily mean this was directly deployed to support a NbS initiative; for example, a large organisation may have many departments but only one directly involved in a NbS project.

*Table 5 Typology of NbS-relevant expertise*

| **Actor expertise** | **Description** |
|---|---|
| 1. Biophysical interventions | Expertise in understanding biophysical system and challenges, or in designing or implementing practical activities. |
| 2. Socio-economic challenges | Expertise in one or more socio-economic issues, or in intervening to tackle societal challenges. |
| 3. Procedural expertise | Experience in bringing together different perspectives, capacities and resources to shape, plan, resource and manage the implementation of NbS. |

## 4.3 Actors' roles within NbS

A description of actors' attributes is necessary but insufficient to understand their implications for achieving change. Compared to body of work on stakeholder analysis which focuses on identifying and describing stakeholders' attributes, this is a relatively under-developed area, especially in relation to NbS. However, there is a very recent analysis of stakeholder roles specific to NbS (Mitincu et al., 2023) which suggests diffusion of innovation theory can help to anticipate and analyse stakeholders' role. They analyse roles in terms of innovator, change agent, transformer, mainstreamer, laggard, reactionary and controller. This is useful in highlighting temporal aspects of NbS processes, and stakeholders (initial) enthusiasm for NbS, but says less about the mosaic of inputs that might be required at any point of time, to enable and deliver an NbS initiative. In Table 6 we therefore provide below a typology of stakeholder roles. This is a working typology and a key subject for further development and refinement.

In section 5.2 we apply this categorisation to describe the roles of involved actors as was apparent at the point in time that we conducted our analysis. We recognise that role are likely to be dynamic and fluid, as NbS initiatives unfurl and actors evolve in their interests, capacities and interactions with each other (Wittmayer et al., 2017).

*Table 6 Working typology of roles describing actors involvement in NbS. Any actor may be involved in more than one role; and any role(s) may vary between NbS cases.*

| Roles in and for NbS | Description of role |
|---|---|
| 1. Initiating & leading | Responsible for giving impetus to NbS concept. Organisational structures and resources may be explicitly orientated towards providing leadership and coordinating collective action for NbS. |
| 2. Steering | Contributes to strategic decision-making, shaping the goals and plan of action and implementation of NbS. Often associated with formal roles on advisory boards, steering groups. |
| 3. Implementing | Undertakes actions on the ground to deliberately change biophysical conditions – implementing the plan to put NbS 'in practice'. Associated with providing 'in kind' resources e.g. staff time. |
| 4. Mediating | Facilitates or mediates meaningful engagement of different partners in NbS and/or other stakeholders (e.g. relationship building, process facilitation, process evaluation) to inform of NbS design and to bolster its social licence. |
| 5. Self-adapting | Connects and inserts NbS approach and support for its actors formally into an organisation's own pre-existing or new policies and processes, so these support or avoid conflict with NbS implementation. |
| 6. Promoting | Highlights links to other-NbS related initiatives and actors. Shares ideas, knowledge, information or guidance with audiences outside of the NbS, to promote understanding and support for NbS. |
| 7. Financially contributing | Provides financial resources (funding or investment). |
| 8. Specialist support | Provides specialist advice, expertise or technical input e.g. site surveys, equipment, monitoring, legal requirements & compliance. |

Some roles are essential to the creation and development of every NbS initiative – in particular, NbS cannot exist without actors to initiate and argue for the idea (**initiating** role), decide and plan what is needed (**steering** role) and carry out the plan (**implementing** role).

Other work on partnership working – which is inherent to NbS – suggests that the success strongly depends on the capacity of an actor to mediate or facilitate partnership working (e.g. Waylen et al., 2020). It is possible that an existing small partnership which already has strong shared objectives may not seem to depend on this **mediating** role but this role is likely essential at least some points in the journey of NbS delivery.

Other roles are helpful for enabling NbS - and may be judged essential to achieve transformative NbS at scale – but are not necessarily evident in every case at every stage. These roles include adapting internal policies in order to support or avoid conflict with NbS (**adapting** role), lobbying for others to support NbS (**promoting** role) and providing inputs of expertise (**Specialist support** role) or money (**financially contributing**).

The availability of financial resources is dependent on actors who may or may not be directly involved in the NbS. For example some grants may be available from NatureScot, who is also often a key partner in NbS, albeit involving different staff and departments. Similarly, the possibilities for action are often shaped and constrained by regulations and licences, which are often set and implemented by SEPA. SEPA was often involved in the cases of NbS that we reviewed, but a very

different department from those involved in enforcement. This highlights blurred boundaries between what counts as actors internal and external to an NbS initiative. This study does not scope those actors in the wider governance context that shapes and constrains NbS, but we note the need to be alert to internal boundaries and differing roles within large organisations.

There are also other possible roles that could be considered – e.g. monitoring – but were not evident in our data, so we do not discuss here.

## 4.4 Identifying potentially under-involved actors

A stakeholder analysis draws attention to the groups potentially influenced by an initiative, as well as those who are or could be influencing.

**Affecting (influencers)** To identify those who could be influencing we considered the agencies and organisations with statutory responsibility over water and other aspects of natural resource management. Less directly, other actors may also influence catchment landscapes, e.g. by shaping rules and resources available to land-managers.

**Affected (beneficiaries)** To identify actors that are potentially influenced by catchment-based NbS, we identified key benefits provided by catchments, based on the typologies of ecosystem services provided in UKNEA (2011). We then considered which types of actors would be expected to the direct and indirect beneficiaries of these goods and services, so who might be motivated to get involved in or support NbS. Comparison of this list with who is involved in our case studies gives insight into who could be more or differently involved than at present.

In doing so, we noted that hypothetical catchments can be enormously variable, potentially encompassing a range of habitats that provide a range of benefits, so identifying beneficiaries is challenging when working hypothetically. This suggests the need for analysis of beneficiaries specific to place and project contexts. To this end, we present the CSGN's own analysis of its beneficiaries.

# 5 Results: analysing stakeholder involvement in Scottish catchment-based NbS

In the six cases we studied (described in section 4.2.2) we identified 140 named actors involved in some way[7]. As may be expected, the steering-level initiatives tend to involve a greater number of actors than the subsidiary project-level initiatives. In addition to the named actors, some generic categories of stakeholder groups were also evident as considered somehow relevant or involved, these were; 'community', 'residents', 'local authorities', 'consultants', 'landscape architects', 'schools', and 'young people'.

This large set of actors involved actors of many types: with varied interests; operating at different scales; and taking varied roles in relation to one or more NbS initiatives. The following subsections consider each of these issues separately. We first describe *who* is involved in the NbS cases (section 5.1, before turning to consider *how* they are involved (section 5.2), before highlighting key actors that are involved – and those that may be under-involved (section **Error! Reference source not found.**).

## 5.1 Actors in NbS

### 5.1.1 Sectoral involvement

Looking at the sectors of those involved in NbS - using our categories laid out in Table *2* (page 11) - there first two categories of **public sector and non-profit actors** form a 'core group' who appeared to

[7] We plan to provide these data on the actors identified and our analysis of them via our project webpage, later in Spring 2023. Alternatively, if you would like more information please email the authors.

be common and influential in the cases that we studied. These actors typically have an active role in bringing about NbS initiatives, whether using that term or other labels. **Network** actors are also commonly linked with NbS initiatives but perhaps less vital in initiating and driving their creation.

Looking at the remaining types of actors in Table *2* (page 11) – for profit actors, community, residents and research institutions - shows that they can all be involved in creating opportunities for and delivering NbS, but less consistently.

Where **for-profit actors** are involved, the type most often found are consultants on land use planning and environmental management and compliance (e.g. CEMEX; Cbec). Other for-profit actors were developers (e.g. Stewart Milne homes); owners of specific recreational sites (e.g. The Royal and Ancient) and financial/ market-based brokers (e.g Abundance Investment; Forest Carbon; Conservation capital).

**Community actors** are often identified in terms of generic categories (e.g. young people, residents etc.). This may reflect that both the type and number of community groups and people will vary for interventions within and between initiatives; and also most of the initiatives we studied (with the exception of the Eddleston) are expected to be relevant to multiple communities of place.

**Research actors** involved were higher education organisations (e.g. Abertay University, University of Dundee, University of Edinburgh Centre for Sustainable Forest landscapes) and those orientated only to knowledge development (e.g. BRE). Often knowledge development type research actors involved had a specific focus on a specific setting (e.g. The James Hutton Institute and Scotland's Rural College orientated towards rural settings) or sector (e.g. Forest Research or BRE which is focused on built infrastructure).

This pattern of 'core' versus other actors is particularly associated with NbS at the strategic level – for example, the Tweed Forum, CSGN or Riverwoods. Network actors are particularly likely to be engage at the strategic level; indeed, since these NbS initiatives could themselves be seen as a networks working for a shared goal, this highlights blurred boundaries between different networks and initiatives.

There is a large overlap between organisations that are involved at the strategic and project level of NbS. Therefore it is not possible to classify or predict whether some organisations are more suitable to operate at the strategic or project level, albeit for larger organisations we speculate that the different levels may sometimes involve different teams or individuals within an organisation. However, there is a tendency for a larger and more diverse set of actors to be involved at the strategic level, reflecting the larger number of interests and objectives that may be considered at this level.

There also seems to be an association between the set of actors involved, and the geography (if any) of the NbS initiatives. The CSGN is a strategic level initiative that is explicitly mandated to cover an large spatial area which also has a high population density; this drives engagement with a large number of place-based or related organisations as it has a very high number of involved actors. At least 94 different actors are involved in CSGN, including 19 local authorities, which is similar to the total number of actors involved across the other studied initiatives. Other strategic level initiatives also have diverse interests to consider and objectives to achieve, but are not bound to engage with all parts of a large geographic area and have fewer involved actors.

In conclusion, the mixes of actors involved in all the NbS initiatives indicate that collective action is critical for achieving NbS, and is seen as such. There is a strong reliance on the public and third sector to lead this collective action, but specific types of private sector actor are involved. This is true across

levels: there are not discrete sets of strategic versus project level actors, although a greater diversity tend to be involved in NbS at the strategic level. The specific geography and bounding of NbS initiatives also seems to have a stronger influence on the diversity and number of involved actors.

### 5.1.2 Scales of operation

In our cases, there was not obvious involvement by any actor with supra-national operational objectives, but there were actors with objectives spanning all smaller levels (Table 3, page 12).

Most actors involved in NbS had operational impacts at the **national scale**, i.e. they are interested in working and achieving change across Scotland, rather than only working in a particular place. This pattern was evident at each of the strategic-level NbS initiatives examined, but also largely true of the project-level initiatives. The newly formed Riverwoods initiative is entirely formed of actors working at this level, reflecting its orientation to encourage riparian woodland wherever relevant across Scotland. Many of the same actors appear across different NbS initiatives, which we discuss more in section 5.1.4, page 18.

The next most common group of actors were those working at a **subnational** scale, i.e. spanning more than one place. This reflected the involvement of many Local Authorities. The involvement of Local Authorities may reflect their multiple duties and obligations to support society – as NbS offers a mechanism by which to achieve their multiple objectives – though their roles varied (see section 5.2). Other 'subnational' actors participating in NbS include others organised around administrative boundaries (e.g. Edinburgh and Lothians Green Space Trust; Green Action Trust), as well as organisations predicated on specific landscape features (designated parks, trails, catchment) (e.g. Southern Uplands Partnership; Clyde River Foundation); and mix of both (e.g. Glasgow and Clyde Valley Green Network Partnership; Fife Coast and Countryside Trust).

Actors working at the **local** scale were involved in all NbS initiatives that we studied, but far more of these actors were present in project-level NbS which were located in or encompassed significant proportion of urban areas. These types of actors ranged from schools, community trusts, and also local businesses. Several local actors had explicit goals of achieving social benefit. These were involved in both the strategic and project-level initiatives of CSGN, which encompassed a relatively densely populated part of Scotland. CSGN was also unusual in that organisations such as community councils and interest groups were explicitly framed as partners rather than beneficiaries.

This suggests that the stakeholders recognised and involved in NbS initiatives is shaped by the framing of their NbS objectives and spatial focus (if any) – or vice versa – as well the social geographical context. We consider more how these different stakeholders are engaged in section 5.2.

### 5.1.3 Topic focus

All NbS cases at both strategic and project level involved a set of actors who varied in their focal topics i.e. natural conservation, health, infrastructure (Table 4). That said, across the cases examined, there was a clear dominance of actors with a **nature conservation** focus, i.e. with interests and expertises related to biodiversity conservation and ecosystem restoration. This may reflect the genealogy of NbS projects, as many arise from past projects framed in terms of environmental goals. Many of these same actors (e.g. NatureScot and the RSPB) were involved across multiple initiatives. These issues are generally considered in the public interest, which is reflected by these actors being public sector, networks or non-profit actors. For this nature conservation topic, non-profit actors were particularly common – such as the Woodland Trust Scotland that is interested in halting the loss of native woodland and restore existing native woodland.

Those cases which had a strong focus on larger urban settings – especially the strategic and project-level CSGN - included a greater diversity of other interests, especially those tackling **societal challenges** such as health or education. These settings were also more likely to have involved those who focus on the built environment, such as housing and infrastructure developers. Some of these actors were found in more than one case, but - unlike for the nature conservation actors - there were no 'usual suspects' found repeatedly across our sample.

Actors focused on extracting and **using natural resources** were often involved in NbS initiatives (e.g. Scottish Water, National Farmers Union Scotland and Scottish Land and Estates) but never in a steering role. Mostly these were representative organisations (e.g. NFUS and SLE) speaking on behalf of land owners and managers, but the large public utility of Scottish Water was also sometimes represented.

A very few actors are involved that have a role in **finance** and financial brokering, found predominantly within the Riverwoods strategic-level case (e.g. Abundance Investment, Conservation Capital and Forest Carbon, the latter of which was also found in the Eddleston Water case) . This may relate to the recent and emergent nature of the Riverwoods case, which is actively building a community of actors to strengthen and fund the delivery of NbS at a large-scale, so actively seeking resources beyond public sector grant funding. Financial actors are all part of the for-profit sector, which is otherwise not much represented in our cases (see section 4.2.1).

**Network actors** are collectively linked with a range of topic interests, but often have a focus on socio-environmental interface e.g. connecting ecological management with and for societal benefits. For example, partnerships and Trusts have been created by two or more local authorities to help deliver statutory ecological duties in the context of scarce public resources (e.g. Edinburgh and Lothian Greenspace and Lower Clyde Greenspace). Membership-based networks tend to have a focus on representing a specific (extractive) use of the natural environment (e.g. National Union of Farmers and the Scottish Council for Development and Industry, Built Environment Forum). Some networks with more holistic visions, may include for-profit actors (e.g. Scottish Town Centre Partnerships) but these actors are less likely to be directly represented in the NbS.

Overall, this suggests that NbS initiatives tend to rely on certain types of actors more than others. Namely, actors with environmental interests, from the public and third sectors, predominate. We expand more on these 'usual suspects' in the next section. However, we note initiatives working urban contexts tend to have a greater diversity of actors and hence interests, including more focused on managing for nature for social benefits. However, in all cases there are relatively few for profit actors partnering in NbS, though there is recognition that desired scales of action may not be feasible without new sources of resources.

### 5.1.4 Expertise and capacities

Actors' topic focus is strongly suggestive of the expertise that they bring to NbS. However our separate analysis of capacities to offer expertise (see section 4.2.4) highlighted a wealth of different expertises are potentially informing NbS initiatives. Any one organisation may have capacity to offer a variety of expertises relevant to NbS; we initially highlight the dominant expertises evident in our sample, before going on to highlight actors whose expertise spans or connects these broad categories.

Firstly, **Biophysical expertise** was strongly represented by many actors whose organisational focus relates to achieving environmental improvements (e.g. RSPB, Buglife, Butterfly Conservation, British Geological Survey, SEPA, Fisheries Management Scotland). They often led the design of physical interventions in places and landscapes. These interventions were often designed with accessibility in

mind, in order to create local access and appreciation of nature i.e. via educational visits and awareness raising. Although important, the full connection to tackling socio-economic challenges was not always explicit. Nature-based interventions that help tackle socio-economic challenge may require more fundamental design considerations.

Secondly, **Socioeconomic expertise** was offered by a small set of actors, who also usually offered some type of procedural expertise. Examples of these actors include Scottish Enterprise; Edinburgh Cyrenians; Scottish Town Centre Partnership. Some of these actors are already centrally involved (e.g. Scottish Enterprise undertakes a steering role in some NbS initiatives), whereas for other such actors often their role is marginal (e.g. unclear or promoting the idea of NbS in general terms).

Thirdly**, Procedural expertise** was found in every case but held by a smaller set of actors (e.g. Democratic Society; Involve; Architecture and Design Scotland). predominantly focused on skills in facilitating community engagement. This was often provided by community scale actors might not appear to play a pivotal role in NbS planning but were critical for stakeholder engagement (e.g. Communities along the Carron). These actors often worked for co-design and place-based approaches, helping to reframe potential beneficiaries as more equal partners, at least in project-level NbS. For example, a raingardens pilot in Glasgow was co-designed with local secondary school pupils and used as a showcase for COP26. Procedural expertise also includes financial expertise i.e. understanding how to identify and access different sources of funding. Some actors with some socio-economic expertise may also provide procedural expertise in terms of challenges for business and for involving the private sector in delivering NbS – for example the Scottish Town Centre Partnership.

As noted above many actors held **more than one type of expertise**, mostly a mixture of biophysical and socio-economic expertise. Most notably, local authorities and linked network actors have a diversity of expertise. Whilst some are adopting a central role in NbS (e.g. Glasgow City Council and Glasgow and Clyde Valley Green Network Partnership), others currently undertake a more marginal role in NbS. There were also actors with some such as Scottish Land commission, Forth Estuary Forum, Scottish Land and Estates, Scottish Power and Scottish water, who have an interest in managing landscapes and ecosystems for economic benefit, and so potentially could offer expertise that spans biophysical and socio-economic. These actors did not normally appear to be key influences on NbS delivery although Scottish Water was identified as a key partner in delivering the £10k rain gardens initiative. Lastly, some actors hold expertise relating to all three aspects. These actors often have an interest relating to managing nature for societal benefit (e.g. Green Action Trust, Scottish Wildlife Trust; Tweed Forum and are experienced in steering or leading projects related to NbS.

Overall, the capacities of actors involved in NbS suggests good potential to draw on and combine multiple insights for designing, planning and delivering NbS. That said, our analysis cannot identify which capacities are actually used in NbS – for large organisations, the expertise held in different departments may remain relatively siloed. Additionally, a minority of the involved actors provide the expertise needed to tackle social challenges and engage non-environmental sector stakeholders.

## 5.2 Actors' roles within NbS

We scrutinised the involved actors for more detail about exactly how they are involved, classifying their involvements as per the typology of roles in 4.3.

For most actors, one more or more clearly defined roles were identifiable. Steering roles are especially easy to identify. However, for about a third of the actors that we analysed (60 of the total

197 data entries[8]) their specific roles were unclear and likely to be marginal or peripheral. Involvement was also likely to be marginal for some of these actors who demonstrated strategic or rhetorical alignment i.e. by providing material that is cross-linked to the NbS, suggesting less reciprocal influence between the NbS initiative and actor.

Table 7 identifies dominant associations between roles and types of actor, as per their sector. It makes clear that public sector and non-profit actors are fulfilling most of the roles. NbS is generally initiated and managed by non-profit actors from the environmental sector (e.g. SWT) as well as networks – mostly bespoke partnerships set up to facilitate the NbS e.g. Tweed Forum, Seven Lochs Partnership and Glasgow and Clyde Valley Green Network Partnership.

We also identified that certain role types were especially strongly associated with actors' with a specific topical focus or scale of operation. Firstly, the **implementation** role was often associated with actors with a relatively distinct geographic or site-specific focus, e.g. housing association, house builders, primary schools, young people living within a particular place as well as local authorities and other public bodies owning and managing their own land. Secondly, **mediating** roles were predominantly associated with community-level actors, e.g. community councils and trusts) and non-profit actors with process-based expertise (e.g. Involve and Democratic Society). There were a very few for-profit actors with other types of procedural expertise, e.g. in creating a financial return from NbS initiatives. Thirdly, the **adapting** role was undertaken by many public sector organisations (the Scottish Government, the Scottish Parliament and local authorities – for the latter see below).

*Table 7 Identifiable roles in NbS undertaken by different actors in different sectors (see section 4 for description of roles and sectors). In this table the public sector is further broken down to allow differentiation of different patterns of involvement. For more information about the public sector organisations that were commonly involved, see the following section.*

| | **Actor sector** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Public sector | | | Non-profit | Network | For-profit | Research | Community |
| **NbS Role – i.e. type of involvement** | Commonly involved public agencies | Local authorities | Other public sector and Scot Gov | | | | | |
| Initiating/ leading | Some | Some | - | Yes | Yes | - | - | - |
| Steering | Yes | Yes | Yes | Yes | Yes | - | Yes | - |
| Implementing | Some | Yes | Yes | Yes | Yes | Yes | - | Yes |
| Mediating | Some | | Some | Yes | - | Yes | - | Some |
| Self-adapting | | Yes | - | - | - | - | - | - |
| Promoting | Yes | Yes | - | Some | Yes | - | - | - |
| Financially contributing | Some | Yes | - | Yes | - | - | Some | - |
| Technically advising | Yes | - | Some | Yes | - | Some | Yes | - |

*'Some' indicates one or two actors in that category are found in that role, but there is not a strong association between that role and sector type in our data.*

There is temporal dimension to roles, i.e. actors change in their involvement over time – and NbS itself changes over time. For example, in the case of the Seven Lochs Wetland Park, we know that the

[8] There are more roles recorded (197) than actors (140) as some actors were present in more than case study and/or had more than one role in a case study.

Glasgow and Clyde Valley Green Network Partnership initially undertook a more active leadership role for NbS but has stepped back, and the NbS is now managed by a new site-specific partnership. Our methodology cannot fully probe this issue, but it remains an important question as to if and how roles change over time.

## 5.3 Differing patterns of involvement

In this section we first identify the actors who seem prominent across our sample of NbS cases – the 'usual suspects' – and explore how they are involved (section 5.3.1); we then consider local authority involvement, a class of actors who are often involved but a different one every time (section 5.3.2) and then lastly identify types of actors who are absent or potentially under-involved (section 5.3.3).

### 5.3.1 Commonly involved key actors - the 'usual suspects'

Across the 6 cases we examined, we found 17 actors were commonly involved. NatureScot was involved in 6 cases, and the Scottish Government in 5. Table 8 lists these actors, their attributes, and their roles in the NbS projects.

These 'usual suspects' were either non-profit or public sector actors with a focus on the natural environment. Accordingly, the dominant expertise was in tackling biophysical challenges, but also some expertise in socio-economic challenges (e.g. health and wellbeing, skills and employment) and process expertise (mostly community engagement).

The public sector bodies typically work at a national scale whilst some of the third sector actors (Green Action trust; Tweed Forum) work more regionally. The exception to these statements is the Glasgow City Council, the only local authority in this list, with a more place-specific remit and a broader mix of interests and expertise.

All these actors are potentially pivotal in shaping the development and implementation of catchment-based NbS in Scotland. However, to understand more about their influence it is important to understand their role within a NbS project. An actor who is only peripherally involved, or engages only on specific topics will likely has less influence over the conceptualisation and ambitions of NbS than an actor responsible for initiating and planning NbS from its earliest stages. The last column of table 4 therefore categorises the roles played by these actors across the NbS cases that we analysed; usually they play multiple roles within one case as well as across the set. Amongst all these actors, the SWT emerges as a key actor, due to its role in initiating and leading NbS initiatives.

Commonly, these 'usual suspects' undertake formal role within the 'strategic-level NbS i.e. contribute as a member of a board or steering group, so contributing to high level decision-making. It should however be noted that the formality of this role (alongside financial contribution) makes it more visible on websites and other public data. Other 'usual suspects' are evident more in terms of providing specialist technical support, e.g. BugLife provides entomological expertise whilst Forest Research providing forest management expertise. Either way, these usual suspects usually have more 'arm's length' roles, with others involved in making specific physical changes on the ground.

*Table 8 The 'usual suspects' – key actors commonly involved in NbS. Shared case colour coding shows NbS projects related at the strategic and project level.*

| | Case in which they are involved | | | | | | Actor characteristics | | | | Actor capacity | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Actors** | Strategic Case: Riverwoods | Strategic Case: Tweed Forum | Project Case: Eddletone | Strategic Case: CSGN | Project Case: 10k Raingardens | Project Case: 7 Lochs | Sector | Topic focus | Scale of Operation | **Role(s) in NbS** | Biophysical expertise | Socioeconomic expertise | Procedural expertise |
| Buglife | Y | | | Y | | | Non-profit | Biodiversity and ecosystems | National | Specialist support | Yes | | Some |
| Forest carbon | Y | | Y | | | | For-profit | Natural resources | National | Mediating | Yes | Some | Yes |
| Forest Research | Y | | | Y | | | Research | Biodiversity and ecosystems | National | Specialist support | Yes | Some | Some |
| Forestry and Land Scotland | Y | Y | | | | Y | Public | Natural Resources | National | Steering | Yes | Some | Some |
| Green Action Trust | Y | | | Y | | | Non-profit | Social-environmental interface | Subnational (although shifting to a national focus) | Leading; promoting | Yes | Yes | Yes |
| NatureScot | Y | Y | Y | Y | Y | Y | Public | Biodiversity and ecosystems | National | Steering; financial | Yes | Some | Some |
| RSPB | | Y | | Y | | Y | Non-profit | Biodiversity and ecosystems | National | Steering; specialist support | Yes | Some | Some |
| SRUC | Y | | | Y | | | Research | Social-environmental interface | National | Likely Specialist support | Yes | Yes | Yes |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Scottish Forestry | Y | Y | Y | Y | | | Public | Biodiversity and ecosystems | National | Steering | Yes | Some | Some |
| Scottish Government | | Y | Y | Y | Y | Y | Public | National Government (multiple) | National | Multiple: Steering; financial; enabling | Some | Some | Some |
| Scottish Land and Estates | | Y | Y | Y | | | Network | Natural Resources | National | Promoting | Yes | Some | Some |
| Scottish Water | Y | Y | | Y | Y | | Public | Natural Resources | National | Steering; Implementing (proposed) | Some | Some | |
| SWT | Y | Y | | Y | | | Non-profit | Biodiversity and ecosystems | National | Multiple: Leading; Steering; implementing; promoting | Yes | Some | Yes |
| SEPA | Y | Y | Y | Y | | | Public | Environment | National | Multiple: Steering; promoting; specialist support | Yes | Some | Some |
| Tweed Forum partnership | Y | | Y | | | | Network | Social-environmental interface | Sub national | Leading; Steering | Yes | Some | Some |
| Woodland Trust Scotland | Y | | Y | Y | | | Non-profit | Biodiversity and ecosystems | National | Steering | Yes | Some | Some |

### 5.3.2 Local Authorities

There is no local authority that is appears in more than one of our strategic level (or linked project level) cases, as different local authorities are involved in initiatives in different places, depending on local authority boundaries.

Multiple local authorities were identified as contributing to NbS. For the CSGN strategic level NbS, and its connected project-level initiatives, several local authorities were involved, whereas the other strategic and project level cases each involved only one local authority (for example, the Tweed and Eddleston projects involve the Scottish Borders Council). NbS initiatives in densely populated areas – or covering large geographical scales – are more likely to involve multiple local authorities. However, we can also speculate that some local authorities may be more 'pro NbS' as even within our small sample we can see local authority Glasgow City Council and Falkirk Council involved in more than one initiative, whereas other local authorities are not. It is also possible that involved-departments or individuals may affect how and when local authorities engage, as we see some councils' involvement focuses on wetlands and natural flood management whereas others focus on woodland ecosystems and creating new recreational opportunities.

Across our sample, local authorities typically had formal status as steering group, partnership or advisory board members. They were most strongly associated with **enabling** roles, by adapting their internal policies to explicitly provide a link to the NbS initiatives. NbS often seems linked with or enabled by spatial planning, as all the involved Local Authorities cite NbS within Local Development Plans and nested technical planning guidance. NbS is also sometimes cited in other plans and policies, especially environmental sector policies: biodiversity policy – mandatory biodiversity reporting often includes NbS – also sustainable development; climate change; flood management. Additionally, Inverclyde linked NbS to travel policy and Fife to place-making. Some local authorities policies mirror the language and goals set out in NbS strategic levels (or vice versa).

Direct action to **implement** NbS was also seen though less common. This occurred where action was needed in sites that are part- or wholly-owned by them (e.g. Clackmannshire council; South Lanarkshire Council). Local authorities also seemed to be involved in "proof of concept" type actions (e.g. Falkirk council working to create a raingarden in, the Rose Garden at Zetland Park, Grangemouth; Glasgow City council pilot rain gardens). Local authorities did not appear to fill other roles, i.e. in mediating or providing specialist technical support.

Overall, local authorities have an especial focus on enabling, and tend to link NbS to their environmental objectives, which is perhaps suggestive of expertises involved in NbS.

### 5.3.3 Who could be involved in NbS?

There are a very wide range of benefits potentially generated by catchments. Their regulating ecosystem services have generally been degraded by actions such as wetland draining to provide immediate short-term benefits, often for food production but also for localised flood protection (UKNEA, 2011), which suggests redressing these could be a focus for a future NbS.

Focusing more on freshwater itself it is possible to be slightly more specific about the range of ecosystem services provided – but focusing on other components of the catchment system, such as riparian woodlands or lowland agriculture, would also identify many other benefits.

In Table 9 we identify some potential benefits from catchment systems, and the societal groups who use or enjoy those benefits. The nature of some the benefits and beneficiaries suggests that many of the ecosystem services delivered have the character of public goods – that is, benefits that are not easily or fully captured by private for-profit actors – for example, local climate regulation. By

contrast, provisioning services are typically those that have been well represented in existing markets – e.g. the extraction of food, peat are both linked with long-standing profitable industries.

*Table 9 Identification of beneficiaries of goods and services provided by catchment systems, focusing especially on the freshwater part of this systems based on table 9 and table 9.1 of the UK NEA (2011) – also incorporating additional consideration of hydropower and riparian woodlands, the latter building on the Riverwoods Evidence Review (The Riverwoods Science Group, 2022).*

| **Category of Benefits (goods and services)** | **Subcategories of good(s) and service(s)** | **Direct Beneficiaries** |
|---|---|---|
| ***Provisioning services*** | | |
| Fish | Commercial fisheries (crayfish, salmon, trout) | Freshwater Aquaculture sector (much smaller than coastal aquaculture) – of carp and possibly rainbow trout. |
| Dairy and beef | Grazing, silage and hay from wetland silage. | Agricultural sector – livestock farmers / suppliers thereof. |
| Reeds, osiers [willows] and watercress | Thatching | Thatching businesses |
| | Withies for basket making and other crafts | Crafting businesses |
| | Watercress | Foragers, mostly recreationally but potentially for profit.<br>Watercress is not (yet) commercially farmed in Scotland. |
| Clean Water | Drinking water | Scottish Water<br>All citizens / the general public |
| | Irrigation | Agricultural sector – all Farmers esp arable |
| | Power water cooling, | Nuclear power stations (if any operate?). Potentially other types of power stations? |
| | Industrial processing | Whisky industry/ gin<br>Papermills?<br>Other Industries? |
| | Fish farming | Counted above. |
| Peat extraction | Components for Horticulture<br>Ingredient for some whisky<br>Bioenergy | Horticulture industry – garden centres, suppliers of those, mushroom farms<br>Whisky producers<br>Use of peat for fuel is not expected in future. |
| Navigation | Canal boats and boats for lakes, rivers | Recreational Canal boat operators<br>Any other freshwater navigation<br>Scottish Canals |
| Health products | Mineral spas | Spa hotels in tourism industry |
| | Medical plants (bog beans) | Foragers, recreationally |
| | Medical leaches | NHS |
| ***Regulating*** | | |
| Carbon regulation | Reduced /slowed climate change | All society within and beyond Scotland. |

| | | |
|---|---|---|
| | | Those buying/selling carbon credits, and brokers thereof. |
| Flood regulation | Reduced downstream flood risk | Householders and business owners affecting by flooding, infrastructure operators.<br>Local authorities and SEPA (and Scottish Water) responsible for flood risk management |
| Flow regulation | Irrigation<br>Power water cooling<br>Navigation<br>Industrial processing<br>Hydropower generation | Agriculture,<br>Recreational and commercial users of waterways, British Waterways<br>Scottish & Southern Electricity (SSE)<br>Communities operating small-scale hydroelectric schemes |
| Water quality regulation | Wastewater treatment | Scottish Water |
| Local climate regulation | Improved air quality | Local communities |
| Fire hazard regulation | Reduced fire risks | Emergency services<br>Estates and Landowners |
| Human health regulation | Venues for physical recreation | Local people & visitors |
| | Clean air and cooling | Local people & visitors |
| | Aesthetic /visual benefits to improve well-being | Local people & visitors |
| **Cultural services** | | |
| Science and education | Environmental archives, site for learning | Scientists & other academics (environmental science, hydrology, historical studies etc)<br>Schools and teaching |
| Religion | Spiritual values<br>Sites of historical baptism and religious festivals | Some isolated cases and visitors. |
| Tourism and recreation | Recreational fisheries - game and coarse | Those holding fishing rights – usually Riparian land-owners (often linked to Fisheries Boards and Trusts) |
| | Tourism based on landscape +iconic species (aspects of biodiversity) | Tourism industry – hotels and services supplied to tourists<br>Local people & visitors |
| | Recreation based on water qual, appearance and access | Local people & visitors (overlap with human health category above) |
| Sense of place | Landscape character, literature, art, local culture | Local people & visitors<br>Those valuing Scottish culture<br>Crafts, book and art sales etc |
| History | Battlefields, boundaries, folklore | Local people & visitors<br>Scottish culture / appreciators thereof |

Because catchments can potentially encompass every terrestrial habitat type, at a generic level practically every societal group is a potential direct and indirect beneficiary. For this reason in table 10, we only focus on identifying direct beneficiaries – those directly enjoying a benefit or responsible for providing – as identifying indirect beneficiaries for an all-encompassing list of benefits tends to identify a huge range of groups and identifying every societal group as a stakeholder would be practically and analytically unusable.

However, table 10 highlights key groups that may benefit from a proposal oriented around delivering particular benefits, and thus may be particularly interested to engage in and support that proposal. An analysis that is specific to a particular context and a particular proposal is needed to highlight the beneficiaries. For example, a NbS concept focused around reducing downstream risk and improving access may provide distinct benefits to local communities, recreational interest groups but also disbenefits to upstream farmers for whom it may imply reduced or changed agricultural production.

An example of the analysis of potential beneficiaries is provided for a linked strategic and project-level cases, the CSGN and the 10k Raingardens cases, based on CSGN's own analysis of its benefits.

*Table 10 An analysis of potential benefits and indirect benefits for CSGN and 10k Raingardens, with categories in column derived from The CSGN vision (Central Scotland Green Network Trust, 2011) and the resources for different types of stakeholders produced by the 10k raingardens for Scotland (e.g. 10k raingardens for Scotland, undated). The distinction between direct and indirect benefits is added by us.*

| Case | Future benefits identified by initiative | Direct or indirect benefit? | Beneficiaries identified by initiative |
|---|---|---|---|
| CSGN | Delivery of goods and services from green network. e.g. support climate adaptation (increase flood resilience) | Direct | Businesses; Community; Public sector |
| | Attract employees; healthier employees | Indirect | Businesses |
| | Delivery of goods and services from green network. e.g reduce energy and water use | Direct | Businesses; tourism sector |
| | Strengthen 'green' sector in area - i.e. attract more to the area | Indirect | Green businesses |
| | More tourists | Indirect | Tourism sector |
| | Employment; tax revenues; reduced preventable diseases; reduced health inequalities; | Indirect | Public sector |
| | Access to quality greenspaces; improved services from green network (i.e. climate adaptation/ sustainability transport connectivity/ wellbeing/ more physically active/ nature connections/ social space/ sense of community and place); Environmental learning opportunities (e.g food growing). | Direct | Towns and cities (urban Communities) |

| | | | |
|---|---|---|---|
| | Reduce health inequalities; increased sense of place; enhanced collective agency within communities | Indirect | Community |
| | Protecting and enhancing the natural environment | Direct | Land based sector (i.e Forestry); Tourism sector |
| | Job creation | Indirect | Community |
| | Skills development | Indirect | Land-based industries; 'Green' industries; Low-carbon industries; Individuals |
| | Educational opportunities | Indirect | Community |
| | Developing social capital | Indirect | Community |
| | Improving local amenity | Direct | Community; tourism sector |
| Raingardens | Water attenuation | Direct | Households; Neighbourhoods; Schools; Leisure park managers; Developers; Community garden groups |
| | Flood impact | Indirect | Households; Neighbourhoods; Schools; Leisure park managers; Developers; Community garden groups |
| | Surface water drainage | Direct | Households; Neighbourhoods; Schools; Leisure park managers; Developers; Community garden groups |
| | Biodiversity | Direct | Households; Neighbourhoods; Schools; Leisure park managers; Developers; Community garden groups |
| | Pollution (water quality) | Direct | Households; Neighbourhoods; Schools; Leisure park managers; Developers; Community garden groups |
| | Air quality | Indirect | Households; Neighbourhoods; Schools; Leisure park managers; Developers; Community garden groups |
| | Connectivity/ green networks | Direct | Households; Neighbourhoods; Schools; Leisure park managers; Developers; Community garden groups |
| | Traffic and congestion reduction | Direct | Households; Neighbourhoods; Schools; Leisure park managers; Developers; Community garden groups |
| | Green space | Direct | Households; Neighbourhoods; Schools; Leisure park managers; Developers; Community garden groups |
| | Place aesthetics | Direct | Households; Neighbourhoods; Schools; Leisure park managers; Developers; Community garden groups |
| | community perception | Indirect | Households; Neighbourhoods; Schools; Leisure park managers; Developers; Community garden groups |
| | Health and wellbeing | Indirect | Households; Neighbourhoods; Schools; Leisure park managers; Developers; Community garden groups |

| | | | |
|---|---|---|---|
| | Behaviour change | Indirect | Households; Neighbourhoods; Schools; Leisure park managers; Community garden groups |
| | Recreation/ outdoor access | Direct | Households; Neighbourhoods; Schools; Leisure park managers; Developers; Community garden groups |
| | Economic regeneration | Indirect | Businesses; Community |
| | Business perception | Direct | Businesses; Community |
| | Skills and training | Indirect | Businesses; Community |
| | Accessibility | Direct | Businesses; Community |
| | community viability/ area profile | Indirect | Businesses; Community |
| | Amenity | Direct | Businesses; Community |

### 5.3.4 Who may be under-involved in NbS?

We have already noted actors who are playing key roles (section 5.2) and commonly involved (e.g. section 5.3.1) in our NbS cases. By comparing these with potentially influencing or influenced by NbS (5.3.3), we can identify some groups who may be under-involved at present.

**Those affecting NbS i.e. those enabling and constraining catchment initiatives**

Firstly, those who are currently formally responsible for freshwater policy and other aspects of catchment management are typically the 'usual suspects' already involved in the NbS cases. These are primarily SEPA and NatureScot (responsible for implementation of the Water Framework Directive, Floods Directive, and Nature Conservation Policy) although other public bodies such as Local Authorities also have statutory duties to support these policy goals (and others). Those who are absent are those who may more indirectly influence catchment management e.g. by shaping and influencing agricultural policy.

**Those affected by NbS i.e. potential beneficiaries of catchment-based NbS**

Those who currently rely on regulating services, such as sufficient flow of quality water –notably Scottish Water and Scottish and Southern Electricity networks – do not appear as yet to play significant roles in any of our cases. The call for more the involvement of private sector for-profit businesses is commonly heard and these data suggest *some* types of business that could be involved. However, it is important to differentiate the precise type of private sector actor in order to understand any rationale for their involvement. In particular, there could be more involvement of a diverse set actors in the tourism-related industries for whom catchments provide a variety of opportunities. However, in other cases there may be limited rationale for these types of actors to get involved – as many of the goods provided have the nature of public goods that are not well represented in markets.

Local communities are already involved, or intended to be, in all of our cases, and the range of ways in which they may relate to and benefit from freshwaters and catchments highlights the need to deepen their involvement. This may not always be straightforward, and indeed attachment to place can sometimes lead to resistance to change, but will be essential to designing and achieving appropriate NbS at scale.

In some cases there may already be involvement but also opportunity for them to adopt more or different roles, to strengthen the implementation of NbS. In particular, Local Authorities – who represent and act for local people – warrant further attention. At present Local Authorities are often involved in NbS but seem to be more in the mode of supporting and citing NbS within their policies, rather than being key players shaping NbS: an important question for the future is whether and how their involvement in NbS could be strengthened.

# 6 Discussion and Conclusion

Our six cases of catchment-based NbS indicate patterns of stakeholder involvement and activity that may shape the future progress of NbS in Scotland.

We find that eNGOs and public sector organisations with a core focus on nature and the environment are dominant in these cases, playing multiple key roles in conceptualising resourcing and implementing NbS. Promisingly, there is also good representation of actors with procedural expertise e.g. skills in facilitating partnership working or community engagement. This is important as involving urban and rural communities is likely to be essential, given the wide range of benefits they can potentially draw from NbS. At present communities are involved, but only partially, consulted or involved only in certain parts of NbS planning; there may be opportunities to involve them more fully, especially in NbS conceptualisation.

BY contrast, for-profit private sector actors are not commonly involved, which resonates with previous studies of catchment working (Waylen et al., 2020). Identifying opportunities to deepen their involvement may require more catchment and project-specific analyses of beneficiaries, but it must also be recognised that not all ecosystem goods and services are likely suitable to capture in markets, which will shape the involvement of for-profit actors, except if corporate social involvement is their aim. The creation of carbon markets, and more recently biodiversity net gain trading, show there is some potential for changing governance arrangements to involve some private sector actors for profit motives.

By carefully choosing cases to represent a range of NbS practices, and enriched by our pre-existing expertise in catchment working and NbS, we consider these cases offer insights that are generalisable to other cases, though testing this would be useful challenge for other research. It would be particularly interesting to test if there are different patterns of stakeholder engagement associated with or entailed by different levels of intervention; and by NbS with different focal issues.

A recent review of stakeholder engagement in NbS across Europe, focused on local communities and citizens (Ferreira et al., 2020) has found there is often a focus on access and well-being, but not economic consequences, nor risks or justice. The Nbs literature is also generally more focused on urban than rural settings (e.g. Dorst et al., 2022). This may limit the ability of NbS plans to acknowledge and adapt to tradeoffs, and limit who is involved, especially economic actors. To some extent, this reflects existing patterns of responsibility and involvement in what are seen as environmental issues. There are lots of understandable reasons why stakeholders who have not previously thought of and worked with the environment are not motivated or able to re-orient to work with NbS – and why those that do have a history of environmental concern retain their responsibility and do not widen their collaborations (Waylen et al., 2015).

To understand what blocks and helps unblock actors' involvement in NbS needs indepth work to understand the experiences of different actors esp those currently under-involved; new collection methods to understand who has been invited in, so far, and who has not; and appreciation of the constraints in what current NbS leaders can do on this. We hope to explore some of these issues within later work of this project.

Whilst there are many research needs and gaps, there are also clear opportunities to broaden stakeholder engagement by those currently focused on NbS. A case-specific appraisal of key stakeholders – both those affected by and affecting NbS – can help to inform the scope of work and those to engage, and there is extensive guidance about how to do this (e.g. Reed, 2008). Considering how – and at what point – different stakeholders are involved or engaged is also necessary; there is less concrete guidance about how to do this, but considering the issues of roles (e.g. Mitincu et al., 2023) in connection with stages in project delivery provides an opportunity to reflect on this issue.

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