A Review of the Biological Recording Infrastructure in Scotland

By the

Scottish Biodiversity Information Forum

Enabling Scotland to be a global leader for biodiversity

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1. Executive summary

Purpose of this Review

In response to concerns about the efficacy and sustainability of the biological recording infrastructure in Scotland (the Infrastructure), the SBIF Review set out to determine its current limitations and how it could be transformed so that the business case for such a transformation could be determined.

Key findings

- No one can easily provide, access or use all of the biodiversity data collected in Scotland. Although the advent of the NBN Atlas and other online recording tools and resources has been beneficial, poor data flow remains problematic. The plethora of apps and routes for data submission causes confusion rather than simplification of the data flow pathway. Much of the data collected is never made available for use.
- Those involved with the collection, management and sharing of biodiversity data are under-resourced. As a result, they are struggling to maintain the status quo, let alone improve the Infrastructure. This precarious state has been exacerbated by expectations that Open Data should be made freely available and by ever-tightening public funding.
- Volunteer energy is stifled by the shortcomings of the Infrastructure. People are happy to participate but their contributions and ease of operation are then curtailed by the frustrations encountered. Some of the volunteers we rely on most heavily experience fatigue and burnout.
- Services to support data flow, public engagement and decision-making are not sustained in all areas of Scotland. Geographic and taxonomic gaps in the availability and currency of data make the provision of services and appropriate regard for biodiversity duty difficult. Where services are provided, there is no consistency on how these services are delivered locally.
- Against the backdrop of global threats to nature and biodiversity declines, these problems hamper our contribution to global biodiversity aspirations (the Aichi Targets). There is an urgent need for a step change to increase the sustainability of the biodiversity sector and to maintain its momentum and optimism.

Our preferred option

The options for service provision, in-country governance, funding source and community funding have been evaluated to create a blueprint for improving the biological recording infrastructure in Scotland. Our preferred option is for a full transformation of the Infrastructure through the provision of regional, national and UK services to maximise value and optimise public services and engagement. This would entail the establishment of public funding to sustain an Open Data business model (using a revenue stream based on sectors gaining value from the Infrastructure or causing environmental harms); the establishment of a dedicated Scottish arm of the National Biodiversity Network (NBN), NBN Scotland, to provide in-country governance; and, the creation of a Community Fund to scale up expertise, activity and outreach across Scotland.

Key benefits

Transformation of the Infrastructure will remedy the issues cited above with the following benefits:

- Recorders using clear, affiliated data flow routes and submission points will be confident in how and where to submit their records and so more records will be submitted more effectively and easily.
- Data Users in every sector will have Open access to all available biodiversity data for Scotland via a single, definitive, central data repository with opportunities and time-savings for all.
- Services that support Recorders and Data Users will be available and in use across Scotland with integrated services and innovative data products for Service Users (including Local Authorities, National Government, businesses, academia, land managers and local communities).

- People involved in recording will have access to high quality training and support and will feel valued for their skills and contribution; more people will feel a sense of worth and a connection to nature.
- A single organisation will have strategic oversight of the whole Infrastructure for maximum cohesion and efficacy, working in far-reaching partnerships with local relevance and pride.
- Organisations that provide or govern key parts of the Infrastructure will have the capacity and financial security to build capabilities in support of Scotland's strategic goals, with greater interoperability and an easing of pressure on keystone individuals.
- With more people involved, the skills base in ecology and taxonomy will be greatly increased with more records of more sites and species of interest then available (so fewer data gaps in future).
- A transformed Infrastructure will substantially underpin delivery of five of the National Outcomes for Scotland, assist public bodies in their Biodiversity Duty through easier mobilisation and use of data, and support the Scottish Government's ambition of being the greenest country in the world.
- Changes in species and habitats' distribution and abundance will be better detected and understood to inform planning and land management decision-making and responses to environmental harms.
- Improved standards will facilitate compliance with biological recording best practice while more available data and better services facilitate community participation in public decision-making.

The value and costs of transformation

We estimate that the tangible economic value of the benefits underpinned by a fully transformed biological recording infrastructure is in the region of **£7 billion per annum for Scotland** (based on the value of natural capital, ecosystem services, wildlife tourism, land management and planning decision-making, community empowerment and public health gains). Wider intangible benefits were also assessed and are thought to potentially offer a further £12 billion worth of value per annum.

In contrast, the costs of transformation and annual operation in perpetuity amount to £6.43 million per annum (if Scotland covers all costs at the UK level at least during the period of transformation) or £2.85 million (if Scotland contributes to UK level infrastructure in proportion to its population size). Public funding in Scotland provided £368,567 in 2018/19 to support the activities of the NBN Trust, five Local Environmental Record Centres and a major recording group.

Expected return on investment

Investment in the biological recording infrastructure offers an impressive benefit:cost ratio for Scotland. For every £1 invested, between £10 and £23.50 of economic value is underpinned (based on the most conservative estimate), or between £1087 and £2450 (based on the least conservative estimate), depending on the extent to which Scotland contributes to UK level costs (i.e. whether 100% or 10% of UK level costs are covered).

This value is realised through the provision of a definitive evidence base to support a long-term environment strategy, and effective environmental protection and decision-making which together facilitate a sustainable economy. This is only possible due to the scale of volunteer participation, the depth of taxonomic expertise and rich knowledge about the ecology, occurrence and status of species, and the openness of data facilitating use for all sectors, purposes and generations.

Next steps

Following the publication of this Review and a period of time for discussion with key stakeholders, the SBIF Advisory Group will work to develop an appropriate strategy and Implementation Plan with a view to securing funding and progressively fulfilling our recommendations - subject to consultation - by 2025.

Our Implementation Plan will develop a benefits roadmap for the public, commercial, academic and third sectors to encourage each one to champion, realise and sustain the benefits anticipated. We will report on progress through quarterly highlight reports and an annual programme review. For informal updates, please follow **@sb_info_forum** on Twitter.

Recommendations

OUTCOME 1: TRANSFORMED DATA FLOWS

1. PRIMACY OF THE NBN & NBN ATLAS: The National Biodiversity Network (NBN) and NBN Atlas platform remain the primary place for the submission, dissemination and discovery of biological records and added-value datasets and services.

2. AFFILIATION OF DATA SUBMISSION ROUTES: All biological records should be submitted online and channelled to the NBN Atlas via standard, affiliated routes.

3. SINGLE, CENTRAL ROUTE FOR CASUAL RECORDS: iRecord should be the single, central affiliated channel through which to submit 'ad hoc' records for verification, inclusion in relevant National Recording Schemes and dissemination via the NBN.

4. PRIMACY OF AFFILIATED DATA SUBMISSION ROUTES: Biological records for a specific National Recording Scheme, recording group, project or organisation should be submitted via their affiliated route.

5. PROVISION OF RECORDS COLLECTED UNDER LICENCE OR FOR CONSENT/STATUS: Biological records collected with public funding, under licence, for Environmental Impact Assessment or planning consent, or for an academic or professional qualification, should be provided to the NBN Atlas as a matter of good practice.

6. RECOGNITION & RESOURCING OF A CENTRAL DATA MANAGEMENT PORTAL: Recorder 6 and Marine Recorder should evolve to become the common, central data management portal for data custodians to collate, view and manage their own biological records and datasets (unless a suitable internal business system is used).

7. RECOGNITION & RESOURCING FOR SUPER PARTNERS*: Super Partners should be fully recognised and sustained to a level that has the capacity to support verification on a major scale.

8. SYSTEM SIMPLIFICATION: The systems and tools available for collecting, curating, aggregating and disseminating biological records across all environments (terrestrial, freshwater and marine) and sectors should be rationalised.

9. ESTABLISHMENT OF AN NBN NATIONAL HUB: An NBN National Hub for Scotland should be established to support a network of NBN Regional Hubs and to facilitate the flow of biological records into the NBN Atlas to create a definitive evidence base for Scotland.

10. ESTABLISHMENT OF A NETWORK OF NBN REGIONAL HUBS: A network of NBN Regional Hubs operating in partnership with the NBN Trust covering the whole of Scotland should be created.

11. AUTOMATED USE FEEDBACK & SHOWCASING: Use feedback for Recorders and Data Providers should be built into all automated processes facilitated by the NBN Atlas.

OUTCOME 2: TRANSFORMED SERVICE PROVISION

12. NBN REGIONAL HUB SERVICE FOCUS & BRANDING: NBN Regional Hub Partners should provide services that i) support the flow of biological records to the NBN Atlas for Open use, ii) raise the awareness of, engagement in, and support for biological recording, and iii) support the effective interpretation and use of biological records in local and regional decision-making.

13. CONSISTENT SERVICE PROVISION ACROSS SCOTLAND: NBN Regional Hub Partners should offer a set of core services in a consistent way so that service users from across Scotland can access the same core service from any location in Scotland.

14. NBN REGIONAL HUB HOSTING ARRANGEMENTS: NBN Regional Hub Partners should be hosted by an organisation that can provide access to professional back office support (including finance, human resources and IT), line management and office facilities.

OUTCOME 3: TRANSFORMED GOVERNANCE AND CULTURE

15. NATIONAL & REGIONAL HUB SERVICE STRATEGY: A national service strategy for the biological recording infrastructure in Scotland should seek to perennially grow the contribution of the Infrastructure in support of the National Outcomes for Scotland.

16. RECOGNITION & RESOURCING OF A CENTRAL HUB FOR THE UK: The NBN Trust should be given special status as the Lead Governance Body for the biological recording infrastructure in Scotland.

17. GOVERNANCE OF NBN SCOTLAND: The NBN National Hub for Scotland should be established as a division of NBN Trust and should be known as NBN Scotland.

18. UNIFICATION OF BRC & NBN TRUST DATA MANAGEMENT SERVICES: The data management services of the Biological Records Centre (within the Centre for Ecology and Hydrology) and the NBN Trust should be brought together either through amalgamation or through a formal partnership arrangement for maximum synergy.

19. TEAM BUILDING & PROFESSIONAL DEVELOPMENT: The NBN Trust should invest in a National and Regional Hub professional development programme to build rapport, to encourage common ways of working and to grow collective capacity through developing the skills and capabilities of everyone involved.

OUTCOME 4: TRANSFORMED FUNDING

20. A SINGLE FRAMEWORK AGREEMENT: Sufficient public funding should be provided to cover the core operating costs of the NBN Trust and its network of National and Regional Hubs, Super Partners and community groups in perpetuity where these are providing public services as a public good in support of the National Outcomes for Scotland.

21. FUNDING DRAWN FROM THOSE WHO GAIN VALUE OR CAUSE HARMS: The source of public funding should be designed to i) share the core operating costs of the Infrastructure between the sectors who need to access biodiversity data and realise value from doing so and to ii) base the greatest burden of funding upon those whose activities are key drivers of biodiversity loss.

22. A SINGLE APPROVED BODY TO DISBURSE FUNDS: The NBN Trust should be the Approved Body for the disbursement of funding provided through any Framework Agreement.

23. COMMUNITY FUNDS TO SUPPORT VERIFIERS, RECORDERS & OUTREACH: A Community Fund should be established to facilitate the scaling up of public participation in biological recording to ease current pressure points and to encourage participation and equal access for all.

OUTCOME 5: TRANSITION BY 2025

24. AN IMPLEMENTATION PLAN TO ACHIEVE RECOMMENDATIONS BY 2025: The SBIF Review Working Group should develop a detailed Implementation Plan for the period from 2020 to 2025 that sets out how the transition from the current situation to the future situation in Scotland will be achieved and monitored.

For more context on each recommendation, please refer to Section 8 (pages 55-61).

* *The term 'Super Partner' refers to the organisations or systems that provide major components of the Infrastructure or public services upon which the Infrastructure depends (other than LERCs and the NBN Trust). These include:*

- *Museum and garden collections and collection curators such as those in the National Museum of Scotland, the London Natural History Museum and Royal Botanic Gardens;*
- *Major National Recording Schemes such as the National Plant Monitoring Scheme run by the Botanical Society of Britain and Ireland, BirdTrack run by the BirdTrack Partnership and the National Moth Recording Scheme run by Butterfly Conservation;*
- *The UK Species Inventory, iRecord, Recorder 6, Marine Recorder, the Non-Native Species Secretariat and the State of Nature Partnership.*

2. Introduction

Almost a decade has passed since Public Petition PE1229 was submitted to "call on the Scottish Parliament to urge the Scottish Government to establish integrated local and national structures for collecting, analysing and sharing biological data to inform decision making processes to benefit biodiversity". Despite this passing of time, the primary underlying issue - a lack of sufficient, sustainable funding - has yet to be resolved.

In 2009, the Scottish Government's Biodiversity Science Group was asked by the Environment Minister to consider the issues associated with Petition PE1229 and to make observations and recommendations for future action to be provided to the Petitions Committee. Reporting back in 2010, four of their recommendations were that:

> **Recommendation 2:** "Scottish Government should become the key subscriber/contributor to the NBN on behalf of the Scottish public sector to maximise access to, benefit from and use of information provided through the NBN Gateway"; the Scottish Government further responded that "the Scottish Government is content to consider the merits of [being the key subscriber] following the submission of a full business case by the NBN";
>
> **Recommendation 6:** "The Scottish Government, SNH and others should establish a Scottish [Biodiversity] Information Forum (SBIF), whose membership should be cross sectoral and whose role should be to develop a strategic approach (by consensus) to the collection, collation and sharing of biological data across Scotland. This forum must work in close partnership with the NBN to provide maximum mutual benefit. The forum should develop an Action Plan with a clear schedule for implementation";
>
> **Recommendation 7:** "SNH and/or SBIF should review the means by which data for key and priority Scottish species are provided to the NBN and made available to organisations that need them";
>
> **Recommendation 10:** "SBIF should review the role, funding and coverage of LRCs and other local options for biological data management across Scotland as part of the process to ensure that the necessary structures are in place to collect and disseminate biological information across Scotland".

The Scottish Biodiversity Information Forum (SBIF) was established in 2011 in accordance with these recommendations. In 2016, its Action Plan culminated in this Review of the biological recording infrastructure in Scotland to investigate the issues, mechanisms and business case for their resolution.

The Review has identified twelve different roles (see Annex I for details) played by people involved in biological recording (with people often playing several roles) and investigated what is working well and less well across all sectors with an interest in biological recording. The perspectives of 47 influential stakeholders, 290 responses to a public questionnaire (from over 95 organisations and the general public) and the findings of four cross-sectoral workshops on data flow, services, governance and funding (involving 39 organisations) have given an unprecedented level of insight into problems that have persisted for over 40 years and that are today limiting Scotland's contribution to almost all of the Aichi Targets.

Our business case sets out the current situation and the changes needed to address the issues raised in Public Petition PE1229 and since. It considers the options that could achieve these changes and the transition arrangements that would facilitate them. It also appraises the level of value that would be gained from significant investment in the Infrastructure to assess whether such investment would be truly worthwhile for Scotland. Finally, it makes 24 recommendations that, if adopted, will bring many benefits for all sectors and stakeholders.

We are grateful for the time, effort and in-kind support from all of the contributors to this Review. Our workshops were funded through sponsorship from the Scottish Wildlife Trust (SWT), Scottish Natural Heritage (SNH), Biological Recording in Scotland (BRISC) and the Royal Society for the Protection of Birds (RSPB). SNH have also provided funding for secretariat support to the SBIF Advisory Group and the Working Group who undertook this Review.

3. The current situation

The first step in undertaking this Review was to obtain a clear understanding of the current state of the Infrastructure through a literature review, stakeholder interviews and a questionnaire. Although aspects of the Infrastructure are working well there are a number of areas in which problems are experienced, many of which have long been recognised. Despite the issues being so well described and understood, our literature review revealed that some particular challenges around funding and governance have persisted for over forty years.

What is currently working well?

ACCESS TO RESOURCES AND SERVICES

Online access to resources is valued by all sectors

Online access to resources, eg. species identification tools, scientific journals and species distribution maps, are valued by many. Where support exists, from specialist taxonomic expertise to venue booking, facilitation of data flows and administrative support, this is also considered a benefit. Ease of access to a comprehensive data source in a single central place, eg. the NBN Atlas (formerly the NBN Gateway), to enable informed decision making, land management etc, with minimal time spent searching, is also highly valued.

TRAINING

The provision of training in species identification, both face to face and online

Provision of species identification training, when and where it occurs, is of particular value at the local level, especially when delivered at low cost or free of charge, or through bursaries and apprenticeships. This is of benefit whether face to face or when delivered on-line.

LOCAL ENVIRONMENTAL RECORD CENTRE SERVICES

Recorders and Data Users appreciate easy access to local data, services and support

Local service provision, e.g. by Local Environmental Record Centres (LERCs) where they exist, is working well with Recorders and Data Users both gaining from access to these. Also, LERCs are able to provide data and bespoke services that are not currently available from any other source. Accreditation by the Association for Environmental Record Centres (ALERC) offers a governance framework and access to supporting resources for participating LERCs.

ONLINE RECORDING

Smart phone apps and online portals have revolutionised recording

Portals such as those provided by Butterfly Conservation, or tools such as iRecord and BirdTrack for recording wildlife sightings, have improved the recording experience for many. Take-up is not universal but, where used, these reduce the effort of data management and speed verification while easing the passage of data to nationally available repositories, making data more accessible both to the originator and others. The trend away from paper based recording methods to standardised online tools and systems has revolutionised recording with positives for all concerned.

NATIONAL SCHEMES AND THE BIOLOGICAL RECORDING COMMUNITY

An immense contribution is made by national schemes and volunteers

National schemes are regarded as being beneficial regardless of size and scale. They provide valued support to Recorders, such as species expertise and identification training, as well as data management services and production of species distribution maps. Their ability to promote and co-ordinate recording provides a network that enables Recorders to feel involved and valued. The enthusiasm and dedication of those involved in the biological recording community inspires others to get involved. Ease of access to taxonomic expertise works well via a variety of channels, including social media, the UK Species Inventory, recording groups and County and Vice-County Recorders, so that Recorders (who are largely self-sufficient and self-motivated) can access taxonomic lists and other reference materials when needed.

What is currently working less well?

ACCESS TO RESOURCES AND SERVICES

Inconsistent access to, and provision of, services across Scotland

Incomplete LERC coverage across Scotland results in wide variation in the availability of services from area to area. Duplication of effort also occurs due to the high level of overlap between, and inconsistency within, roles in terms of the activities undertaken and perceived responsibilities.

Technical services to support the biological recording infrastructure are lacking

IT and data management skills are unevenly distributed leaving some organisations in unsustainable positions and in danger of losing valuable data. There is a lack of software with all of the functionality necessary for effective handling of taxonomic information. Systems that are utilised by smaller organisations are often locally developed, do not integrate at a regional or national level and are supported on a 'best endeavours' basis. Maintenance of such independent local databases duplicates data flows.

Where technology is available, such as recording apps, it is inconsistently adopted - sometimes related to a reticence to change behaviour, but also owing to a lack of access to training and education, especially in remote areas where face to face support is limited. These issues absorb time that could otherwise be used for value-added activities.

Funding is uncertain making it impossible to plan for the long term

This is largely responsible for the high reliance on voluntary resource and the corresponding lack of paid resource. This, coupled with an inability to support strategic planning, accounts for some of the local shortfall in technological skills, and the lack of training provision, as well as impacting the speed to verify and mobilise data. Lack of funding is a problem at the local, regional and national levels with users seeking a level of service that cannot be fulfilled with existing resources.

ACCESS TO DATA

The lack of a stable, inclusive, central data repository

While the NBN Trust, via the NBN Atlas, provides a digital infrastructure that could fulfil this role, not all Recorders or local and regional data aggregators submit data to the NBN Atlas. This has been exacerbated recently by the push towards fully Open Data by the funders of the NBN Atlas, as many organisations rely on the income generating services from data searches to enable them to resource data management tasks.

Therefore, potential Data Users cannot easily determine if they have accessed all available data. Furthermore, procedures to seek permission to access and use data vary between data providers and are often a time-consuming, costly process. The absence of a clear process for requesting data is a deterrent to local planners and developers to incorporating biodiversity data into the planning process and in wider decision making.

DATA SUBMISSION

The lack of clear data flows and feedback, and loss of access controls

There are a plethora of routes for submitting data and the proliferation of online tools causes confusion, which often results in the same data being sent to multiple recipients, or to the same recipient but via multiple routes. Conversely, the complexity may result in data not being sent at all. User experience is often poor, both in terms of the user interface of online tools, issues with connectivity, and in the lack of feedback. There are no clear data flow descriptions to enable Recorders to submit records secure in the knowledge of where their records will be available for use and where they may aid decision-making and production of species distribution maps. Data Users are frustrated by data being unavailable via the NBN Atlas and by licensing that is felt to be complex. The perceived risk of alienating the volunteer recording, verification and curation community, by imposing a governance framework, results in freedoms being afforded regarding processes and data formats. This results in additional effort by those who need to collate data. Different schemes and projects impose their own requirements on Recorders which may conflict and make it difficult for Recorders and data aggregators who work with multiple schemes or taxa to easily submit and aggregate data.

TRAINING

Availability of training is inconsistent

The cost of training, access within a reasonable distance and a lack of funding for covering travel expenses are issues. Training is considered problematic by most sectors outside academia, and particularly for LERCs, Recorders, recording groups and Recording Group Operators.

VERIFICATION

A lack of verification resource

The majority of individuals acting as Verifiers for species identification are volunteers and the taxonomic skills required are concentrated in an ageing population. Furthermore, the huge increase in records being submitted - due to technological advances such as recording apps and digital citizen science opportunities - also increases the burden on a small number of highly skilled individuals. The lack of standardised data recording formats places extra pressures on Verifiers' time as they have to spend valuable time reformatting data from Recorders because standards are not enforced and details provided are often insufficient, eg. lack of a photo. Physical specimens are often still required for invertebrate, plant, fungi and moss identification, for example. Few tools are being employed to automate appropriate aspects of the process. Unverified data are not made widely available as there is limited provision for data quality to be flagged. These factors result in unverified data not being processed in a timely fashion which in turn leads to delays in the publication of data.

Priorities for attention

In response to being asked for the top three priorities for earliest or greatest SBIF attention, 226 questionnaire respondents made 564 suggestions. Each suggestion was classified by one of twenty broad themes - listed below - and by the role of the respondent. The themes were then ranked from 1 to 20 (for the theme receiving the most suggestions to the theme receiving the least) as follows:

1. Outreach, networking, training and capacity building (n=92 suggestions, 16.3%)
2. Sufficient sustainable resourcing (n=68, 12.1%)
3. Functionality and ease of use of online tools (n=60, 10.6%)
4. Clarity on, and improvement of, data flows (n=54, 9.6%)
5. An improved national to local data infrastructure (n=39, 6.9%)
6. Improved coordination and integration, reduced duplication (n=39, 6.9%)
7. Improved data availability (n=37, 6.6%)
8. Standardisation, consolidation or centralisation (n=29, 5.1%)
9. Full coverage of Scotland (n=25, 4.4%)
10. Improved data quality (n=21, 3.7%)
11. Verification (n=20, 3.5%)
12. Open Data (n=16, 2.8%)
13. Promoting the value of biodiversity data and recording (n=16, 2.8%)
14. Other (n=13, 2.3%)
15. Recognition and feedback (n=10, 1.8%)
16. Use of biodiversity data for decision-making (n=8, 1.4%)
17. Access to EIA data (n=6, 1.1%)
18. Access to experts and other resources (n=4, 0.7%)
19. Recording of priority or under-recorded sites or species (n=4, 0.7%)
20. Improve recording of effort and absence (n=3, 0.5%)

These priorities, alongside further insights gained through the SBIF Review Workshops, illustrate many of the changes necessary to realise the full value of the biological recording infrastructure in Scotland. In this business case, the case for change is made in terms of the drivers, objectives and benefits of change (opposite). It is notable that in each of the SBIF Review Workshops, participants expressed considerable frustration with the current situation and were emphatic that the 'status quo' should not be allowed to continue.

The case for change

DRIVERS OF CHANGE

1. Insufficient sustainable funding and resources to operate the biological recording infrastructure effectively.
2. Demand for timely access to Open Data of known quality.
3. Demand for complete coverage for service provision in Scotland.
4. Proliferation and complexity of competing data flows causes inefficiency, confusion and frustration.
5. Insufficient support for, and recognition of, volunteers involved in biological recording.
6. Demand to achieve the Scottish Biodiversity Strategy Goals and UN Sustainable Development Goals.

CHANGE OBJECTIVES

1. By 2025, to establish and embed the preferred models for data flow, service provision, governance and funding to achieve the SBIF Vision.
2. By 2025, provide consistent high quality services equally accessible to all public bodies in support of their statutory biodiversity duties and strategic goals.
3. By 2025, better facilitate and grow the network of volunteer Recorders and Verifiers who are actively supporting, or being supported by, the Infrastructure.
4. By 2025, facilitate the open provision of biological records from all sectors for onward dissemination through a single central data repository.
5. By 2025, establish a feedback mechanism for Recorders and Data Providers to showcase the use of their records and value of their contribution.
6. By 2025, be universally recognised and valued for being the definitive provider of biological records in Scotland as a common evidence base for all purposes, all sectors and all generations.

BENEFITS OF CHANGE

1. Clear data flows and submission points, with feedback on quality and use, so Recorders know how to submit records and where their records are used.
2. All data are of known quality, quickly and openly available and easily accessed through a single central data repository with links to voucher specimens and appropriate metadata.
3. Services are consistently provided in perpetuity and service users know what services are available to them and are using them effectively for operational and strategic advantage.
4. Recorders, Verifiers, Recording Groups and Recording Schemes have consistent access to high quality training and support and feel valued for their skills and contribution.
5. A single organisation with oversight of the whole Infrastructure creates cohesion while achieving economies of scale and the most efficient and effective risk management and use of resources.
6. Organisations that provide or govern key parts of the Infrastructure as a public service have sufficient funding/resources to do so effectively with improved well-being for staff and volunteers.
7. Our skills base is increased with more people engaged in biological recording, more records being collected and verified, and fewer taxonomic gaps overall.
8. The Infrastructure makes a key contribution towards delivery of the Scottish Government's strategic goals, positioning Scotland as a global leader in the guardianship of biodiversity.
9. Changes in species' distribution and abundance are more rapidly understood to inform appropriate responses to climate change and invasive species and to assess site condition and natural capital.
10. Compliance with statutory requirements such as GDPR and good practice/standards required of affiliated partners and users of the Infrastructure.

4. The changes needed

In each of the SBIF Review Workshops, participants were asked what should stop, start, continue, or continue with changes, to achieve the preferred model for data flows, services, governance or funding (see Annexes II to VI).

All of the changes proposed were used to develop the set of specific high-level business changes that would facilitate the benefits of change that we are seeking. Each benefit is dependent upon one or more of these business changes being implemented. The dependencies between each benefit and each business change have been mapped using a Benefits Dependency Network Diagram (Annex VII).

The options to achieve the changes needed covering four dimensions (service provision, in-country governance, funding source and community funding) are discussed in Section 5. The transition arrangements necessary for effective change management are outlined in Section 6 and the proposed programme of investment to achieve the preferred option for each dimension is then appraised in Section 7.

Broad areas of business change to realise the benefits sought

TO TRANSFORM DATA FLOWS:

- Establish and normalise clear routes for record submission via affiliated channels that deliver records directly to the central data repository for immediate aggregation.
- Establish an online data management and verification portal for viewing and management of relevant records, automated where appropriate.
- Include use statistics and voucher specimen links in record metadata and offer a suite of data layers to aid analysis/visualisation.

TO TRANSFORM SERVICE PROVISION:

- Ensure that services are equally accessible to all sectors and standardised through the use of common tools and processes.
- Establish a Digital First approach so that all services are easily accessible online (e.g. taxonomic training and planning screening).
- Bring together the service functions of NBN, BRC and LERCs to maximise synergies between taxonomic and technical expertise.

TO TRANSFORM GOVERNANCE:

- Appoint one Lead Governance Body to be the independent supervisory authority for the biological recording infrastructure.
- Establish a Country Committee to oversee delivery of in-country services/products via a network of Regional and National Hubs.
- Establish a central service strategy with product ownership at the national level.

TO TRANSFORM FUNDING:

- Provide full funding in perpetuity for the activities of the Lead Governance Body - at UK, national and regional levels - and to support the activities of Super Partners (i.e. National Recording Schemes, National Museums and Botanic Gardens, the UK Species Inventory, the Non-Native Species Secretariat and State of Nature Partnership) who also deliver core platforms or services.
- Establish financial accountability and performance review processes to report on the use and value of the funding provided.

TO TRANSFORM CULTURE:

- Engender common goals, values and rapport between regional, national and central teams to create a One Team culture.
- All sectors realise value from making a genuine contribution in support of an Open Data Infrastructure.
- Establish an Agile approach in all aspects of the development and operation of the Infrastructure and its services.

Benefits supported by each broad area of business change

The benefits supported by each broad business change area are (benefit numbers from Annex VI):

BENEFITS SUPPORTED BY TRANSFORMING DATA FLOWS:

Via clear data flows to a central data repository, with easy data submission and feedback on use

1. Clear data flows and submission points, with feedback on quality and use, so Recorders know how to submit records and where their records are used.
2. All data are of known quality, quickly and openly available and easily accessed through a single central data repository with links to voucher specimens and appropriate metadata.
4. Recorders, Verifiers, Recording Groups and Recording Schemes have consistent access to high quality training and support and feel valued for their skills and contribution.
9. Changes in species' distribution and abundance are more rapidly understood to inform appropriate responses to climate change/invasive species and to assess site condition/resilience and natural capital.

BENEFITS SUPPORTED BY TRANSFORMING SERVICE PROVISION:

Via full coverage for services across Scotland and an online Digital First approach for service improvement

3. Services are consistently provided in perpetuity and Service Users know what services are available to them and are using them effectively for operational and strategic advantage.
4. Recorders, Verifiers, Recording Groups and Recording Schemes have consistent access to high quality training and support and feel valued for their skills and contribution.
6. Organisations that provide or govern key parts of the Infrastructure as a public service have sufficient funding and resources to do so effectively with improved well-being for staff and volunteers.
7. Our skills base is increased with more people engaged in biological recording, more records being collected and verified, and fewer taxonomic gaps overall.
8. The Infrastructure makes a key contribution towards delivery of the Scottish Government's strategic goals, positioning Scotland as a global leader in the guardianship of biodiversity.

BENEFITS SUPPORTED BY TRANSFORMING GOVERNANCE:

Via a Lead Governance Body working in partnership through a network of National and Regional Hubs

5. A single organisation with oversight of the whole Infrastructure creates cohesion while achieving economies of scale and the most efficient and effective risk management and use of resources.
10. Compliance with statutory requirements such as GDPR and good practice/standards required of affiliated partners and users of the Infrastructure.

BENEFITS SUPPORTED BY TRANSFORMING FUNDING:

Via funding provided in perpetuity for Lead Governance Body, Super Partner and community activities

5. A single organisation with oversight of the whole Infrastructure creates cohesion while achieving economies of scale and the most efficient and effective risk management and use of resources.
6. Organisations that provide or govern key parts of the Infrastructure as a public service have sufficient funding and resources to do so effectively with improved well-being for staff and volunteers.

BENEFITS SUPPORTED BY TRANSFORMING CULTURE:

Via introduction of agile ways of working and engendering of One Team rapport

4. Recorders, Verifiers, Recording Groups and Recording Schemes have consistent access to high quality training and support and feel valued for their skills and contribution.
8. The Infrastructure makes a key contribution towards delivery of the Scottish Government's strategic goals, positioning Scotland as a global leader in the guardianship of biodiversity.

5. Options to achieve the changes needed

Overarching principles

Three overarching principles apply to the options to achieve the changes needed:

i. Options should fulfil Scottish needs first and foremost.
ii. Value for money (economy, efficiency and effectiveness) should be optimised.
iii. The recommendations of the Biodiversity Science Group relating to Petition PE1229 should be honoured where possible.

Dimensions considered

Four dimensions were considered that together form a blueprint for the biological recording infrastructure in Scotland: Service Provision, In-country Governance, Funding Source and Community Funding.

Up to five options for change were developed for each of the following:

A. SERVICE PROVISION exploring the scale at which services should be provided to deliver Infrastructure services effectively, clarifying which combination of UK, national and regional services provides greatest positive value to Service Users in Scotland.

B. IN-COUNTRY GOVERNANCE exploring what governance arrangement for national and regional levels in Scotland is best placed to provide the governance necessary for the Infrastructure to fulfil its purpose and to maximise stakeholder confidence in both the short and the long term.

C. FUNDING SOURCE exploring which funding model could facilitate the effective operation of the Infrastructure and fully Open Data while being based on payment by those who require biodiversity data for their own gain and/or those whose activities drive biodiversity loss.

D. COMMUNITY FUNDING exploring the funding necessary to motivate submission of records as Open Data, especially for under-recorded species or areas, while better supporting volunteers, Super Partners and the public so that more people gain from being involved.

A. SERVICE PROVISION OPTIONS

These options explore which scales (local, regional, national and UK-wide) are best placed to redesign and deliver Infrastructure services and clarify whether one (UK only or National only), two (UK and National) or three (UK, National and Regional) levels are preferred.

Objectives

1. To deliver each service at the scale (regional, national or UK) that maximises the economy, efficiency and efficacy of that service and of the Infrastructure as a whole.
2. To cluster services together to maximise synergies within and between each scale in the Infrastructure.
3. To ensure that all services are consistently provided so that Service Users can access the same range and quality of services from wherever the user is located.
4. To engender parity of esteem and a sense of pride for each service and each scale.

Outcomes

Services provided by the Infrastructure will be trusted by, and equally accessible to, all users and optimised for economy, efficacy (in terms of value to the user), efficiency and synergy. The role and responsibilities at each scale will be appreciated by everyone involved to create a sense of pride in both place and purpose. As a result, the services provided will make a tangible contribution towards national and local biodiversity duty and the National Outcomes for Scotland.

Assumptions and constraints

- The above objectives are valid even if Scotland is the only UK country to deliver services in this way (i.e. other countries may take a different approach for the delivery of their national and/or regional services however the UK services proposed will still be valid).
- Every service will have an online presence to facilitate its discovery and use and to allow users to participate online from any location.
- Internet speeds continue to improve so that connectivity is no longer a limiting factor (or community funds could be deployed to resolve critical connectivity issues).
- Each scale will have sufficient resources to operate effectively without having to divert time and effort to seek funding.
- Regional service provision in Scotland would be through at least four, and possibly up to ten, Regional Hubs to best suit local needs and circumstances.
- A business analysis approach will be used to determine user requirements for every service so each one can optimise service consistency, appeal and value for all users.
- Consistent services - redesigned for greatest efficacy - will take time to develop and implement.

Options considered and our preferred option

The range of options considered covers the geographic scale at which services are provided, their relevance, likely effort and value at each scale. A summary of the options and their advantages and disadvantages is presented in Table 1. Each option was assessed for the extent to which it could fulfil service provision objectives, with the option best meeting all objectives becoming the preferred option in Table 2. Options failing to at least partially meet all objectives were discounted.

Our preferred way forward - given the analysis of options considered and the high level of support expressed for this configuration of service delivery at the Service Provision and Governance Workshops - is for services to be delivered at three levels, that of the UK, nationally and regionally (Option A4). See Annex III for a detailed list of the services that would be delivered in each location.

Impact assessment for our preferred option

Existing LERCs in Scotland would be replaced by a network of NBN Regional Hubs acting as the regional level of the NBN to provide regional and local services with oversight from a single National Hub. Such Regional Hubs could be established either as partners of NBN Trust hosted in a partner organisation, or as NBN Trust employees if no suitable partners come forward for a region. Either way, Regional Hub staff would become part of a larger network with access to greater support, training and career opportunities.

For the first time, people anywhere in Scotland would be able to access a consistent range of services that are highly tailored to their needs. All services would be accessible online and automated where appropriate. Regional and national staff would be involved in the analysis of user requirements and development of the products through which services are provided. This involvement would build trust and rapport between service providers and users.

With greater cohesion arising from UK, national and regional levels working together in support of biological recording in Scotland, considerable synergy would be achieved. The Infrastructure as a whole would be better recognised and understood by the general public as a single brand using both 'National Biodiversity Network' and 'NBN Regional Hub' concepts. Pooling resources and expertise would allow each level to achieve more collectively than on their own.

Regional service delivery would be more expensive due to the higher level of resource required to cover all geographic areas. However, the value that can be realised through the inclusion of this tier is greater than that of any of the other options. More people would become aware of, and take part in, biological recording and citizen science to make a tangible contribution to the national outcomes for Scotland. Regional and National Hubs (and any area teams) would champion

Table 1: Service provision options and their advantages and disadvantages

Service Provision Option A0: Status quo

All services provided by the Infrastructure will continue to be delivered through a combination of regional LERCs in-country in parallel with the central services offered through the NBN Trust and BRC. There are no Service Providers at the national level and regional coverage is incomplete so many areas have no access, or inconsistent access, to regional services.

Advantages
- Least disruption for existing service users and providers
- No new investment required/low cost
- Familiar LERC 'brand' can continue unchanged

Disadvantages
- Inefficiencies and issues discourage new investment
- Under-funded LERCs will fold exacerbating service gaps
- Plethora of data flows will continue to be confusing
- Lack of join-up across sectors and data silos remain
- Considerable duplication in data management activities
- Services are inaccessible for many users

Service Provision Option A1: Centralised services

All services provided by the Infrastructure are delivered centrally through one UK Service Provider acting as the single point of delivery for services in the UK. All services would be available online and all users would have the same service provider. The people who provide the service would not necessarily be based in the same part of the UK as the people who use the service. There would be no Service Providers at national or regional levels.

Advantages
- Greater economies of scale
- Greater consistency through a single service provider
- Few competing services online and in-country

Disadvantages
- Service provision perceived as remote to most users
- Loss of local and regional knowledge/contacts/pride
- Not optimised for local or regional use and value
- Least likely to engender local and regional buy-in

Service Provision Option A2: Nationalised services

All services provided by the Infrastructure are delivered in-country through one national Service Provider acting as the single point of delivery for all services offered in that country. All services would be available online and users would need to choose which country to obtain a service from. In this model, there would potentially be four Service Providers in the UK, each potentially providing a set of devolved services that could differ between the countries. There would be no central Service Provider offering services across the whole of the UK.

Advantages

As for Option A1 plus:
- Highly tailored to in-country needs
- Countries work in their own way at their own pace
- Arrangements for one country aren't imposed on others

Disadvantages
- Duplication of services that are common to all countries
- Service provision still perceived as remote to many users
- Loss of local and regional knowledge/contacts/pride
- Less able to accommodate regional needs and variations

Service Provision Option A3: Centralised and nationalised services

Services provided by the Infrastructure are either delivered centrally (where it makes sense to avoid duplicating services that are needed in all countries of the UK) or nationally (where it makes sense to devolve delivery of a service to be within each country due to jurisdictional differences). All services would be available online and users would choose the relevant country to obtain a service from. There would potentially be four national Service Providers (for devolved services) and one central Service Provider (for services common to all four countries of the UK). There would be no Service Providers at the regional level.

Advantages

As for Option A2, plus:
- No duplication of services common to all countries
- High level of central support bolsters in-country services
- High level of access to taxonomic/technical expertise

Disadvantages
- Loss of local and regional knowledge/contacts/pride
- Less able to accommodate regional needs and variations

Service Provision Option A4: Centralised, nationalised and regionalised services PREFERRED OPTION

Services provided by the Infrastructure are either delivered centrally (where it makes sense to avoid duplicating services that are needed in all countries of the UK), nationally (where it makes sense to devolve delivery of a service to be within each country due to jurisdictional differences) or regionally (where it makes sense to have a local presence). All services would be accessible online and users would choose the relevant country or region to obtain a service from. There would potentially be four national Service Providers (for devolved services), one central Service Provider (for services common to all four countries of the UK) plus a network of NBN Regional Hubs within each country to provide regional and local services. Hosting arrangements for Regional Hubs would maximise the reach into, and mutual support between, all sectors through building partnerships and sharing back office facilities.

Advantages

As for Option A3, plus:
- Regional presence engenders local and regional buy-in
- Regional presence maximises local face-to-face contact
- Greatest career progression options for staff
- Regional needs and variations can be accommodated
- Greater connection to place and sense of regional pride
- Local and regional knowledge/relationships maintained
- Greatest reach into, and involvement of, all communities

Disadvantages
- Highest operating costs as more staff needed
- Higher costs for Scotland if other countries make little or no contribution towards the costs of UK services

affiliated routes for data flow so that all records become available from a single central data repository. All sectors, across marine and terrestrial environments alike, would be able to submit, discover and access biological records with ease, confident that the records being accessed are definitive and of known quality.

With many more biological records for a wider range of taxa and an improved suite of services to aid their dissemination and interpretation, there would be a greater evidence base to inform environmental decision-making and accountability in both terrestrial and marine environments.

Flexibility in the number of Regional Hubs and area teams, and in their hosting (e.g. within public bodies or NGOs) will maximise the availability of regional level services across Scotland. Value for all Local Authorities and Community Councils, in support of their biodiversity duty and development planning processes in particular, will be facilitated across Scotland.

Expansion of the Infrastructure services in Scotland at both national and regional levels would place greater demands upon the UK level. There would be an expectation that the UK team would have sufficient capacity to support in-country services as they become operational. This would require a significantly larger team than is in place at present both to meet this expectation and to avoid reducing the level of service that can be provided in parallel to other jurisdictions of the UK.

Table 2: Evaluation of the options for service provision

OPTIONS OBJECTIVES	A0 Status Quo (UK & Regional)	A1 UK Only	A2 National	A3 UK & National	A4 UK, National & Regional
To deliver each service at the location level that maximises the relevance, economy, efficiency and efficacy (in terms of value to users) of that service and that of the Infrastructure as a whole	×	×	×	×	✓✓
To cluster services together to maximise synergies within and between each location level in the Infrastructure	×	✓	✓	✓	✓✓
To ensure that all services are consistently provided so that users can access the same range and quality of services from wherever the user is located	×	✓✓	✓✓	✓✓	✓✓
To engender parity of esteem and a sense of pride for each service and each location level	×	×	×	✓	✓✓
OUTCOME	Discounted	Discounted	Discounted	Discounted	Preferred

× = not met, ✓ = partially met, ✓✓ = fully met

Risks and dependencies

The preferred option relies on the successful establishment of a National Hub to drive forward effective service design and delivery. This is dependent on there being a compelling vision at the national level and effective management of staff to bring about the changes needed. Such a vision should be developed with input from all three levels of the network (UK, national and regional).

There is a risk that service design (and, where appropriate, automation) is complicated and time consuming and that changes to align services at each scale are difficult for existing staff to accept and deliver. To minimise this risk, a programme of staff training and team building would be needed to give all staff a common knowledge of business analysis and agile approaches and the confidence to develop ways of working in support of continual service improvement.

Successful implementation of the preferred option depends on the UK Hub having sufficient capability and capacity to provide common services and expert support from the outset. There needs to be synergy and rapport between national and UK leaders to create a consistent vision that is also relevant at a regional level. Successful implementation also depends on the national and regional levels having sufficient capacity and capability as soon as (but not before) the UK Hub is ready to support in-country implementation.

B. IN-COUNTRY GOVERNANCE OPTIONS

These options explore which governance arrangement is best placed to provide the governance necessary for the Infrastructure to fulfil its purpose in Scotland and to maximise stakeholder confidence.

Objectives

1. To provide strong and effective leadership and governance at national and regional levels.
2. To maximise the economy, efficiency and efficacy of the Infrastructure in Scotland and its contribution at the UK level.
3. To maximise stakeholder confidence in the Infrastructure in Scotland to maximise its impact at every level.
4. To engender a One Team culture with the governance and common language to facilitate successful transformational change.
5. To respect the devolved nature of the UK and to recognise the need for in-country customisation within a UK framework.

Outcomes

Effective governance maximises stakeholder confidence and value. Everyone involved helps realise the full potential of the Infrastructure. Risks and opportunities are managed appropriately; economy, efficiency and effectiveness are optimised and the Infrastructure makes a world class contribution in support of Scottish biodiversity and Scottish Government's goals of Scotland becoming healthier, wealthier, safer, smarter and greener.

Assumptions and constraints

- The above objectives are valid even if Scotland is the only UK country to govern its in-country infrastructure in this way (i.e. other countries may take a different approach for the governance of their national and regional infrastructure however within Scotland and at the UK level the proposed approach will still be valid).
- There will be a single Lead Governance Body in Scotland to act as the lead supervisory body for the Infrastructure at regional and national levels.
- Governance at the UK level is provided by the NBN Trust and its Trustees, setting standards and policy in consultation with the Lead Governance Body for Scotland.
- Any changes in governance in Scotland have no impact on arrangements in other jurisdictions of the UK.
- The changes needed to improve the biological recording infrastructure in Scotland are transformative and such changes will be impossible to achieve without first improving existing in-country governance arrangements.
- At the UK level and across Scotland there will be a common and agile approach to product development for Infrastructure platforms and tools, with an in-country national product owner to identify and champion national and regional requirements for Scotland.
- It will take time to establish and embed new governance arrangements and to establish an effective One Team culture between regional, national and UK teams.

Options considered and our preferred option

The range of options considered cover the relationship between the Lead Governance Body in Scotland and the Lead Governance Body at the UK level and whether these should act independently, in affiliation or partnership, or in unity as NBN Scotland. A summary of the options and their advantages and disadvantages is presented in Table 3. Each option was assessed for the extent to which it could fulfil in-country governance objectives, with the option best meeting all

Table 3: In-country governance options and their advantages and disadvantages

In-Country Governance Option B0: Status quo

The organisations who currently provide some degree of governance within the Infrastructure in Scotland (the SBIF Advisory Group, Statutory Agency staff, BRC and National Scheme operators, NBN Trustees, Scottish LERC Boards of Directors and Trustees of other Service and Data Providers) will continue to do so. There is no single Lead Governance Body able to act as an independent supervisory body to ensure effective operation and regulatory compliance (e.g. for GDPR and safeguarding matters).

Advantages	Disadvantages
• Low cost • Familiar brands well known in their own communities • Local arrangements work well locally	• Multiple players, no Lead Governance Body • Competing brands reduce Infrastructure reach/impact • Transformational improvements are impossible • Excessive exposure to risks from compliance failures relating to GDPR, safeguarding and conflicts of interest

In-Country Governance Option B1: Independent National and Regional Hubs

A single Lead Governance Body with its own Board of Trustees will be established (e.g. through amalgamation of existing LERCs in Scotland) to oversee the Infrastructure in Scotland. This organisation will be an entirely independent legal entity with no affiliation to, nor partnership with, the Lead Governance Body for the UK, the NBN Trust. It is not required to meet NBN standards nor to procure NBN services although it can choose to do so where there is value in this for Scotland. The relationship with the Lead Governance Body in the UK is contractual with no guarantee that the contract will be renewed in perpetuity. Cultural differences and optionality mean that transformational change is almost impossible.

Advantages	Disadvantages
• Highly acceptable to those stakeholders who prefer a more evolutionary approach to change • Independence allows Scotland to set its own pace • Improved governance increases regional value	• Little or no contact and rapport with the UK level • Costly to develop separate services and standards • Transformational change impeded by lack of UK join-up • Many of the problems of the status quo go unresolved • Charges could apply for unaffiliated use of UK services

In-Country Governance Option B2: Affiliated National and Regional Hubs

A single Lead Governance Body with its own Board of Trustees will be established (e.g. through amalgamation of existing LERCs in Scotland) to oversee the Infrastructure in Scotland and be affiliated with the Lead Governance Body in the UK, the NBN Trust. This Scottish governance body is required to meet NBN standards and is able to access NBN services where there is value in doing so for Scotland. Although optionality is lessened, cultural differences between national and UK organisations mean that transformational change remains hard.

Advantages	Disadvantages
• As for Option B1 plus: • Affiliation increases consistency across the Infrastructure • Acceptable to those stakeholders who prefer a more evolutionary approach to change	• Low contact and rapport with the UK level • Transformational change limited by low UK rapport • Some of the problems of the Status Quo go unresolved • Less attractive to those stakeholders who seek a more revolutionary approach to change

In-Country Governance Option B3: NBN Scotland with Affiliated Regional Hubs PREFERRED OPTION

A new Scottish Division of NBN Trust, NBN Scotland, will be created to oversee national and regional infrastructure levels in Scotland. NBN Scotland, guided by a Country Committee with representatives from all sectors. will act as the National Hub, working in formal partnership with affiliated Regional Hub Partners and their host organisations. Where there is no Regional Hub Partner, NBN Scotland will act as the NBN Regional Hub in that region. NBN Trust will be the Lead Governance Body at the UK level and at the national level in Scotland.

Advantages	Disadvantages
• As for Option B2 plus: • Partnership working grows rapport and shares skills • Partners can work towards a One Team culture • Partnership agreements lead to transformational change • Highly acceptable to both Scottish LERCs and NBN Trust	• Transformational change through a partnership requires effort and negotiation • Partners vary in capacity, capability and culture which impedes alignment and the pace of change • Competition between partners for profile and resources

In-Country Governance Option B4: NBN Scotland

A Scottish Division of NBN Trust, NBN Scotland, will be created to provide both national and regional infrastructure in Scotland. With multiple NBN Regional Hub offices to fully cover all regions of Scotland, both National and Regional Hubs are hosted within larger organisations to facilitate cost-effective access to back office support. UK level infrastructure strategy is developed by the UK Board of Trustees with Scottish product ownership and services delegated to NBN Scotland, guided by a Country Committee with representatives from all sectors.

Advantages	Disadvantages
• Common, agile approach and a One Team culture • Line management can set all employees the common objective of achieving a transformational change • Transformational change is cohesive and rapid • Fully devolved with maximum autonomy • All necessary expertise is in house for Divisional use with maximum use made of shared 'backend' services	• Less attractive to those stakeholders who prefer a more evolutionary approach to change • Less acceptable to those stakeholders who prefer the Scottish Infrastructure to be independent of other countries so that Scotland can work at its own pace • Less acceptable to existing LERCs who wish to remain independent from the NBN Trust

objectives becoming the preferred option in Table 4. Options failing to at least partially meet all objectives were discounted.

Our preferred way forward is therefore for in-country governance to be delivered through the formation of NBN Scotland to oversee a network of affiliated Regional Hub Partners (Option B3). Governance can be facilitated through the use of the terms and conditions of funding for each Regional Hub and through the presence and leadership of NBN Scotland to champion this network.

Table 4: Evaluation of the options for in-country governance

OPTIONS OBJECTIVES	B0 Status Quo	B1 Independent Entity	B2 Affiliated National and Regional Hubs	B3 NBN Scotland with affiliated Regional Hubs	B4 NBN Scotland
To act as the Lead Governance Body in Scotland to provide strong and effective leadership and governance at national and regional levels	×	✓✓	✓✓	✓✓	✓✓
To maximise the economy, efficiency and efficacy of the Infrastructure in Scotland and also its contribution at the UK level	×	×	✓	✓✓	✓✓
To maximise stakeholder confidence in the governance arrangements for the Infrastructure in Scotland to maximise its impact at every level	×	✓	✓	✓✓	✓✓
To engender a One Team culture with the governance and common language to facilitate successful transformational change	×	✓	✓	✓	✓✓
To respect the devolved nature of the UK and to recognise the need for in-country autonomy and partnerships within a UK framework	×	✓✓	✓✓	✓✓	✓
OUTCOME	Discounted	Discounted	Possible	Preferred	Possible

× = not met, ✓ = partially met, ✓✓ = fully met

Impact assessment for our preferred option

For the first time, governance for the Infrastructure would be established at the national level to ensure cohesion across Scotland. Formation of NBN Scotland enables service delivery to be at the national level, complementing regional services and providing new insights and added-value products for Scotland. A new Country Committee would be needed to act as a steering group for the Lead Governance Body in Scotland (with representation from each sector and regional committee). This Country Committee would supersede the SBIF Advisory Group in due course. Through NBN Scotland, NBN Trust would have a presence in Scotland, and therefore Scottish relevance which will transform the impact that its governance can achieve.

Strong and effective governance through NBN Scotland at the national level would resolve many of the underlying issues that have impeded the effective operation and overall value of the infrastucture to date. With greater impact, the quality and quantity of biological records will increase, enabling Scotland to be well-informed about the presence of, and changes in, biodiversity across Scotland. The natural heritage of Scotland will be better known and better protected, whether as natural capital or iconic species and habitats in their own right.

Risks and dependencies

The establishment of a Lead Governance Body for Scotland is essential if improvements to the Infrastructure are to be realised. The majority of stakeholders agree that the NBN Trust is the most appropriate entity to assume this role. However, there are a minority of stakeholders who disagree.

People with this view have a preference for independence and are unlikely to endorse any change away from the status quo. Therefore, there is a need to build rapport and to listen to feedback so that NBN Scotland is responsive to, and representative of, all stakeholders. If successful, the formation of NBN Scotland may create demand from stakeholders in other UK jurisdictions seeking a similar arrangement for their country or region.

Implementation of the governance structure necessary to support NBN Scotland (detailed in Annex IV) is dependent on a source of sufficient sustainable funding being established. There is a dependency on the right collaboration tools and office accommodation to facilitate effective working conditions and relationships. There is also a dependency on there being a compelling vision at the UK and national level and effective leadership to realise the changes in governance needed.

It is essential that the NBN Atlas platform and associated tools are developed using an agile product model approach with a product owner to represent the requirements of each UK jurisdiction using these tools. Their successful development depends on there being an integrated technical road map for all affiliated platforms and tools.

During implementation, there is a dependency on having sufficient HR support and expertise in developing partnership agreements with parity of esteem for all partners. There is also a dependency on securing funding early so that the right groundwork can be undertaken to prepare NBN Trust to have the right capacity and capability to play a larger part in Scotland without detriment to other countries of the UK.

C. FUNDING SOURCE OPTIONS

These options explore which source of funding can best facilitate the effective governance and operation of the Infrastructure in perpetuity (with payment being made primarily by those who require biodiversity data for their own gain and/or those whose activities drive biodiversity loss).

Objectives

1. To provide sufficient funding to support the activities of the Lead Governance Body (including National and Regional Hubs and a commensurate Community Fund), and to support activities of Super Partners who also deliver core platforms and services.
2. To provide secure/durable funding in perpetuity.
3. To share Infrastructure operating costs between the sectors who need to access biodiversity data and realise value from doing so (i.e. the public, commercial, academic and third sectors).
4. To base the greatest burden of funding upon those whose activities are key drivers of biodiversity loss.
5. To facilitate Open Data.
6. To facilitate ease of administration.

Outcomes

The stresses and strains of the current Infrastructure are resolved, as the Lead Governance Body and its Super Partners have sufficient sustainable funding to operate effectively. The achievement of an Open Data Infrastructure makes it easy for any individual or organisation to use or develop added-value data products and digital services, and there is open access to biological records from all regions and sectors. With such access, there is faster detection of invasive species which reduces the economic costs of their control, and the impacts of climate change on our native species can be better understood and mitigated. Scotland becomes renowned globally for the efficacy of its biological recording infrastructure and for the value and safeguarding of its biodiversity. Such an Infrastructure enables Scotland to make a fundamental contribution to the Scottish Biodiversity Strategy, National Outcomes for Scotland and the Aichi Targets.

Assumptions and constraints

- The above objectives are valid even if Scotland is the only UK country to fund its in-country infrastructure in this way (i.e. other countries may take a different approach for the funding of their national and regional infrastructure however at the UK level the proposed approach will still be valid).
- The level of funding needs to fully cover the operating costs of the Infrastructure for the people impacted to fully commit to the changes involved in its transformation - and to achieve Open Data - and that anything less would entail too much disruption for too little benefit to succeed.
- These operating costs comprise three elements:
    i. all of the operating costs of one National Hub and at least four Regional Hubs to deliver national and regional services in Scotland as recommended in the option evaluation for service provision above;
    ii. a contribution towards the operating costs of the UK Hub which provides common services to Scotland and other UK jurisdictions;
    iii. a contribution towards the operating costs of Super Partners who also provide or govern key parts of the Infrastructure as a public service in Scotland and other UK jurisdictions.
- The level of funding also needs to be able to fully cover the costs of providing a Community Fund as recommended in the option evaluation for community funding below.
- The contribution from Scotland towards the UK Hub and Super Partners will be based on an assessment of the needs and ambitions of Scotland relative to other UK jurisdictions; for the purposes of this Review, the contribution rate for Scotland is assumed to be 10% to reflect the proportion of the UK population living in Scotland (8.2% using mid-2017 official statistics).
- If the other countries of the UK make little or no contribution to the costs of improving the UK Hub and Super Partner infrastructure, Scotland will need to bear a larger proportion of these costs - at least for the first five years of transformation - to gain the anticipated benefits in Scotland.
- It is unlikely for sufficient Scottish revenue to be raised from commercial and academic users of the Infrastructure, or from environmental taxes, without government support or intervention due to the lower level of human population and commerce in Scotland.
- If there is a wish to base payment on those whose activities drive biodiversity loss on land or at sea, the Climate Change Levy may provide the most suitable mechanism to reach all key sectors through using energy consumption as a proxy for the extent of industrial, commercial and agricultural activities which, directly or indirectly, cause environmental harms; a new Biodiversity Levy on sectors whose activities are known drivers of biodiversity loss could be considered, or a biodiversity supplement on the poundage rate for Business Rates in Scotland.
- Whether public or user funding or a blend, it will take some time to design, agree and implement the models for data flow, service provision, governance and funding, the costs of which will need to be covered as transitional or 'set-up' costs (until the funding model provides revenue at a sufficient level to cover all ongoing costs).
- If public funding is adopted, the Lead Governance Body for the Infrastructure in Scotland would act as the Approved Body able to distribute revenue received from environmental taxes or any framework agreement with Scottish Government covering the provision of services to government agencies, departments and planning authorities.
- If user funding is adopted, this will impact on the ability of Data Providers and Service Providers to allow their biological records and services to be openly available as they would need to be able to apply charges to cover operating costs.
- It will take time to establish and embed new funding arrangements such that interim funding will be needed and existing contractual arrangements may require revision.

Options considered and our preferred option

The range of options considered cover the source of funding that could faciliate the effective operation of the Infrastructure while also making provision for a commensurate Community Fund, basing contributions on those who require biodiversity data for their own gain and/or those whose

Table 5: Funding source options and their advantages and disadvantages

Funding Source Option C0: Status quo

The current sources of funding available in Scotland will continue to be available, diversified where appropriate to maximise income security but with no pursuit of an alternative model for funding. There is insufficient funding for the NBN Trust, Scottish LERCs and Super Partners to significantly support the preferred models for data flow, service provision and governance. A lack of join-up and integration perpetuates competition for resources as every funder has a declining budget and there is little strategic oversight to guide investment. Open Data cannot be facilitated as Service Providers depend upon commercial arrangements to bring in core income to cover operating costs. Funding is piecemeal and there is low return on investment for many funders. LERCs and the NBN Trust may go out of business if funding challenges persist, leading to the loss of valued support for Recorders, NGOs, Local Authorities and others.

Advantages
- Low cost for National Government
- Low cost for users of LERC services
- Diverse sources of funding allow greater income security
- Long established funding relationships are maintained
- Long established local arrangements are maintained

Disadvantages
- Low ROI, no strategic join-up, little community funding
- Insufficient income to provide full geographic coverage
- No surplus income for reinvestment in the Infrastructure
- High level of fundraising necessary on an ongoing basis
- Competition for resources and profile with users
- LERCs, NBN Trust and Super Partners are underfunded
- Service Provider business models preclude Open Data

Funding Source Option C1: Public funding PREFERRED OPTION

Sufficient public funding will be provided in perpetuity to enable UK, National and Regional Hubs and Super Partners to operate the preferred models for data flow, service provision and governance. A Single Framework Agreement or equivalent between Scottish Government and the Lead Governance Body would define the level of revenue from a biodiversity levy or other tariffs (e.g. a minor increase to business rates) necessary to cover relevant operating costs of the Infrastructure and its Super Partners. The Lead Governance Body would disburse this funding between National and Regional Hubs and Super Partners and Community Fund applicants to maximise the strategic impact and contribution of each one to the National Outcomes for Scotland and the Scottish Biodiversity Strategy. These disbursements would replace current funding arrangements and commercial charges, releasing funds currently committed by Public Bodies to LERCs and the NBN, enabling biodiversity data to be open and Infrastructure services to be free to all at the point of use.

Advantages
- An Open Data business model becomes entirely feasible
- If taxation-based, clear link between activities that drive biodiversity loss and who pays for the Infrastructure
- Ease of administration; regular revenue from the outset even while services are in development
- Non-contentious use of environmental taxation/public funds likely to have cross-party political support
- Transformational; positions Scotland as a world leader

Disadvantages
- Political decisions could de-prioritise this funding
- If tax-based, volatility in tax receipts may cause revenue to be too low or too high for Infrastructure needs - e.g. revenue may diminish as environmental taxes succeed in driving 'greener' behaviour
- Government decision-making processes may be slow to the extent that existing LERCs and the NBN Trust go out of business before this option can be implemented

Funding Source Option C2: User funding

Sufficient user funding will be provided in perpetuity to enable UK, National and Regional Hubs and Super Partners to operate the preferred models for data flow, service provision and governance. The Lead Governance Body would define the level of revenue from user subscriptions or other tariffs necessary to cover relevant operating costs of the Infrastructure and its Super Partners. The Lead Governance Body would disburse this funding between National and Regional Hubs and Super Partners and Community Fund applicants to maximise the strategic impact and contribution of each one to the National Outcomes for Scotland and the Scottish Biodiversity Strategy. These disbursements would replace current arrangements (releasing funds currently committed by SNH to LERCs and the NBN), however biodiversity data would not be openly available and Infrastructure services would not be free to all at the point of use.

Advantages
- Clear link between who needs the data and who pays for the data
- Users can exert more influence over the Infrastructure if they pay for it
- Diversity of users creates many options for generating revenue
- Within the control of the Infrastructure

Disadvantages
- Interim funding needed for longer until services are sufficiently developed to attract enough subscribers
- Goes against Open Data principles; the Infrastructure becomes a 'club good' only open to those who can pay
- Data users who make no contribution to Infrastructure costs might still be able to access data as 'free-riders'
- Additional staff required to administer receivable income and promote subscription sales
- Difficult to police non-commercial use of data and to prevent unauthorised commercial use

Funding Source Option C3: Public and user funding

Both public and user funding models will be used to provide funding in perpetuity as per Options C1 and C2 above. It is likely that public funding will be easiest to leverage against national and UK priorities, while revenue from users will be easier to generate on an individual basis. Only publicly-funded data and services will be openly available at the point of use.

Advantages
- Risk of loss of funding is spread across several sources
- Diversified income streams
- Lower cost for tax payers than Option C2

Disadvantages
- Potential disparities if public monies pay for national/UK services while user fees pay for local/regional services
- Subscription fees become more expensive for individual users once full cost recovery is properly applied

activities drive biodiversity loss. A summary of the options and their advantages and disadvantages is presented in Table 5. Each option was assessed for the extent to which it could fulfil core funding objectives, with the option best meeting all objectives becoming the preferred option in Table 6. Options failing to meet all objectives at least partially were discounted.

Given the analysis of options considered, and the direction of the Funding Workshop, our preferred way forward is for the use of public funding to cover the costs of the Infrastructure. There is considerable desire to achieve Open Data across all sectors however a limiting factor (that has been insurmountable to date) is the need to cover the operating costs of data and service providers. This option overcomes this limitation, making the drive for Open Data achievable for all, and thus enables transformation of the Infrastructure in Scotland.

Table 6: Evaluation of the options for funding source

OPTIONS OBJECTIVES	C0 Status Quo	C1 Public Funding	C2 User Funding	C3 Public & User Funding
To provide sufficient funding to support the activities of the Lead Governance Body (including National and Regional Hubs and a commensurate Community Fund), and to support activities of Super Partners who also deliver core platforms and services	×	✓✓	×	✓✓
To provide secure/durable funding in perpetuity	×	✓	✓	✓✓
To share Infrastructure operating costs between the sectors who need to access biodiversity data and realise value from doing so (i.e. the public, commercial, academic and third sectors)	×	✓✓	✓✓	✓✓
To base the greatest burden of funding upon those whose activities are key drivers of biodiversity loss	×	✓✓	✓	✓
To facilitate Open Data	×	✓✓	×	✓
To facilitate ease of administration	×	✓✓	×	✓
OUTCOME	Discounted	Preferred	Discounted	Possible

× = not met, ✓ = partially met, ✓✓ = fully met

Impact assessment for our preferred option

Through use of appropriate taxation mechanisms, this option would place the burden of operating costs upon those who need access to biodiversity data for their own gain and, more importantly, those whose activities drive biodiversity loss. Super Partners and Service Providers at every level are released from the burden of having to generate sufficient revenue to cover their costs of operation without recompense from all who gain from the services and other value provided.

There is a financial impact in that the level of revenue required per annum to cover the core funding needed is around £2.85 million per annum for Scotland, with an additional £3.5 million per annum needed to support the transition unless UK Hub and Super Partner costs can be shared with other UK jurisdictions. See the Investment Appraisal in Section 7 for full details of all costs. For core funding from Scotland, this is an increase of at least eight times the total current spend across the Infrastructure in Scotland. This looks appropriate given the current level of under-funding and given that one of the key drivers for change relates to there being "insufficient sustainable funding and resources to operate the biological recording infrastructure effectively".

If this amount is provided via tax receipts the amount of unrestricted revenue from taxation is correspondingly reduced, although by a tiny amount as a proportion of actual total tax revenues. Taxation rates could be fractionally increased to recoup this difference or a new Biodiversity Levy or business rate supplement could be established (increasing the tax burden by a relatively trivial amount for each relevant tax payer - however this may not be resented for a good cause such as biodiversity and the wish to detect and reverse biodiversity losses and non-native species invasions).

The impact of achieving fully Open Data is that high quality biodiversity data will be available to inform all relevant strategic and operational decisions and to enhance education and citizen science. This creates a source of Big Data that connects all sectors for an annual cost of between 0.2% and 0.44% of the cost of building the £1.35 billion Queensferry Crossing in Scotland.

Such funding will support Super Partners in the provision of key public services such as the verification, curation and provision of records for all taxonomic groups. There should be a review of Super Partners to ensure that there is no duplication of activities or tools while ensuring that records for every taxonomic grouping are managed and provided through National Schemes and other major data providers and aggregators.

If the funding model is implemented as suggested, this Review will have transformed the biological recording infrastructure in a way that no other Review and no other country in the UK has so far been able to achieve. This Infrastructure will facilitate the open sharing of biodiversity data from every sector. This would truly be worthy of being centre stage in the Scottish Biodiversity Strategy for 2030 and beyond.

Risks and dependencies

This funding model depends on the recognition of the immense value of the biological recording infrastructure as a unique public good that is otherwise difficult or impossible to fund for the advantage of all sectors and for all biodiversity. If this is recognised, it will be possible to secure public funds, potentially via the hypothecation of existing environmental taxation or a biodiversity supplement on business rates, to guarantee the long term sustainability of the Infrastructure.

There are three primary risks: i) this funding source is at the mercy of government policy decisions depending on the strength of the economy and political will; and ii) this funding source may be subject to bureaucratic processes beyond the control and influence of the Lead Governance Body for the Infrastructure - it could be time-consuming to establish the arrangements needed and to periodically justify ongoing provision of funding every 5-10 years; and iii) this funding source needs to create enough (and not too much) revenue to cover the operating costs of the Infrastructure in perpetuity. Taxes may be based on driving desired behaviours and if there are widespread behavioural changes then less revenue will be generated. There may be a dependency on the selection of a tax mechanism that delivers a steady revenue stream at the level needed.

These risks should be balanced against the avoided costs which would arise if there were no funding for an effective Infrastructure in future. Without an effective biological recording infrastructure, the costs of aggregating, verifying and disseminating biological records would be prohibitive. These costs would be repeatedly incurred for every individual use in every sector every time biological data were required for decision-making. Invasive non-native species arriving in Scotland might not be detected or reported until beyond the point at which it is cost-effective to intervene and implement necessary controls. Public interest in the natural world would not be supported and amplified for all possible health, well-being and educational benefits and such a lost opportunity would have tangible economic impacts.

There is a dependency on NBN Trust being able to grow the necessary capability and capacity to manage disbursing funds and accounting for their use. NBN Trust will need to introduce effective systems and processes for appropriate levels of financial control.

There is also a risk around whether or not other countries of the UK may or may not implement a similar approach to facilitate a funding model at the UK level with all of the economies of scale that this would imply. If a UK approach is taken, a greater range of mechanisms for generating an appropriate levy or tax may be available which would provide additional opportunities for a long-term funding model. However, there is a risk that widening the model to be at the UK level may slow the selection and implementation of a suitable funding mechanism for Scotland as more jurisdictions need to be consulted and motivated to participate.

Finally, there is a dependency on our ability to communicate the level of public enthusiasm for biological recording and nature to encourage sufficient political will to implement this model.

D. COMMUNITY FUNDING OPTIONS

These options explore the level of revenue that would support i) the verification and submission of biological records for open use and for under-recorded species and places, while ii) making a tangible contribution towards training bursaries and excursion expenses for both emerging and long-standing keystone people in local recording groups and national schemes and societies, and iii) encouraging the participation of the general public in biological recording and citizen science for all of the benefits associated with being outdoors and better connected with nature.

Objectives

1. To increase the collection of records that can be supplied unconditionally for open use.
2. To remove pressure points for keystone people and to aid succession planning through encouraging others to share endeavours and provide local leadership.
3. To increase monitoring of under-recorded species and under-recorded places in Scotland.
4. To increase public participation with National Schemes and other Super Partners in Scotland.
5. To maximise the contribution of the Infrastructure towards delivery of the National Outcomes for Scotland.

Outcomes

Community groups and communities of interest engage and support more people to participate in biological recording and verification. The scale and quality of recording facilitated enables land and marine managers to audit their natural capital and to assess the status of species populations and other natural features and their responses to management interventions in pursuit of favourable conservation status. More people have reason to spend time outdoors in pursuit of experiencing and enjoying nature, and everyone contributes records for Open use in perpetuity. Scottish Government is recognised as a global leader in biodiversity as a result of its demonstrable commitment to the Infrastructure and volunteer-led biological recording.

Assumptions and constraints

- The above objectives are valid even if Scotland is the only UK country to provide community funding in this way (i.e. other countries may take a different approach regarding community funding however within Scotland and at the UK level the proposed approach will still be valid).
- Community funding will ease pressure points that limit Infrastructure capacity and capability as a first priority, and grow participation as a second priority, so that the Infrastructure has sufficient capacity and capability to operate well once demand increases as participation grows.
- Community funding will be provided either in perpetuity or for as long as there is an expectation that biological records will be made openly available and free at the point of use.
- Community funding will be equally available in all 32 Local Authority areas in Scotland, and to all Community Council areas within these, to maximise its reach and impact.
- The Lead Governance Body in Scotland, as the administrator of the Community Fund, will publish a list of beneficiaries of funding and metrics on the extent to which the community funding provided has contributed to the objectives of community funding listed above.

Options considered and our preferred option

The range of options considered cover the breadth and focus of funding that would ease critical bottlenecks and maximise levels of recording skill and activity for all taxa and all communities. A summary of the options and their advantages and disadvantages is presented in Table 7. Each option was assessed for the extent to which it could fulfil community funding objectives, with the option best meeting all objectives becoming the option recommended in Table 8. Options failing to meet all objectives at least partially were discounted.

Table 7: Community Fund options and their advantages and disadvantages

Community Fund Option D0: Status quo

No community funding will be provided over and above any that is already in existence e.g. bursaries available through LERCs and BRISC for students, or studentships supported by SNH.

Advantages	Disadvantages
• No additional costs • Some community support is available through existing Scottish LERCs, BRISC and SNH (e.g. training bursaries and loan of kit) • No additional effort required to disburse funds	• Existing pressure points continue to be limiting factors • An Open Data culture cannot be fully achieved • Remote or low income communities and academia remain hard to engage and inequalities persist • The scale of verification necessary to support growing participation in biological recording cannot be achieved

Community Fund Option D1: Verifiers Fund

Community funding will be focused solely on resolving the most urgent issue in biological recording, that of easing pressure on Verifiers, Collection Curators and National Recording Schemes so that there is sufficient capacity and capability for all biological records to be appropriately verified through sustaining the core skills and systems necessary for this. This funding would support costs such as the postage and curation costs for receiving, holding and returning biological specimens for verification, travel and specialist equipment for field excursions to confirm the presence of rare or colonising species, and professional development for Collection Curators and Recording Scheme Operators. Individual Verifiers would be able to apply for occasional contributions to their costs while a Collection Curator or Recording Scheme Operator would be able to apply for occasional or regular contributions to relevant expenditure.

Advantages	Disadvantages
• Pressure points on Vice-County and County Recorders and their National Schemes are alleviated/eliminated • Development of the next generation of Verifiers across all taxonomic groups • Increased data quality • Revitalisation of local/regional natural history collections	• Additional costs that increase total operating costs • An Open Data culture cannot be fully achieved • Remote or low income communities remain hard to engage and inequalities persist • No reach into academia to facilitate training and data exchange

Community Fund Option D2: Verifiers & Recorders Fund

In addition to the funding for Verifiers, Collection Curators and National Recording Schemes as above, community funding will also focus on supporting affiliated recording groups through i) provision of training bursaries for Recorders to learn specialist taxonomic skills, particularly for under-recorded species, and ii) through contributions towards the expenses incurred in running specialist taxonomic training courses locally, running group or individual excursions to under-recorded areas or the costs of accessing specialist or high-cost equipment such as boats or microscopes. With such a fund, the funding administrator could occasionally accommodate costs for high-cost/high-value surveillance or monitoring to facilitate full coverage for Scotland for species of strategic interest that may otherwise be unachievable.

Advantages	Disadvantages
All of the above, plus: • Pressure points on Recording Group Operators are alleviated/eliminated • Development of the next generation of Recording Group Operators in all geographic areas as more groups operate effectively and gain new members • Capacity to support strategic monitoring by focusing support for Recorders on species and areas of interest • Increased participation by groups and individuals • Increased willingness to supply records for Open use	• Additional costs that increase total operating costs • Remote or low income communities remain hard to engage and inequalities persist • No reach into academia to facilitate training and data exchange

Community Fund Option D3: Verifiers, Recorders & Communities Fund PREFERRED OPTION

This option assumes that, in addition to the funding for Verifiers, Curators, Schemes and Recorders, community funding will also focus on teachers, communities and individuals new to recording (e.g. local community groups, university students, schools and early learning centres). Such funding would enable affiliated individuals or groups such as childminders, Forest Schools, Community Councils or Universities to apply for funding for excursion expenses, specialist or high-cost equipment or teaching materials such as field guides. PhD studentships that further taxonomic knowledge or species ecology or the connection between people and nature could also be sponsored. With the expansion of funding into these settings, there is great scope for increasing skills and learning at all levels, especially for urban and low income households with less opportunity to enjoy high quality green space and a genuine connection to nature.

Advantages	Disadvantages
All of the above, plus: • Support for groups within Community Council areas to learn about their local biodiversity • Universities, schools and childminders can access support and equipment for a class, home or outdoor activity to encourage learning in all settings • Mainstreaming of the value of the Infrastructure for academia and the public leads to more records being submitted for Open use and public benefit	• Additional costs that increase the total cost of operation of the Infrastructure

Given the analysis of options considered, and the significance of its contribution towards strategic objectives, the preferred way forward is for provision of community funding that goes beyond core participants (Verifiers and existing Recorders) to reach the general public to the greatest extent.

Table 8: Evaluation of the options for community funding

OPTIONS / OBJECTIVES	D0 Status Quo	D1 Verifiers	D2 Verifiers & Recorders	D3 Verifiers, Recorders & Communities
To increase the collection of records that can be supplied unconditionally for open use	×	✓	✓✓	✓✓
To remove pressure points for keystone people and to aid succession planning through encouraging others to share endeavours and provide local leadership	×	✓	✓✓	✓✓
To increase monitoring of under-recorded species and under-recorded places in Scotland	×	✓	✓✓	✓✓
To increase public participation with National Schemes and other Super Partners in Scotland	×	✓	✓	✓✓
To maximise the contribution of the Infrastructure towards delivery of the National Outcomes for Scotland.	×	✓	✓	✓✓
OUTCOME	Discounted	Possible	Possible	Preferred

× = not met, ✓ = partially met, ✓✓ = fully met

Impact assessment for our preferred option

No negative impacts are anticipated (other than the overall costs of operation being greater if there is also provision for a commensurate Community Fund). However many positive, strategic impacts are thought likely for the following reasons:

i) Pressure points on keystone individuals will be relieved and so Collection Curators, Recording Groups and National Schemes can provide essential taxonomic expertise in perpetuity. Such expertise is crucial for correctly identifying species so that conservation status of important sites and populations can be understood and so that invasive species alerts and conservation advice can be issued with confidence. Without such expert species knowledge, it will not be possible to inspire the general public nor to hold decision-makers to account.

ii) An Open Data culture becomes possible as the biological recording community feels that their contribution - often a lifetime's work - is appreciated and valued and that commercial users are supporting the collection and verification of biological records. The provision of an Open evidence base underpins the protection and enhancement of our natural environment leading to well-informed decision-making that facilitates Scotland's contribution to the global Sustainable Development Goals and Aichi Targets.

iii) The extent of public participation in a rewarding outdoor pursuit could be massive, enabling a significant contribution towards Scottish Biodiversity Strategy Goals and the National Outcomes for Scotland. For maximum gain, the biological recording infrastructure must support, inform and involve all communities and interests.

Risks and dependencies

As for the Funding Source option above, there is a dependency on political will for community funding to be feasible. If funding for the Infrastructure comes to rely on user funding, it is unlikely that sufficient 'profit' can be generated to resource sufficient community funds over and above the running costs of the Infrastructure. Public funding is therefore likely to be essential for there to be any significant level of community funding in reality.

There is a risk that if Scotland is able to resource national schemes and other Super Partners better than other countries of the UK, that their activities will be focused almost exclusively on Scotland to the detriment of the other countries. There is also a risk that the Infrastructure is flooded with records for Scotland such that the strategic priority at the UK level then changes to focus on facilitating recording outside Scotland. These risks can be mitigated through Scotland deploying its funding to pioneer improvements and deliver value both within and beyond Scotland.

SUMMARY OF OUR RECOMMENDED OPTIONS FOR CHANGE

In presenting and evaluating our options, we have identified options that are both achievable and transformational. In doing so, we are facilitating a way forward for the biological recording infrastructure that has long been at an impasse between the desire to maximise the use and value of its data versus the ever-present need to cover operating costs.

Given that funding is yet to be secured, we have used these options as the basis for a proposed investment programme for consideration by funders (e.g. the Scottish Government) and/or subscribers (e.g. public, commercial, academic and third sector users). The value of this investment programme for Scotland is appraised in Section 7.

Table 9: Our recommended options for change

SERVICE PROVISION	OPTION A4: CENTRALISED, NATIONALISED AND REGIONALISED SERVICES Services provided by the Infrastructure are either delivered centrally (where it makes sense to avoid duplicating services that are needed in all countries of the UK), nationally (where it makes sense to devolve delivery of a service to be within each country due to jurisdictional differences) or regionally (where it makes sense to have a local presence). All services would be accessible online and users would choose the relevant country or region to obtain a service from. There would potentially be four national service providers (for devolved services), one central service provider (for services common to all four countries of the UK) plus a network of Regional Hubs within each country to provide regional and local services. Hosting arrangements for Regional Hubs would maximise the reach into, and mutual support between, all sectors through building partnerships and sharing back office facilities.
IN-COUNTRY GOVERNANCE	OPTION B3: NBN SCOTLAND WITH AFFILIATED REGIONAL HUBS A new Scottish Division of NBN Trust, NBN Scotland, will be created to oversee national and regional infrastructure levels in Scotland. NBN Scotland, guided by a Country Committee with representatives from all sectors will act as the National Hub, working in formal partnership with affiliated Regional Hub Partners and their host organisations. Where there is no Regional Hub Partner, NBN Scotland will act as the NBN Regional Hub in that region. Over time, national and regional performance will be evaluated so that factors associated with high performance can be encouraged.
FUNDING SOURCE	OPTION C1: PUBLIC FUNDING Sufficient public funding will be provided in perpetuity to enable UK, National and Regional Hubs and Super Partners to operate the preferred models for data flow, service provision and governance. A Single Framework Agreement or equivalent between Scottish Government and the Lead Governance Body would define the level of revenue from a biodiversity levy or other tariffs (e.g. a minor increase to business rates) necessary to cover relevant operating costs of the Infrastructure and its Super Partners. The Lead Governance Body would disburse this funding between National and Regional Hubs and Super Partners and Community Fund applicants to maximise the strategic impact and contribution of each one to the National Outcomes for Scotland and the Scottish Biodiversity Strategy. These disbursements would replace current funding arrangements and commercial charges, releasing funds currently committed by Public Bodies to LERCs and the NBN Trust, enabling biodiversity data to be open and Infrastructure services to be free to all at the point of use.
COMMUNITY FUNDING	OPTION D3: VERIFIERS, RECORDERS & COMMUNITIES FUND Community funding for Verifiers will ease pressure on Verifiers, Collection Curators and National Schemes so that there is sufficient capacity and capability for all biological records to be appropriately verified through sustaining the core skills and systems necessary for this. This funding would support costs such as the postage and curation costs for receiving, holding and returning biological specimens for verification, travel and specialist equipment for field excursions to confirm the presence of rare or colonising species, and professional development for Collection Curators and Recording Scheme Operators. Individual Verifiers would be able to apply for occasional contributions to their costs while a Collection Curator or Recording Scheme Operator would be able to apply for occasional or regular contributions to relevant expenditure. Community funding for Recorders will also focus on supporting affiliated recording groups through i) provision of training bursaries for Recorders to learn specialist taxonomic skills, particularly for under-recorded species, and ii) through contributions towards the expenditure incurred in running specialist taxonomic training courses locally, running group or individual excursions to under-recorded areas or the costs of accessing specialist or high-cost equipment such as boats or microscopes. With such a fund, the funding administrator could occasionally accommodate costs for high-cost/high-value surveillance or monitoring to facilitate full coverage for Scotland for species of strategic interest that may otherwise be impossible to achieve. In addition, community funding for outreach into communities will focus on teachers, communities and individuals who are new to recording (e.g. local community groups, university students, schools and early learning centres). Such funding would enable affiliated individuals or groups such as childminders, Forest Schools, Community Councils or Universities to apply for funding for excursion expenses, specialist or high-cost equipment or teaching materials such as field guides. PhD studentships that further taxonomic knowledge or species ecology or the connection between people and nature could also be sponsored. With the expansion of funding into these settings, there is great scope for increasing skills and learning at all levels, especially for urban and low income households with less opportunity to enjoy high quality green space and a genuine connection to nature.

6. Transition arrangements

This section outlines how the transition from the current to the future situation will be achieved to realise all of the benefits promised. As for any infrastructure project with significant investment costs and delivery over multiple years, there will be risks and challenges that need robust management. Some temporary funding will be necessary to cover the running costs of a dedicated Programme Office to resource this.

Rather than the construction of a physical building or bridge, 'construction' of a biological recording infrastructure largely entails the building of the capabilities, culture, events, products and services that facilitate the NBN Data Flow Pathway (RECORD & COLLECT > QUALITY ASSURE > CURATE > AGGREGATE > ANALYSE > USE). An effective transition needs to facilitate the development, alignment and fulfilment of each of these in accordance with our preferred options for change in the previous section.

To facilitate such development, alignment and fulfilment, we will put the following resources, controls and phasing in place:

Project and programme management

A small dedicated programme and project team to support the transition needed will be set up. This team will comprise four roles for at least three years: a Programme Manager and a Project Manager (to undertake programme and project management activities), a Business Analyst (to aid requirements gathering for product and service development) and a Communications Officer (to aid communications and outreach into all sectors). The Programme Manager will be line managed by the CEO of the NBN Trust and will line manage the other roles.

Programme and project management best practice (e.g. MSP®), documentation and gateways will be used to plan, approve, deliver and review each project and the overall change programme. Programme and Project Board and Project Team members will be drawn from the NBN Trust, NBN Scotland and Regional Hub Partners and Super Partners, and other stakeholders, as appropriate.

Change management

As there will be a considerable shift from established ways of working to new approaches, pro-active change management will be essential. In the short to medium term, SBIF Advisory Group members will be encouraged to act as a Sponsoring Group to promote and advocate the changes needed (using a model such as the Prosci ADKAR® Model to cover the people aspects of business change). In the longer term, the Country Committee and Regional Committees once established will be tasked with actively sponsoring the changes needed at the national and regional level.

A 'maturity curve' approach will be taken to encourage the progression of each National and Regional Hub as their confidence and experience develop. Each phase of transition will be followed by a review to share lessons learned and to encourage knowledge sharing. Early adopters will be encouraged and show-cased to promote the advantages of new ways of working. The annual NBN Conference will continue to bring together UK, national and regional staff and partners with an increased focus on aspects that aid benefits realisation and team building.

Risk management

Key risks are likely to arise from resistance to change and a lack of senior commitment and sponsorship. The current SBIF Advisory Group, and in due course any NBN Country Committee for Scotland, will act as a sponsoring group for the transition. If the capabilities needed at the UK level are slow to materialise, the Regional Hub Partners will have no choice but to continue old ways of working for longer. The dependencies between all aspects of the Infrastructure will be prioritised so that the most critical dependencies can be addressed first. There will need to be clear responsibilities for risk management to ensure that all risks are identified at an early stage along with appropriate mitigation measures.

A Programme Risk Register will be maintained to aid management and reporting of all risks and their mitigation measures. The release of funds to the UK, National and Regional Hubs and Super Partners should be contingent on progress measures and programme milestones being achieved.

Agile product and service development

An Agile product and service development approach will be introduced from the outset following at least introductory training for all participating staff from Super Partners and UK, National and Regional Hubs. The NBN Atlas Product Owner for Scotland will be based within NBN Scotland to gather and prioritise the requirements of all stakeholders and sectors in Scotland. The core Product Team (developing NBN Atlas) will be based within the NBN Trust.

UK, national and regional level services provided through the Infrastructure will be prioritised for attention. Each service will be optimised to provide the best possible user experience and to maximise the value of the service for Scotland and beyond.

Benefits realisation

The benefits promised will be defined in a Programme Benefits Log and regularly reviewed to identify where further effort is needed to champion, realise, and then sustain, the benefits anticipated. A bespoke benefits roadmap will be developed for each sector (public, commercial, academic and third).

Team development

Support will be given to those individuals who need to develop new skills and the confidence to do things differently. All Regional Hub Partners and NBN Scotland will have a leadership role and will need to develop new skills, therefore investment in people is essential.

Team building events and open communication will be encouraged to develop a One Team rapport between Regional Hub Partners, NBN Scotland and the wider NBN Trust and Super Partners.

Monitoring and evaluation

Baseline information will be gathered against which to measure progress against the implementation plan and overall programme of delivery. Annual evaluation will provide feedback on progress of Infrastructure implementation and delivery of key objectives and benefits. Key measures of performance will include the level of service use and service user satisfaction, data provision and data provider satisfaction and the extent to which gaps in service provision and data collection have been closed. Longer term monitoring at 3, 5 and 10 years after implementation will assess the extent to which the programme has achieved the outcomes sought.

Progress reporting

Annual programme updates and quarterly project updates will be provided to communicate progress against programme KPIs, with quarterly highlight reports for key stakeholders.

Potential phasing and milestones

The exact phasing will be confirmed during the implementation planning stage. Interim support will be needed to recruit and maintain Regional Hub Partners while awaiting Phase 3.

Phase 1: Capacity building for NBN Trust and Super Partners
KEY MILESTONES: recruitment of all roles, affiliation of all Super Partners, initial team building and the training of all staff in Agile product development.
Phase 2: Capacity building for the National Hub for Scotland
KEY MILESTONES: recruitment of all roles, development of a vision for national infrastructure services and 'handover' to live operation with metrics on product and service use and satisfaction.
Phase 3: Capacity building for the Regional Hub Network in Scotland
KEY MILESTONES: recruitment of all roles, development of a vision for regional infrastructure services and 'handover' to live operation with metrics on product and service use and satisfaction.
Phase 4: Capacity building for community outreach in Scotland
KEY MILESTONES: establishment of the Community Fund, its administration and application processes, definition of and reporting on strategic priorities for its first year of operation.

7. Investment appraisal

Having explored the options for change in Section 5 to identify a preferred way forward, this section appraises the value of the proposed investment to transform the biological recording infrastructure in Scotland. It covers:

- Spending objectives
- Assumptions and constraints
- Expected benefits: ease, expertise, evidence & engagement
- Contribution to National Outcomes and Aichi Targets
- Monetary value of these benefits
- Expected costs: set up and operation
- Profile of the costs and benefits
- Potential return on investment
- Limitations of this appraisal

Such an appraisal is challenging primarily because no direct tangible economic benefits arise from the Infrastructure itself, and because a full economic assessment is beyond the scope and resources of this Review. That said, it is well-documented (see Table 10 for examples) that Scotland gains billions of pounds of economic value from its natural capital, ecosystem services, wildlife tourism, effective land use and planning decision-making, the health and educational benefits of people enjoying the natural world and the avoided costs of biodiversity degradation (e.g. loss of pollinators or arrival of invasive species) and data degradation (e.g. loss of evidence and insights for decision-making). All of these are dependent on the presence and efficacy of the biological recording infrastructure. As a result, the value of this underpinning Infrastructure can be monetised by considering the economic value within each dependency that is at risk if the Infrastructure ceases to exist or remains unimproved.

We have taken a simple approach to comparing the benefits and costs to the Scottish Government of transforming the biological recording infrastructure in Scotland. Although simple, it facilitates

Table 10: Examples of economic assessments of relevance to the biological recording infrastructure

Bateman, I.J et al. 2011. **UK National Ecosystem Assessment: understanding nature's value to Society (Technical Report, Chapter 22: Economic Values from Ecosystems):** "Our economic analysis provides a bridge from the ecosystem habitat focus of the natural science elements of the UK National Ecosystem Assessment (UK NEA) to consideration of the goods and services those ecosystems provide and the values these yield to individuals. [...] While information gaps mean that we cannot estimate values for all services, those values that are reported are substantial and underline the vital role which the natural environment plays in supporting current human wealth creation and well-being and in offering the foundations for a sustainable future economy. [...] The value of UK fish landings is about **£600 million** per annum (p.a.) [...] Biodiversity pollination services are estimated at **£430 million** p.a. [...] Willingness to pay (WTP) estimates of the non-use (existence) value of terrestrial biodiversity range from **£540 million to £1,262 million** p.a. and for marine biodiversity, estimates of around **£1,700 million** p.a. have been reported."

Bryden, D.M., Westbrook, S.R., Burns, B., Taylor, W.A., and Anderson, S. 2010. **Assessing the economic impacts of nature based tourism in Scotland**. Scottish Natural Heritage Commissioned Report No. 398: "The value to Scotland's economy (the direct economic impact) of nature based tourism is **£1.4 billion** per year."

RPA & Cambridge Econometrics. 2008. **The Economic Impact of Scotland's Natural Environment.** Scottish Natural Heritage Commissioned Report No. 304: "The value to the economy of industry's sustainable use of the natural environment has been estimated at **£17.2 billion** [...] for 2003. This figure is equivalent to 11% of Scottish total output in that year. In addition, the environment was estimated to support [...] almost 14% of all full-time jobs in Scotland in 2003."

Way, L., Bunch, N., Robinson, A. 2015. **JNCC terrestrial surveillance: evaluation and developing a future strategy**: "Monitoring ranges from structured surveillance schemes for birds, bats, plants and butterflies, to less structured, ad hoc recording for a wide range of other taxa. JNCC investment in these volunteer schemes is currently around £1.1 million per annum, with volunteer contributions in time conservatively valued in excess of **£8.6 million** per annum."

Williams, E., Firn, J.R., Kind, V., Roberts, D., McGlashan, D. 2003. **The value of Scotland's ecosystem services and natural capital**: "In this paper we [...] derive a current annual ecosystem service value of approximately **£17 billion**."

Williams, F., Eschen, R., Harris, A., Djeddour, D., Pratt, C., Shaw, R. S., Varia, S., Lamontagne-Godwin, J., Thomas, S. E., Murphy, S. T. 2010. **The Economic Cost of Invasive Non-Native Species on Great Britain** (www.cabi.org - Williams et al. 2010): "The total current annual cost of INNS to the British economy is estimated, when corrected for double counting, at £1,291,461,000 to England, £244,736,000 to Scotland and £125,118,000 to Wales. Therefore the total annual cost of INNS to the British economy is estimated at approximately **£1.7 billion**."

the calculation of the potential return on each pound spent, i.e. the return on investment, in familiar economic terms:

- **Net Present Value** (NPV) as a measure of the total impact of the transformation in monetary terms; a positive value means that the return on the investment exceeds its cost.
- **Present Value of Costs** (PVC) as a measure of the monetary cost to the Scottish Government's budget were the public purse to cover the cost, including set up and annual running costs.
- **Present Value of Benefits** (PVB) as a measure of the total impact of the transformation in monetary terms but excluding costs to the public purse, such that NPV-PVC=PVB.
- **Benefit-Cost to Government Ratio** (BCR) as a measure of the value for money, using PVB divided by PVC to calculate the return on each pound spent.

Spending objectives

We have focused on the costs and benefits of investment that arise from supporting the following spending objectives:

1. To transform the Infrastructure as demanded by Public Petition PE1229 which originally triggered this Review to resolve long-standing issues and achieve the SBIF Vision.
2. To maximise the contribution of the Infrastructure towards the delivery of the National Outcomes for Scotland and the Aichi Targets.
3. To enable Scotland to become a global leader for biodiversity through facilitating effective evidence gathering and decision-making, maintaining long-held traditions and expertise in biological recording and encouraging participation from diverse communities and sectors.
4. To avoid the costs and harms of an inadequate Infrastructure that would otherwise fail in four key areas: i. an ineffective evidence base for decision-making in support of strategic objectives; ii. the loss or degradation of biodiversity and the costs of its recovery; iii. the unnoticed arrival or spread of invasive species and associated costs of control; and iv. the loss or degradation of biodiversity data and associated lost opportunities relating to future use and re-use of data.

Assumptions and constraints

- Valuing the biological recording infrastructure by the economic value it underpins is a valid way to monetise the benefits accrued from its presence and efficacy.
- The tangible economic and social value of conserving species and ecosystems for future generations is worth billions of pounds per significant taxon group; therefore our estimate of NPV (and so PVB) will be an under-estimate for the number of such taxon groups is likely to be greater than the factor of 3 used in this appraisal to represent the taxa and ecosystems within the three natural environments (terrestrial, freshwater and marine).
- As the costs of operating the biological recording infrastructure are well-understood, our estimate of PVC will be reasonably accurate.
- Due to the eternal value of the natural world, our estimate of NPV should either be not discounted, or discounted at lower rates than the HM Treasury Green Book sets out (to reflect the immediacy of the current biodiversity crisis, the instrumental value of biodiversity to future generations and the intrinisic value of biodiversity in its own right).
- The desired level of transformation is achievable within the first decade of investment.
- The Scottish Government aspires to be the greenest country in the world and it will act quickly to implement the recommendations of this Review so that the desired level of transformation, and so the expected value, is achievable (and achieved) within the first decade of investment.
- Our estimates of NPV, PVC, PVB, and BCR are valid even if Scotland is the only UK country to invest in transforming its biological recording infrastructure over the coming decade.
- Other jurisdictions of the UK will benefit from Scotland playing a pioneering role in transforming the biological recording infrastructure however our cost estimates are based upon the costs incurred by the Scottish Government.
- Although this investment appraisal does not provide a full economic assessment, it is sufficient to inform an in-principle decision on whether to implement the recommendations of this Review.

EXPECTED BENEFITS: EASE, EXPERTISE, EVIDENCE & ENGAGEMENT

The benefits of transforming the biological recording infrastructure were determined through analysis of our interview, questionnaire and workshop findings. Ten direct benefits are expected and their dependencies upon business changes and enabling projects have been mapped (see Annex VII). Ten areas of wider benefit have also been identified as areas of value that will be realised beyond the direct beneficiaries and users of the biological recording infrastructure.

Each of these areas are described below, with their strategic contribution, monetary value, cost and the potential return from investment in them evaluated further below.

Direct benefits

MAXIMISING CONFIDENCE AND PACE

The clarification and embedding of clear, affiliated data flow routes and submission points will enable the rapid provision of biological records from all sectors to the NBN Atlas. Recorders will be confident in where and how to submit their records and will receive feedback on their records' quality and use. Data submission will be easier, confusion over where to submit records will be eliminated, and bottlenecks (e.g. for verification) will be eased through the improved use of online apps and standard formats for data submission (so that the time necessary for compiling and formatting records before verification is also significantly reduced or eliminated).

OPENING UP BIODIVERSITY DATA

The quality and quantity of biological records openly available via the NBN Atlas will increase to provide a comprehensive, definitive biodiversity evidence base for Scotland for use by all sectors. All records will be of known quality and easily accessed through a single central data repository with links to voucher specimens and appropriate metadata. Open access to centrally available data facilitates the development of added-value datasets and services which in turn generate additional revenue and opportunities for collaboration, education and insights of advantage for every sector.

PROVIDING SUPPORT AND INSIGHTS

Services that support Recorders and Data Users will be available across the whole of Scotland so that there will no longer be gaps in service provision. Core services will be designed to provide a 'universal user experience' with the same range and quality of services available in all areas. New added-value capabilities will be created through the provision of bespoke services and insights for decision-makers, academia and businesses. Integration of the NBN Atlas with business processes and development of innovative data products and services will maximise its value to Scotland. A Digital First approach will enhance the user experience and facilitate lower overheads per service transaction.

ENGENDERING PARTICIPATION

Everyone involved in biological recording, from individual Recorders and Verifiers to local Recording Groups and National Recording Schemes, will have consistent access to high quality training and support and will feel valued for their skills and contribution. This will increase levels of participation through motivating more people to participate in more ways and with a deeper level of engagement and skill. As a result, recording groups and schemes will be more active, more sustainable, and will produce more biodiversity data. More people will experience a sense of worth, a sense of community and a sense of connection to the natural world with all the benefits that these bring.

OPTIMISING EFFICIENCY AND SUSTAINABILITY

Governance of the biological recording infrastructure will be transformed with a single organisation having oversight of the whole Infrastructure in Scotland. Maximum cohesion will be achieved alongside economies of scale with efficient and effective risk management and sustainable use of resources. Partnerships at the regional level will achieve greater reach into the key sectors (national and local government, commercial, third sector and academia) and will have far greater local relevance and value. The underlying issues (of a lack of leadership and a multiplicity of organisations operating in the same space) that limit the efficacy of the biological recording infrastructure will be resolved.

DEVELOPING CAPACITY

Organisations that provide or govern key parts of the Infrastructure as a public service will have sufficient funding and resources to do so effectively with improved well-being for staff and volunteers. The easing of pressure on keystone individuals will eliminate staff and volunteer fatigue and burnout, thereby enabling people to have an ongoing and rewarding level of involvement with enhanced well-being. The Infrastructure as a whole will have the capacity and financial security to build capabilities in support of Scotland's strategic goals. A shared technical road map will rationalise and integrate the systems and technologies in use to eliminate legacy systems and silos.

GROWING SKILLS AND CAPABILITIES

With more people participating in and learning about biological recording and species identification, the skills base in species ecology and taxonomy will be greatly increased. This will lead to more records being collected, submitted and verified as more people become active Recorders, some of whom will gain the level of proficiency and interest necessary to act as a Verifier for one or more taxonomic groups. As expertise grows, the range of taxa for which sufficient records are collected to inform long term monitoring and state of nature reporting will grow to reduce or eliminate data gaps for under-recorded sites and species in Scotland.

INCREASING NATIONAL AND GLOBAL IMPACT

A transformed Infrastructure will support the National Performance Framework (e.g. for metrics on biodiversity, condition of protected nature sites, visits to the outdoors and natural capital). Through underpinning the delivery of five of the eleven revised National Outcomes for Scotland in particular (relating to a sustainable economy, empowered communities, health, environment and education), and the Scottish Government's ambition of being the greenest country in the world, the Infrastructure will facilitate greater connection with, and care for, nature which in turn will position Scotland as a global leader in the guardianship of biodiversity.

TRANSFORMING DECISION-MAKING

The collection, verification, aggregation, analysis and use of biological records facilitated by the Infrastructure will enable changes in species and habitats' distribution and abundance to be more rapidly and accurately detected and understood to inform appropriate and timely responses to climate change, species invasions and harmful land use or land management decisions. The status of species of conservation interest, and the impact of management interventions and environmental subsidies, and the condition or resilience of sites and ecosystems and their natural capital, will be better understood to inform management action and environmental subsidy and support in future.

UPHOLDING STANDARDS

Transformation of the data flows, services and governance of the Infrastructure will facilitate compliance with biological recording best practice and any relevant statutory requirements (such as GDPR or the safeguarding of vulnerable people who may participate in biological recording activities and communities). Improved standards, through the affiliation of data submission routes and data providers, will greatly reduce the time taken for biological records to become available for use. Improved governance will ensure that the Seven Principles of Public Life are upheld by everyone in receipt of public funding for their part in the Infrastructure.

Wider benefits

AVOIDING COSTS/NUGATORY SPEND

A transformed Infrastructure will help protect against the costs of having no effective mechanism in place to achieve all of the above benefits. The need for, and cost of, species recovery, habitat restoration, invasive species control or fines for failure to comply with legislation for biodiversity protection will be reduced. The burden on the NHS is similarly reduced as public participation in biological recording improves physical and mental well-being. Insights from a comprehensive evidence base will reduce the likelihood that public monies are spent on land management or permitted developments that don't deliver a net gain for biodiversity or that fall short of desired outcomes (e.g. farming subsidies that fail to reverse the declines of farmland species).

ENCOURAGING WILDLIFE & LANDSCAPE TOURISM

Given that the Infrastructure facilitates the protection of iconic species and landscapes that are of immense value for tourism, and encourages participation in biological recording, it will have great potential for generating new visitors with a deep interest in visiting parts of Scotland where iconic or under-recorded sites, species or habitats may occur, or where local wildlife can be encountered. This will increase demand for services such as accommodation or wildlife expeditions in these areas. The potential costs and harms of tourism such as the disturbance of protected species or introduction of invasive species, will be detected and reported more easily.

MAINSTREAMING BIODIVERSITY

Public knowledge, experience and enjoyment of biodiversity is greatly enhanced through the presence of an effective biological recording infrastructure. Investment in support of this signals the Scottish Government's commitment to the monitoring, protection and recovery of biodiversity and the importance of the biological recording community in fulfilling these commitments. It facilitates the inclusion of biodiversity data in decision-making so that this becomes the norm for every decision made, so ensuring the fulfilment of biodiversity duty and corporate social responsibility. The Infrastructure will provide ways of engaging the public with biodiversity, the reasons why it matters and how their own involvement can increase the nation's knowledge and appreciation of the natural world around them. Greater engagement, and the integration of biodiversity data in decision-making, provides communities with the knowledge and access they need to understand and influence decisions being made at a local and national level.

ENHANCING ECOSYSTEM RESILIENCE

Having an Infrastructure that provides access to high quality, up to date data enables greater understanding of species responses to management interventions such that managers will be better able to determine the most appropriate management objectives for a given area of land or sea. Better management planning enables managers to enhance the resilience of the ecosystems they manage and so their resistance to biodiversity loss, INNS, over-exploitation, wildfire, wind damage or flooding, and the cumulative effects of these. Where such ecosystems play a role in sequestering carbon, there will be wider benefits from ameliorating climate change and mitigating its effects.

PREVENTING SPECIES EXTINCTIONS

The biological recording infrastructure underpins the availability of biological records to inform State of Nature reporting and invasive species alerts. These in turn facilitate an awareness of which species may be at risk given their long term decline or the arrival of a competing or predatory species. The increase in participation and taxonomic skill of Recorders afforded by transforming the Infrastructure will facilitate reporting and alerts for a far greater range of species. Decision-makers will be better able to assess and prioritise the need for action to protect species at risk of extinction in Scotland.

EMPOWERING COMMUNITIES

Increasing public access to data and information about biodiversity and the environment, and facilitating school and community group participation in biological recording, analysis and interpretation, the Infrastructure will directly empower communities to take part in local decision-making as intended by the Community Empowerment Act. This in turn will increase the quality of life experienced by people in those communities through aiding the provision of and access to green and blue space, reducing loneliness through encouraging community participation, and reducing the likelihood of wildlife crime and other harms through raising awareness of the threats to biodiversity within the local landscape.

IMPROVING PUBLIC HEALTH

With greater public participation in biological recording, knowledge of the environment and how to access green spaces, tangible public health benefits will be achieved as individuals have an increased connection with the natural world and are empowered to experience and safeguard it. Mental and physical well-being will both improve through being active and forming lifelong social groups and friendships, mitigating the adverse effects of otherwise sedentary lifecycles and reducing for many the likelihood of loneliness. Data and services provided by the Infrastructure will aid the design and protection of essential green and blue space for everyone.

REDUCING LAND USE CONFLICTS

Use of a trusted biodiversity evidence base accessible to all will help reduce confusion and conflicts in the use of land, freshwater and marine resources to ease tension between competing sectors and to avoid environmental harms. It will provide a definitive evidence base to arbitrate if necessary and to inform the protection of sites and species so that environmental protections are applied and upheld appropriately. It will inform target setting, management advice and reporting against management objectives so that land, water and marine management decision-making can facilitate sustainable resource use and minimise the social and financial costs of land use conflicts.

FACILITATING DIGITAL INNOVATION

The advent of an open source, online digital Infrastructure will allow everyone to source definitive biodiversity data for integration with data from their own area of interest. This will facilitate innovative new ways to increase digital participation and cross-sectoral collaboration. Digital resources such as museum collections and eDNA databases will be joined up to facilitate new insights which enable Scotland to lead the world in using technology to safeguard its biodiversity. Business process improvement and innovative new insights for Scotland could be realised through collaboration with technical expertise outside of the biodiversity sector.

ACHIEVING A SUSTAINABLE ECONOMY

The transformation of the biological recording infrastructure is a pre-requisite to the achievement of a sustainable economy. It will provide the evidence base for decision-making and environmental justice that will protect Scotland's natural resources and iconic landscapes so that they may support Scotland's economy and biodiversity now and for future generations. Biological records are essential for informing the development of renewable energy, wildlife-friendly food production and a circular economy to both generate and conserve economic, natural and social capital. All future generations will benefit from the contribution of the biological recording infrastructure today.

Table 11 below sets out the distribution of the above benefits across all key sectors, roles and generations with a stake in the transformation of the biological recording infrastructure in Scotland.

The pyramid below illustrates that these benefits work in synergy to underpin delivery of the National Outcomes for Scotland and to position Scotland as a global leader for biodiversity.

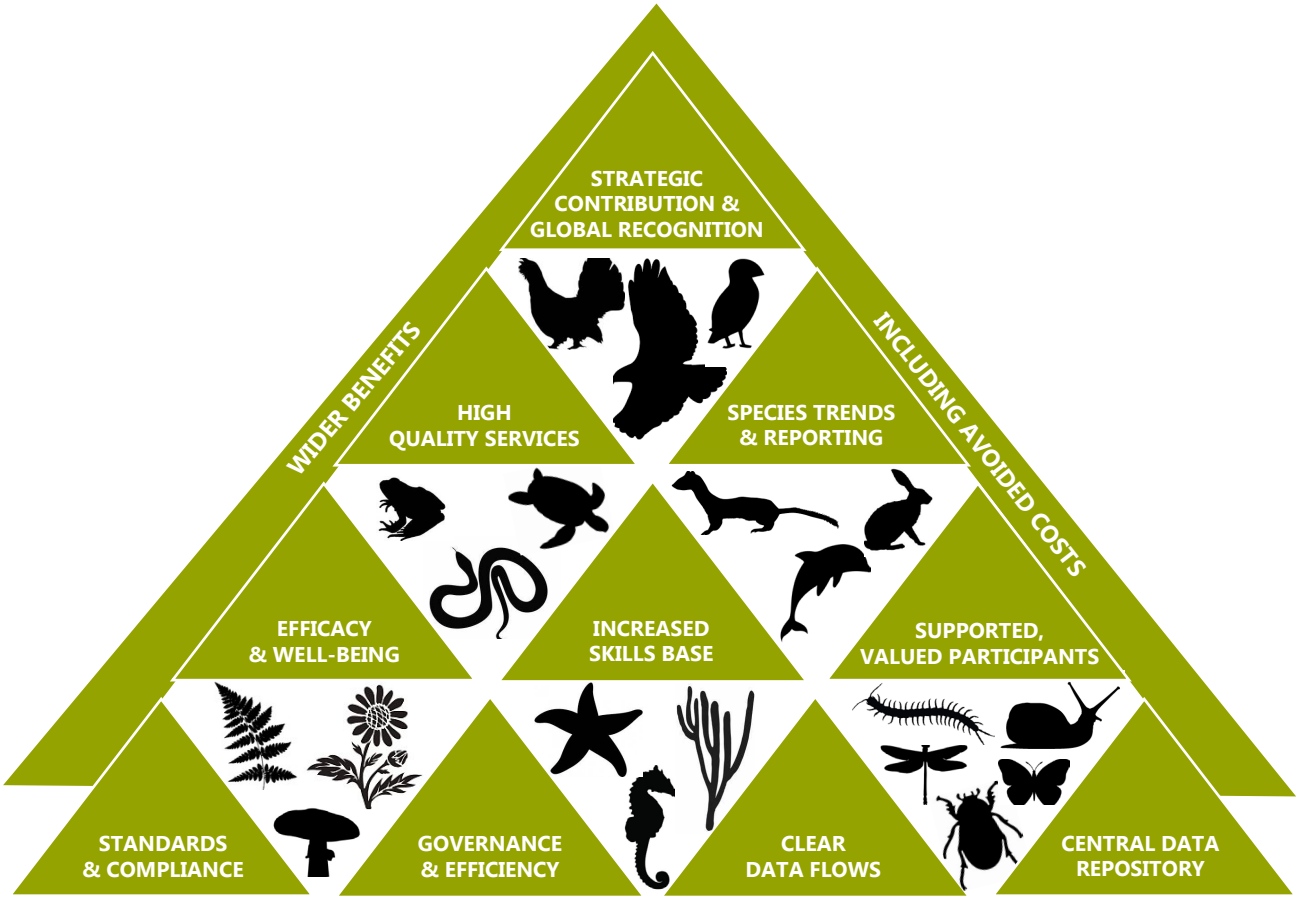

Table 11: Distribution and extent of direct and indirect benefits by sector, role and generation

Seven point scale: **highly negative -3** (---) to **+3** (+++) **highly positive**

SECTOR & ROLE gaining each benefit DIRECT BENEFITS	Academic Sector	Commercial Sector	Public Sector	Third Sector	Recorders	Verifiers	Collection Curators	Group Operators	Scheme Operators	Data Providers	Data Users	Data Developers	Service Providers	Service Users	Facilitators	Funders
1. MAXIMISING CONFIDENCE AND PACE	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++
2. OPENING UP BIODIVERSITY DATA	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++
3. PROVIDING SUPPORT AND INSIGHTS	+	++	+++	+++	+++	+	+	+	+	+	++	++	+++	+++	++	+++
4. ENGENDERING PARTICIPATION	+	+	+++	+++	+++	+++	+++	+++	+++	++	+	+	+	+	+	+
5. OPTIMISING EFFICIENCY & SUSTAINABILITY	+	+	+++	+++	++	+++	+	+	++	+++	+	+	+++	+++	+++	+++
6. DEVELOPING CAPACITY	+	+	+++	+++	++	+++	+++	+++	+++	+++	+	+	+++	+++	+++	++
7. GROWING SKILLS & CAPABILITIES	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++	+++
8. INCREASING NATIONAL & GLOBAL IMPACT	++	++	+++	+++	++	++	+++	++	+++	+++	+++	+++	+++	+++	+	+++
9. TRANSFORMING DECISION-MAKING	+++	+++	+++	+++	++	++	+	+	+	+	+++	+++	+++	+++	+	+++
10. UPHOLDING STANDARDS	+	+	+++	+++	++	++	++	++	++	++	++	++	++	++	+++	+++
INDIRECT BENEFITS	CURRENT GENERATION				NEXT GENERATION						FUTURE GENERATIONS					
11. AVOIDING COSTS/ NUGATORY SPEND	+++				+						+					
12. ENCOURAGING WILDLIFE & LANDSCAPE TOURISM	+++				+						+					
13. MAINSTREAMING BIODIVERSITY	+++				++						+					
14. ENHANCING ECOSYSTEM RESILIENCE	+++				+++						+++					
15. PREVENTING SPECIES EXTINCTIONS	+++				+++						+++					
16. EMPOWERING COMMUNITIES	+++				++						+					
17. IMPROVING PUBLIC HEALTH	+++				++						++					
18. REDUCING LAND USE CONFLICTS	+++				++						+					
19. FACILITATING DIGITAL INNOVATION	+++				+++						++					
20. ACHIEVING A SUSTAINABLE ECONOMY	+++				+++						+++					

Advantages for key sectors

PUBLIC SECTOR

Improvements in the Infrastructure increase the efficacy and efficiency of public spend and services relating to forestry, farming, energy, tourism, flood management, development planning and nature conservation. Through greater engagement of the third sector, the burden of government delivery is reduced and public investment facilitates matching volunteer contributions that engender a very large return on investment. The national biodiversity evidence base supports government decision-making in the face of mounting global environmental concerns. Decision-makers can easily access advanced informatics and surveillance data for all ecosystems and a wider range of taxa for within-season and near real-time assessment of environmental change and harm. Greater connection with nature improves public health and well-being, while improved insights and decision-making facilitate a sustainable and innovative economy and effective land management and development planning, thus safeguarding the value of natural capital, ecosystem services and wildlife tourism, while avoiding the costs associated with environmental harms.

COMMERCIAL SECTOR

Improved data flows provide faster, open access to all available data so that the effort and costs entailed in data searches are both more predictable and greatly reduced. The quality of environmental impact assessments is increased through access to relevant biological records from all sources, resulting in better decisions that minimise or eliminate negative impacts on biodiversity. Open access to data greatly reduces the costs of integrating biodiversity into commercial operations and the availability of standardised services across Scotland reduces effort entailed in locating and analysing data and increases interoperability and comparison of projects. The improved Infrastructure also makes it easier for commercial organisations to contribute data.

ACADEMIC SECTOR

The academic sector gains through open access to all available species occurrence records and analytics that inform our understanding of the environment and environmental change, whether through pre-school, primary, secondary or tertiary education, citizen science or academic research. A transformed Infrastructure builds the capacity of, and access to, experts on the ecology and taxonomy of species to further the ecological understanding of species gained through field studies, taxonomy and traditional biological recording which remains essential. Opportunities to engage children and adults in the life sciences and natural history (through case studies, teaching materials and data or support for student projects or a campus 'bioblitz') are found through the NBN Atlas and its network of partners and users. The profile of the Life Sciences is raised with funders and collaborators within and beyond the UK. Other disciplines, e.g. maths, computing, social sciences and the arts, also benefit from access to Big Data, citizen science and inspiration from the natural world. Improved data flows mean greater value is realised from records collected in the academic sector, enhancing each institution's impact and environmental and social credentials.

THIRD SECTOR

The third sector gains from the improved capacity and capability offered by a transformed Infrastructure so that it can provide a greater range of services and opportunities for participation with greater impact and inclusivity, and a more sustainable and cost effective basis. Recognition of the value of volunteers and of biological records engenders good will so that time and records are offered freely. The transformation means that light work can be made of facilitating data collection and data sharing in perpetuity. NGOs, National Recording Schemes and museums et al who operate key parts of the Infrastructure gain from improved support and efficiency, a lowered cost base and significant recovery of the costs entailed in operating public and supporter services. Co-creation of a shared technical roadmap and toolkit makes it easier to keep up with advances in technology that may otherwise be beyond the reach of the sector. A higher profile for NGOs gives access to a wider range of funders, supporters, collaborators and resources, facilitating new opportunities for all.

CONTRIBUTION TO NATIONAL OUTCOMES & AICHI TARGETS

The programme of investment to transform the biological recording infrastructure in Scotland is expected to provide a significant contribution to the Scottish Government purpose of "focusing government and public services on creating a more successful country, with opportunities for all of Scotland to flourish, through increasing sustainable economic growth". The Scottish Government has set five strategic objectives through which it will work to increase sustainable growth to create a Scotland that is Wealthier and Fairer, Smarter, Healthier, Safer and Stronger and Greener.

Although the Infrastructure is unlikely to ever make a significant tangible contribution to economic growth, it is fundamental for engendering sustainable growth and for protecting the natural resources needed to meet the needs of present and future generations of Scotland and for the intrinsic value of biodiversity in its own right. It will make a significant tangible contribution in this regard.

The contribution made by the investment (Tables 12 and 13) is well aligned to the Scottish Government's strategic objectives and the National Outcomes for Scotland (Annex VIII) and the global Aichi Targets. It supports the Scottish Government's aspiration of being the greenest country in the world and is worthy of becoming one of the 'Next Big Steps for Nature' within the 2030 Scottish Biodiversity Strategy.

Proposed National Outcome for Scotland, 2018:

WE VALUE, ENJOY, PROTECT AND ENHANCE OUR ENVIRONMENT

We see our natural landscape and wilderness as essential to our identity and way of life. We take a bold approach to enhancing and protecting our natural assets and heritage. We ensure all communities can engage with and benefit from nature and green space. We live in clean and unpolluted environments and aspire to being the greenest country in the world. We are committed to environmental justice and preserving planetary resources for future generations. We consume and use our resources wisely, ethically and effectively and have an advanced recycling culture. We are at the forefront of carbon reduction efforts, renewable energy, sustainable technologies and biodiversity practice. We promote high quality, sustainable planning, design and housing. Our transport infrastructure is integrated, sustainable, efficient and reliable. We promote active travel, cycling and walking, and discourage car reliance and use particularly in towns and cities.

Table 12: Contribution to the Scottish Government Strategic Objectives

Level of contribution: **highly negative -3** (- - -) to **+3** (+++) **highly positive**

OBJECTIVE	---	--	-	o	+	++	+++	MECHANISM
SAFER AND STRONGER: Help local communities to flourish, becoming stronger, safer places to live, offering improved opportunities and a better quality of life						++		Through community empowerment and improving the quality of life in Scotland via the design, provision and protection of green and blue spaces for access by local communities being informed by a definitive central biodiversity evidence base.
SMARTER: Expand opportunities for Scots to succeed from nurture through to life long learning ensuring higher and more widely shared achievements							+++	Through supporting life long learning via the life sciences and biological recording; through provision of a Community Fund to support participation in biological recording in every setting (from early learning and forest schools to academia and commercial R&D).
WEALTHIER AND FAIRER: Enable businesses and people to increase their wealth and more people to share fairly in that wealth						++		Through sharing the operating costs of the Infrastructure between the sectors who need to access biodiversity data and realise value from doing so and through basing the greatest burden of funding upon those whose activities are key drivers of biodiversity loss; through greater wildlife tourism and natural capital growing incomes.
GREENER: Improve Scotland's natural and built environment and the sustainable use and enjoyment of it							+++	Through engendering the sustainable use of natural resources, detecting invasive species and informing environmental justice and planning and land management decision-making; through encouraging participation in biological recording and a greater connection with the natural world.
HEALTHIER: Help people to sustain and improve their health, especially in disadvantaged communities, ensuring better, local and faster access to health care							+++	Through motivating the general public to spend time being physically active outdoors via participation in biological recording; through facilitating enjoyment of the natural world and protecting green and blue space for access and improved mental health and well-being.

Table 13: Contribution to the National Outcomes for Scotland and global Aichi Targets

Six point scale calculated from the sum of the scores for dependency and contribution based on subjective assessment:

Level of DEPENDENCY upon the Infrastructure: none = 0 points, low = 1 point, medium = 2 points, high = 3 points

Level of CONTRIBUTION to the Outcome or Goal: none = 0 points, low = 1 point, medium = 2 points, high = 3 points

NATIONAL OUTCOME	DEPENDENCY & CONTRIBUTION	MECHANISM
We have a globally competitive, entrepreneurial, inclusive and sustainable economy	HIGH & HIGH +6	Through using the biodiversity evidence base to inform planning and land management decision-making so that our biodiversity and other natural resources are used sustainably.
We respect, protect and fulfil human rights and live free from discrimination	NONE & LOW +1	Through giving equal opportunity and encouragement to all communities to participate in biological recording and community planning so that they can enjoy nature locally or further afield.
We are open, connected and make a positive contribution internationally	LOW & MEDIUM +3	Through facilitating biological records and Infrastructure services being openly available and through facilitating the Aichi targets.
We tackle poverty by sharing opportunities, wealth and power more equally	LOW & MEDIUM +3	Through increasing access to green and blue space for everyone and through the provision of a Community Fund in every local authority to support the costs of school and community group participation in biological recording and outdoor learning.
We live in communities that are inclusive, empowered, resilient and safe	HIGH & HIGH +6	Through providing and using the biodiversity evidence base to empower communities and inform planning decisions; through providing social opportunities through participation in biological recording and access to local green and blue space.
We grow up loved, safe and respected so that we realise our full potential	NONE & LOW +1	Through increasing well-being via participation in citizen science, biological recording and outdoor activities from an early age, nurturing biological interests to develop the biologists of the future.
We are well educated, skilled and able to contribute to society	LOW & HIGH +4	Through encouraging participation in extra-curricular activities to develop skills in biological recording and the life sciences; through facilitating expert volunteers to lead recording groups/expeditions.
We have thriving and innovative businesses, with quality jobs and fair work for everyone	LOW & MEDIUM +3	Through encouraging innovation, corporate social responsibility and sustainable consumption and production; through provision of a small number of high quality jobs in remote parts of Scotland.
We are healthy and active	HIGH & HIGH +6	Through motivating the general public to spend time being physically active outdoors via participation in National Recording Schemes, local recording groups or citizen science; and, by improving mental health through facilitating deep enjoyment of the natural world and protecting green and blue space for access.
We value, enjoy, protect and enhance our environment	HIGH & HIGH +6	Through monitoring and recording native and non-native species and facilitating the flow and use of biological records to provide a definitive evidence base to inform conservation and land use decision-making, so safeguarding our natural heritage.
We are creative and our vibrant and diverse cultures are expressed and enjoyed widely	LOW & LOW +2	By taking pride in the biological recording community, encouraging others to enjoy natural history and inspiring celebration of the iconic species, habitats and landscapes of Scotland.
AICHI STRATEGIC GOAL	**DEPENDENCY & CONTRIBUTION**	**MECHANISM**
STRATEGIC GOAL A: Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government & society	HIGH & HIGH +6	Through providing a definitive evidence base to facilitate insights into drivers of biodiversity loss, the state of nature and species responses to management interventions; through providing opportunities for raising awareness of, and engagement in, biological recording on a major scale.
STRATEGIC GOAL B: Reduce the direct pressures on biodiversity & promote sustainable use	HIGH & HIGH +6	Through providing a definitive evidence base to inform planning and land management decisions and to raise awareness of environmental issues and species responses; through detecting and reporting INNS.
STRATEGIC GOAL C: To improve the status of biodiversity by safeguarding ecosystems, species & genetic diversity	HIGH & HIGH +6	Through providing a definitive evidence base to inform protected site and ecological network designation and management, species recovery and habitat restoration - in turn safeguarding genetic diversity, species and ecosystems in Scotland.
STRATEGIC GOAL D: Enhance the benefits to all from biodiversity & ecosystem services	HIGH & HIGH +6	Through providing a definitive evidence base to aid natural capital assessment and site condition monitoring; through increasing ecosystem resilience through improved land management and planning decision-making; through raising awareness of the value of biodiversity and natural resources for everyone.
STRATEGIC GOAL E: Enhance implementation through participatory planning, knowledge management & capacity building	HIGH & HIGH +6	Through facilitating great participation in biological recording and community planning; through capacity building for organisations that govern or provide key elements of the Infrastructure; through providing a definitive evidence base to inform state of nature reporting and the sharing of knowledge about the natural world.

MONETARY VALUE OF THESE BENEFITS

Unless the Infrastructure charges for access to services or added-value datasets, it has no cash-releasing revenue streams of its own. Instead, the value of the benefits of its transformation has been monetised by considering the tangible economic value that is at risk if the Infrastructure remains unimproved or ceases to exist (Table 14). The tangible monetary value of each benefit has been estimated - informed by the citations in Table 10 - simply to the nearest order of magnitude and so thousands, millions or billions of pounds respectively.

This estimate of monetary value has been rounded down for the calculation of net present value (NPV) to avoid overstating the benefits. For example, a benefit worth thousands of pounds could have a tangible value of between £1,000 and £999,999 however to calculate NPV it is rounded down to £1000. However, as it is thought that significant costs can be avoided in all three natural environments (terrestrial, freshwater and marine), in this instance the estimated monetary value has first been rounded down and then multiplied by three to avoid understating the benefits. Of the indirect benefits, other than for wildlife tourism, only the monetary value of avoided costs has been estimated to avoid double counting given that most of the indirect benefits relate to avoiding costs in some way (such as costs for the National Health Service which could be avoided if the population in Scotland were healthier).

On this basis, the total tangible monetary value of the proposed investment in the biological recording infrastructure in Scotland is **£7 billion per annum.**

The relative tangible and intangible worth of each benefit has also been estimated using 'Planning Poker' (an Agile estimating technique using Fibonacci numbers to assess the relative size of technical requirements) to assess the relative worth of each benefit. Using this method, the tangible and intangible worth of each benefit were allocated a relative value of between 0 and 100 points. For example, the availability of biological data in an open, central data repository is estimated to have tangible worth of billions of pounds to the Scottish economy and correspondingly has the highest level of relative value of 100 points. In contrast, the benefit associated with the 'hygiene factor' of common standards and regulatory compliance is deemed to have the lowest tangible value and so a low relative value of 5 points as there is no additional financial or commercial value once achieved (excluding avoided costs of non-compliance).

The assessment of intangible worth took into account subjective factors such as non-commercial use of the Infrastructure, its ease of use and the reduction in user frustration, improved quality of data and safer decision-making, opportunities to master new skills, growth in volunteering, academic progress and prowess in the science of species taxonomy, having like-minded friends with whom to participate in biological recording, national and regional pride in the Infrastructure and Scotland, the freedoms afforded by Open Data and sustainable funding, synergies from capacity building in multiple organisations in parallel and the intrinsic value of biodiversity.

Taking the relative tangible and intangible worth of the benefits together enables the monetisation of the entire value of the investment to transform the Infrastructure as follows. If the monetary value of the tangible benefits alone equates to £7 billion per annum, and this value is estimated to form 36.7% of the total worth (given that 651 points is 36.7% of the 1772 points of worth engendered overall), then the total value of the Infrastructure - based on the tangible and intangible value it underpins - is in the region of **£19.1 billion per annum**. Therefore the monetised value of the intangible benefits alone is **£12.1 billion per annum**.

Discounting of the Net Present Value (NPV)

In assessing the global impacts of climate change on current and future generations, the Stern Review considered that standard discount rates did not apply when irreversible transfers of wealth occurred from the future to the present. Discounting for the biological recording infrastructure requires a lower rate of discount for similar reasons. For such situations, the 'Supplementary Green Book Guidance on intergenerational wealth transfers and social discounting' recommends that calculations of NPV compare both the standard discount rate of **3.5%** as published in the Green Book and a reduced long term discount rate of **3.0%** hence both are presented (see Table 15).

In discounting the monetary value of the £7 billion per annum arising from the tangible benefits of a full transformation, after 30 years the Net Present Value (NPV) is **£144.3 billion** using the long term discount rate of 3.0%, or **£135.8 billion** using the standard discount rate of 3.5%.

Table 14: Monetary value and relative worth of each direct and indirect benefit per annum

BENEFIT AREA (and % share of total value)	BENEFIT OR AVOIDED COST	MONETARY VALUE	TANGIBLE WORTH *	INTANGIBLE WORTH *
1. MAXIMISING CONFIDENCE & PACE (3.0%)	Easier data submission, confusion removed Bottlenecks and duplication removed, rapid access to data Feedback on use established	£ THOUSANDS	13	40
2. OPENING UP BIODIVERSITY DATA (11.3%)	Open data of known quality Centrally available data, accessible to all for decision-making Enriched attributes, linked data	£ BILLIONS	100	100
3. PROVIDING SUPPORT & INSIGHTS (4.5%)	Consistent, high quality services accessible online Service users know how to use available services effectively Full coverage of Scotland in perpetuity	£ MILLIONS	40	40
4. ENGENDERING PARTICIPATION (7.9%)	More participants and reduced pressure on keystone individuals Increased well-being and sense of worth for all volunteers Increased skills and motivation to participate	£ MILLIONS	40	100
5. OPTIMISING EFFICIENCY & SUSTAINABILITY (3.0%)	Increased cohesion from improved leadership and direction Effective governance and risk management Efficient use of resources	£ THOUSANDS	13	40
6. DEVELOPING CAPACITY (3.4%)	Improved sustainability of Super Partners Increased well-being and sense of worth for service providers Increased cohesion from integration	£ MILLIONS	20	40
7. GROWING SKILLS & CAPABILITIES (3.4%)	Greater taxonomic, data collection/management skills base Greater participation, more records Fewer taxonomic gaps	£ MILLIONS	20	40
8. INCREASING NATIONAL & GLOBAL IMPACT (7.9%)	Improved strategic outcomes for Scotland and biodiversity Greater connection with, and caring for, nature Greater recognition of Scotland as a global leader for biodiversity	£ BILLIONS	100	40
9. TRANSFORMING DECISION-MAKING (11.3%)	More rapid understanding of changes in species and habitats More appropriate responses to climate change/invasive species Better understanding of site condition progress/natural capital	£ BILLIONS	100	100
10. UPHOLDING STANDARDS (1.0%)	Reduced risk of compliance failures and reputational harm Maintenance of good standards/good practice Seven Principles of Public Life upheld	£ THOUSANDS	5	13
11. AVOIDING COSTS/ NUGATORY SPEND (11.3%)	Catastrophic loss/silo-ing/degradation of data; lost opportunities Catastrophic loss/degradation of biodiversity; recovery costs Unnoticed arrival/spread of invasive species; control costs Burden on the NHS from an under-active population	£ BILLIONS x3 [for terrestrial, freshwater, marine]	100	100
12. ENCOURAGING WILDLIFE/LANDSCAPE TOURISM (7.9%)	More visitors attracted to Scotland to see iconic species/sites Employment opportunities for people offering facilities/activities Local community use of beaches/open gardens/nature reserves	£ BILLIONS	100	40
13. MAINSTREAMING BIODIVERSITY (5.6%)	Biodiversity always considered so the Infrastructure plays its part Improved strategic outcomes for Scotland and biodiversity Greater connection with, and caring for, nature	£ n/a Included within 8 and 11	n/a	100
14. ENHANCING ECOSYSTEM RESILIENCE (0.5%)	Greater resilience against biodiversity loss, INNS, over-exploitation Greater resistance to/amelioration of wildfire, flooding and wind Greater sequestration of carbon and mitigation of climate change	£ n/a Included within 11	n/a	8
15. PREVENTING SPECIES EXTINCTIONS (5.6%)	Genetic diversity maintained No loss of keystone species safeguards ecosystems No loss of iconic/familiar species safeguards tourism/well-being	£ n/a Included within 11	n/a	100
16. EMPOWERING COMMUNITIES (2.3%)	Greater access to green and blue space Increased quality of life and well-being Increased participation, social capital and public health	£ n/a Included within 11	n/a	40
17. IMPROVING PUBLIC HEALTH (2.3%)	Greater connection with, and caring for, nature aids mental health Greater level of outdoor activity reduces obesity Increased community participation reduces social care needs	£ n/a Included within 11	n/a	40
18. REDUCING LAND USE CONFLICTS (1.1%)	Reduced social tension and greater well-being for those in conflict Reduced risk of wildlife crime Reduced need to seek environmental justice	£ n/a Included within 11	n/a	20
19. FACILITATING DIGITAL INNOVATION (1.1%)	Low or zero cost to discover, access and join-up all available data Revenue from sales of added-value products and services Improved business processes and insights through innovation	£ n/a Included within 2 and 11	n/a	20
20. ACHIEVING A SUSTAINABLE ECONOMY (5.6%)	Facilitation of wildlife-friendly farming, fisheries and forestry Facilitation of renewable energy and a circular economy Conservation of resources and genetic diversity for all generations	£ n/a Included within 2 and 11	n/a	100
TOTAL TANGIBLE MONETARY VALUE UNDERPINNED BY THE BIOLOGICAL RECORDING INFRASTRUCTURE PER ANNUM:		£7,004,003,000	651	1121
			1772 (100%)	

* Approximated Fibonacci numbers used for estimating relative value (0, 1, 2, 3, 5, 8, 13, 20, 40, 100)

Table 15: Calculation of NPV and PVC using Green Book discount rates over 30 years

Year	Standard Discount Factor @ 3.5%	Long Term Discount Factor @ 3.0%	NPV using the Standard Discount Rate (£)	NPV using the Long Term Discount Rate (£)	PVC using the Standard Discount Rate (£)	PVC using the Long Term Discount Rate (£)
0	1	1	7,004,003,000	7,004,003,000	6,672,145	6,672,145
1	0.9662	0.9709	6,767,267,699	6,800,186,513	6,208,941	6,239,144
2	0.9335	0.9426	6,538,236,801	6,601,973,228	5,998,806	6,057,284
3	0.9019	0.9151	6,316,910,306	6,409,363,145	5,795,740	5,880,565
4	0.8714	0.8885	6,103,288,214	6,223,056,666	5,599,743	5,709,630
5	0.842	0.8626	5,897,370,526	6,041,652,988	5,410,814	5,543,193
6	0.8135	0.8375	5,697,756,441	5,865,852,513	5,227,669	5,381,896
7	0.786	0.8131	5,505,146,358	5,694,954,839	5,050,950	5,225,098
8	0.7594	0.7894	5,318,839,878	5,528,959,968	4,880,015	5,072,799
9	0.7337	0.7664	5,138,837,001	5,367,867,899	4,714,863	4,924,998
10	0.7089	0.7441	4,965,137,727	5,211,678,632	4,555,494	4,781,694
11	0.6849	0.7224	4,797,041,655	5,059,691,767	4,401,267	4,642,247
12	0.6618	0.7014	4,635,249,185	4,912,607,704	4,252,823	4,507,298
13	0.6394	0.681	4,478,359,518	4,769,726,043	4,108,877	4,376,205
14	0.6178	0.6611	4,327,073,053	4,630,346,383	3,970,072	4,248,324
15	0.5969	0.6419	4,180,689,391	4,495,869,526	3,835,766	4,124,942
16	0.5767	0.6232	4,039,208,530	4,364,894,670	3,705,958	4,004,774
17	0.5572	0.605	3,902,630,472	4,237,421,815	3,580,648	3,887,818
18	0.5384	0.5874	3,770,955,215	4,114,151,362	3,459,836	3,774,718
19	0.5202	0.5703	3,643,482,361	3,994,382,911	3,342,881	3,664,830
20	0.5026	0.5537	3,520,211,908	3,878,116,461	3,229,780	3,558,156
21	0.4856	0.5375	3,401,143,857	3,764,651,613	3,120,536	3,454,053
22	0.4692	0.5219	3,286,278,208	3,655,389,166	3,015,147	3,353,805
23	0.4533	0.5067	3,174,914,560	3,548,928,320	2,912,972	3,256,128
24	0.438	0.4919	3,067,753,314	3,445,269,076	2,814,652	3,161,021
25	0.4231	0.4776	2,963,393,669	3,345,111,833	2,718,902	3,069,127
26	0.4088	0.4637	2,863,236,426	3,247,756,191	2,627,008	2,979,803
27	0.395	0.4502	2,766,581,185	3,153,202,151	2,538,327	2,893,050
28	0.3817	0.4371	2,673,427,945	3,061,449,711	2,452,860	2,808,868
29	0.3687	0.4243	2,582,375,906	2,971,798,473	2,369,320	2,726,613
30	0.3563	0.412	2,495,526,269	2,885,649,236	2,289,635	2,647,572
Note: costs include 100% of UK Hub and Super Partner costs			NET PRESENT VALUE (NPV):		PRESENT VALUE OF COSTS (PVC):	
			135,822,326,576	144,285,963,802	124,862,446	132,627,800

Assumptions on expected benefits for each investment scenario

The level of expected benefits has been considered for three investment scenarios that differ in the degree of transformation and level of benefits being facilitated. We suggest that there is likely to be a linear relationship between costs per annum and the level to which benefits are realised. The investment scenarios considered are as follows:

1. NO TRANSFORMATION - the current status quo would continue to facilitate around 20% of the potential benefits that can be both directly and indirectly realised, however this may be an over-estimate given the growing limitations of the current situation (see Section 3).
2. PARTIAL TRANSFORMATION - transformation of core parts of the Infrastructure would facilitate around 80% of the potential benefits that can be directly realised and 20% of the benefits that can be indirectly realised, and so 54% of both benefit types overall.
3. FULL TRANSFORMATION - transformation of the entire Infrastructure would facilitate 100% of the potential benefits that can be both directly and indirectly realised.

Table 16 compares the expected benefit share, monetary value and NPV for each scenario.

Table 16: Expected level of benefit realisation and NPV for each investment scenario

BENEFIT AREA, SHARE (%) and VALUE (£)			NO TRANSFORMATION		PARTIAL TRANSFORMATION		FULL TRANSFORMATION	
1. MAXIMISING CONFIDENCE & PACE	3.0%	£ THOUSANDS	20%	0.60%	80%	2.40%	100%	3.00%
2. OPENING UP BIODIVERSITY DATA	11.3%	£ BILLIONS		2.26%		9.04%		11.30%
3. PROVIDING SUPPORT & INSIGHTS	4.5%	£ MILLIONS		0.90%		3.60%		4.50%
4. ENGENDERING PARTICIPATION	7.9%	£ MILLIONS		1.58%		6.32%		7.90%
5. OPTIMISING EFFICIENCY & SUSTAINABILITY	3.0%	£ THOUSANDS		0.60%		2.40%		3.00%
6. DEVELOPING CAPACITY	3.4%	£ MILLIONS		0.68%		2.72%		3.40%
7. GROWING SKILLS & CAPABILITIES	3.4%	£ MILLIONS		0.68%		2.72%		3.40%
8. INCREASING NATIONAL & GLOBAL IMPACT	7.9%	£ BILLIONS		1.58%		6.32%		7.90%
9. TRANSFORMING DECISION-MAKING	11.3%	£ BILLIONS		2.26%		9.04%		11.30%
10. UPHOLDING STANDARDS	1.0%	£ THOUSANDS		0.20%		0.80%		1.00%
11. AVOIDING COSTS & NUGATORY SPEND	11.3%	£ BILLIONSx3		2.26%	20%	2.26%		11.30%
12. ENCOURAGING WILDLIFE/LANDSCAPE TOURISM	7.9%	£ BILLIONS		1.58%		1.58%		7.90%
13. MAINSTREAMING BIODIVERSITY	5.6%	£ n/a		1.12%		1.12%		5.60%
14. ENHANCING ECOSYSTEM RESILIENCE	0.5%	£ n/a		0.10%		0.10%		0.50%
15. PREVENTING SPECIES EXTINCTIONS	5.6%	£ n/a		1.12%		1.12%		5.60%
16. EMPOWERING COMMUNITIES	2.3%	£ n/a		0.46%		0.46%		2.30%
17. IMPROVING PUBLIC HEALTH	2.3%	£ n/a		0.46%		0.46%		2.30%
18. REDUCING LAND USE CONFLICTS	1.1%	£ n/a		0.22%		0.22%		1.10%
19. FACILITATING DIGITAL INNOVATION	1.1%	£ n/a		0.22%		0.22%		1.10%
20. ACHIEVING A SUSTAINABLE ECONOMY	5.6%	£ n/a		1.12%		1.12%		5.60%
EXPECTED SHARE OF TANGIBLE & INTANGIBLE BENEFITS (%)			20%		54.0%		100%	
EXPECTED MONETARY VALUE OF TANGIBLE BENEFITS (£)			£1,400,800,600		£3,782,161,620		£7,004,003,000	
NET PRESENT VALUE using the SDR over 30 years(£) [SDR= Standard Discount Rate @3.5%]			£27,164,465,315		£73,344,056,351		£135,822,326,576	
NET PRESENT VALUE using the LTDR over 30 years (£) [LTDR= Long Term Discount Rate @3.0%]			£28,857,192,760		£77,914,420,453		£144,285,963,802	

EXPECTED COSTS: SET UP AND OPERATION

Transformation of the biological recording infrastructure in Scotland does not incur major capital costs for it does not involve construction or acquisition or similar. There is no need to build a bridge nor a building nor to buy stock, land or specialist machinery. The major costs instead come from annual operating costs and costs of service improvement which are both incurred in perpetuity.

CAPITAL COSTS

Exact costs will be determined during an implementation planning phase and so the costs presented in Tables 17-19 are estimates. The primary capital costs arise from the initial purchase of computer hardware, software licences and professional fees for specialist advice.

REVENUE COSTS

The primary revenue costs arise from annual staff, office and event overheads. Other major costs arise from the need for annual community and Super Partner funding. Staff costs are presented for those staff employed to oversee the implementation of the new Infrastructure and those staff employed to fulfil UK, national and regional structures. Costs for the production of promotional and educational materials and legal and professional fees are also included within the revenue costs.

INCOME

Some income generation is expected through the provision of added-value datasets and services, but this is expected to be at a low level prior to, and during, transformation of the Infrastructure. While it is difficult to predict the level that could be achieved post-transformation, it is anticipated that such income would be unlikely to cover the annual costs of operating the Infrastructure in Scotland.

SAVINGS

Statutory Agency funding relates to the provision of funding to LERC, recording group, NBN Trust, Super Partner and community infrastructure where this is an existing budget commitment. If new arrangements supersede such funding, the original funding may be released for other purposes.

Discounting of the Present Value of Costs (PVC)

The same standard and long term discount rates of **3.5%** and **3.0%** respectively are used to discount the Present Value of Costs as were used for discounting the Net Present Value (see Table 15 above).

In discounting the monetary value of the £6.43 million of annual costs arising from the investment scenario with a full transformation of the biological recording infrastructure, and with 100% of UK Hub costs and capital costs included, after 30 years the Present Value of the Costs is **£132.6 million** using the reduced long term discount rate of 3%, or **£124.9 million** using the standard discount rate of 3.5%.

Assumptions on expected costs for each investment scenario

The level of expected costs has been considered for three investment scenarios that differ in the degree of transformation and level of cost involved.

1. NO TRANSFORMATION - showing only the Infrastructure operating costs that were incurred by Scottish Government (via statutory bodies and local authorities) in the 2018/19 financial year. Costs relating to any other activities or non-Government funders are excluded.
2. PARTIAL TRANSFORMATION - the level of Infrastructure operating costs (with full cost recovery) necessary to achieve ~54% of the potential benefits.
3. FULL TRANSFORMATION - the level of Infrastructure operating costs (with full cost recovery) necessary to achieve all of the potential benefits.

Table 17 compares the expected costs per annum and the Present Value of the Costs (PVC) over a 30 year time period for each of these scenarios.

Capabilities of each investment scenario

Each investment scenario offers a particular suite of capabilities, with the least capability offered with 'no transformation' and the greatest capability with a 'full transformation'. Table 18 sets out the capabilities that would be provided, and the staffing levels and operating costs associated, using symbols to denote no capability (○), some capability (◐) or full capability (●). Note that the costs of National and Regional Hubs and community funding outside Scotland are excluded from these scenarios.

NO TRANSFORMATION

Under this scenario, existing organisations encourage public participation, facilitate access to biodiversity data and offer added-value data services but with insufficient resources and join-up. The perennial need to cover costs compromises benefit realisation as effort is diverted from data flow and service improvements to income generation and mitigation of current problems. There is no National Hub for Scotland, nor a Community Fund to build capacity and grow participation. Regional coverage remains incomplete and under-staffed and so the data and services needed to support delivery of biodiversity duty, Recorder support and public engagement are not available in all Local Authorities, and are limited even where they are available. Lack of resources at the UK level impedes development of the NBN Atlas for Scotland and constrains its value to each sector.

Table 17: Expected level of cost for Scottish Government and PVC for each investment scenario

NOTE: Costs for the NO TRANSFORMATION scenario relate to funding provided by Statutory Bodies and Local Authorities during the 2018/19 financial year. Costs include all costs incurred in Scotland and at the UK level (for a UK Hub and key Super Partner infrastructure to provide the range of services and support needed in Scotland). With ~8.23% of the UK population, it is assumed that Scotland's contribution towards such UK costs may need to be 100% during any pioneering stage, then nearer to 10% in perpetuity.

COST OR INCOME AREA	NO TRANSFORMATION	PARTIAL TRANSFORMATION	FULL TRANSFORMATION
CAPITAL COSTS			
Computer hardware	£0	£61,000	£73,000
Computer software	£14,700	£61,000	£73,000
Legal and professional fees	£0	£50,000	£100,000
TOTAL	£14,700	£172,000	£246,000
REVENUE COSTS			
Development staff	£23,700	£165,600	£165,600
Operational staff	£53,100	£1,858,200	£1,986,900
Regional partnerships	£291,767	£607,200	£859,200
Office overheads	£0	£261,750	£310,250
Event and project overheads	£0	£25,000	£30,000
Education overheads	£0	£0	£32,000
Community grants	£0	£300,000	£1,000,000
Super Partner grants	£0	£1,000,000	£1,850,000
Promotional materials	£0	£10,000	£10,000
Legal and professional fees	£0	£50,000	£100,000
Other overheads and contingency	£0	£289,275	£332,195
ANNUAL TOTAL	£368,567	£4,567,025	£6,676,145
INCOME			
Events and projects	£0	£0-£50,000	£0-£100,000
Royalties and product sales	£0	£0-£50,000	£0-£100,000
Advice and services	£0	£0-£50,000	£0-£100,000
Affiliation fees	£0	£0-£50,000	£0-£100,000
Grants and donations	£0	£0-£50,000	£0-£100,000
ANNUAL TOTAL	£0	~£125,000	~£250,000
SAVINGS			
Statutory Agency funding for LERCs/Recording Groups	£0	£291,767	£291,767
Statutory Agency funding for NBN Trust	£0	£91,500	£91,500
Statutory Agency funding for Super Partners	£0	£0	£0
Statutory Agency funding for Communities	£0	£0	£0
ANNUAL TOTAL	£0	£383,267	£383,267
PRESENT VALUE OF COSTS @ 100% OF UK HUB COSTS			
Annual operating costs (£) [REVENUE COSTS - INCOME MIDPOINT]	Not applicable as Scottish Government does not cover 100% of UK Hub costs at present	£4,442,025	£6,426,145
Proportion of 'full transformation' costs (%)		69.1%	100%
Total costs of operation over 30 years (£) [CAPITAL COSTS + (ANNUAL OPERATING COSTS X 30)]		£133,432,750	£193,030,350
Net Present Value of Costs @ 3.5% SDR over 30 years (£)		£86,312,193	£124,862,446
Net Present Value of Costs @ 3.0% LTDR over 30 years (£)		£91,679,936	£132,627,800
PRESENT VALUE OF COSTS @ 10% OF UK HUB COSTS			
Annual operating costs (£) [REVENUE COSTS - INCOME MIDPOINT]	£368,567	£1,596,445	£2,852,515
Proportion of 'full transformation' costs (%)	12.9%	56.0%	100%
Total costs of operation over 30 years (£) [CAPITAL COSTS + (ANNUAL OPERATING COSTS X 30)]	£11,071,710	£47,910,550	£85,600,050
Net Present Value of Costs @ 3.5% SDR over 30 years (£)	£7,161,988	£31,016,121	£55,407,456
Net Present Value of Costs @ 3.0% LTDR over 30 years (£)	£7,607,364	£32,945,265	£58,854,435

PARTIAL TRANSFORMATION

Under this scenario, the UK Hub, UK Species Inventory and some Super Partners (i.e. national recording schemes, iRecord and Recorder 6) are transformed through the provision of sufficient sustainable funding. A National Hub is established to coordinate and support Regional Hub Partnerships and to act as the 'product owner' for the NBN Atlas in Scotland. Full coverage of Scotland by Regional Hubs is achieved with at least a basic level of staff to provide core services in every region. New community funding offers around £10,000 per Local Authority per annum to support community funding objectives through facilitating the activities of Verifiers, Collection Curators, Data Providers, Recorders, recording groups, schools and community groups.

FULL TRANSFORMATION

Under this scenario, UK, National and Regional Hubs and Super Partners are all transformed through the provision of sufficient sustainable funding and a system simplification programme to system rationalisation and integration across all sectors. A larger National Hub coordinates Regional Hub Partnerships, acts as 'product owner' for the NBN Atlas in Scotland and facilitates innovation in its use. Complete coverage of Scotland by fully staffed Regional Hubs provides core and added-value services in all regions. Major new community funding offers around £30,000 per Local Authority per annum to support community funding objectives through facilitating the activities of Verifiers, Collection Curators, Data Providers, Recorders, recording groups, schools and community groups.

PROFILE OF THE COSTS AND BENEFITS

All capital costs would be incurred in Year 1 (Table 18), with maintenance costs then factored into onging annual overhead costs thereafter (Table 19). Benefits realisation is expected to increase in response to improvements in efficacy and efficiency as investment in the Infrastructure is increased. The earlier and greater the level of investment, the earlier and greater the reach and impact of the Infrastructure will be (Table 20).

Table 18: Profile of the capital and revenue costs of each investment scenario

SCENARIO	YEAR 1	YEARS 2-30	TOTAL OVER 30 YEARS
No transformation	£0	£0	£0
Partial transformation	£172,000 (£57,700 if 10% of UK costs)	£0	£172,000 (£57,700 if 10% of UK costs)
Full transformation	£246,000 (£91,200 if 10% of UK costs)	£0	£246,000 (£91,200 if 10% of UK costs)

Table 19: Profile of the revenue costs of each investment scenario (excluding inflation)

NOTE: Year 1 costs are likely to be over estimated as it will take time to recruit all roles and to become fully operational during this year.

SCENARIO	YEAR 1	YEARS 2-30	TOTAL OVER 30 YEARS
No transformation	£0.369 million (with ~10% of UK costs)	£0.369 million (with ~10% of UK costs)	£11.1 million (with ~10% of UK costs)
Partial transformation	Up to £4.44 million (£1.6 million if 10% of UK costs)	£4.44 million (£1.6 million if 10% of UK costs)	£133.4 million (£48 million if 10% of UK costs)
Full transformation	Up to £6.43 million (£2.9 million if 10% of UK costs)	£6.43 million (£2.9 million if 10% of UK costs)	£193 million (£86 million if 10% of UK costs)

Table 20: Profile of potential benefit realisation* under each investment scenario

* Where benefits relate to prevention of extinctions, or similar intangible matters, the potential benefit realisation is considered in relation to the level of contribution that could be achieved by a fully-functioning biological recording infrastructure compared to the level of contribution that could be achieved without such an Infrastructure. For example, if a fully-functioning Infrastructure could have prevented 10 species from becoming extinct, 80% to 100% would equate to 8 to 10 species being saved from extinction.

SCENARIO	YEAR 1	YEARS 2-5	YEARS 6-30	AVERAGE OVER 30 YEARS
No transformation	20%	20%	20%	20%
Partial transformation	30%	30%-45%	45%-54%	47%
Full transformation	50%	50%-80%	80%-100%	84%

Table 18: Operating costs and capabilities for each investment scenario per annum (see text on p. 48 for key)

CAPABILITIES	NO TRANSFORMATION			PARTIAL TRANSFORMATION			FULL TRANSFORMATION		
CENTRAL/UK HUB CAPABILITIES									
UK Hub service design & fulfilment	◐			●			●		
NBN Atlas development & operation	◐			●			●		
iRecord development & operation	◐			●			●		
UK Species Inventory maintenance	◐			●			●		
Recorder 6+ development & operation	◐			●			●		
Recording Scheme support services	◐			●			●		
Data Provider liaison & support services	◐			●			●		
Directory of affiliated partners & data routes	○			●			●		
System simplification programme	○			◐			●		
State of Nature/INNS reporting interfaces	○			◐			●		
Community Fund provision	○			◐			●		
NATIONAL HUB CAPABILITIES									
National Hub service design & fulfilment	○			●			●		
NBN Atlas product ownership	○			●			●		
National & Regional Hub service directory	○			●			●		
Innovation centre	○			◐			●		
Community/education outreach support	○			○			●		
REGIONAL HUB CAPABILITIES									
Regional Hub service design & fulfilment	◐			●			●		
Recorder support services	◐			●			●		
Biodiversity duty support services	◐			◐			●		
Community Fund administration	○			◐			●		
SUPER PARTNER CAPABILITIES									
Major recording scheme platforms	◐			◐			●		
iRecord support for minor schemes	◐			◐			●		
Expert Verifier capacity building	○			◐			●		
Collection Curator capacity building	○			◐			●		
COMMUNITY INFRASTRUCTURE									
Verifiers & Curators Fund	○			◐			●		
Recorders & Recording Groups Fund	○			◐			●		
Local Community/School Groups Fund	○			◐			●		
OPERATING COSTS (covered by Scottish Gov)	LEVEL	FTE/£	Σ £	LEVEL	FTE/£	Σ £	LEVEL	FTE/£	Σ £
CENTRAL/UK HUB INFRASTRUCTURE		Σ =8.8	£0.077 million Scottish contribution		Σ=41	£2.3 million		Σ=41	£2.3 million
CEO & Programe Office/Transition Team	◐	1.5		●	5		●	5	
HR, PR, Finance & Governance Services Team	◐	1.8		●	12		●	12	
User & Partner Services Team	◐	1.5		●	12		●	12	
Technical & Digital Services Team	◐	4		●	12		●	12	
NATIONAL HUB INFRASTRUCTURE		Σ =0	£0 million		Σ =4	£0.23 million		Σ =8	£0.39 million
Partner Liaison Team	○	0		◐	1		●	2	
Data Development & Services Team	○	0		◐	3		●	5	
Education & Outreach Team	○	0		○	0		●	1	
REGIONAL HUB INFRASTRUCTURE		Σ =10.57	£0.29 million		Σ =16	£0.74 million		Σ =24	£1.05 million
North West Scotland Team	○	0		◐	3		●	4	
North East Scotland Team *[Team names given for illustration purposes only]*	●	4		◐	3		●	4	
South West Scotland Team	◐	1		◐	3		●	4	
South East Scotland Team	◐	3.9		◐	3		●	4	
Western Isles Team	○	0		◐	1		●	2	
Northern Isles Team	◐	0.57		◐	1		●	2	
Central Belt Team	◐	1		◐	1		●	2	
National Parks Team	○	0		◐	1		●	2	
SUPER PARTNER INFRASTRUCTURE			£0 million			£1 million			£1.85 million
Major National Schemes	○	£0		●	£520k		●	£520k	
iRecord Services	○	£0		●	£80k		●	£80k	
Recorder 6+ Services	○	£0		●	£50k		●	£50k	
National Collection Curators	○	£0		◐	£350k		●	£1m	
Non Native Species Secretariat	○	£0		○	£0k		●	£100k	
State of Nature Partnership	○	£0		○	£0k		●	£100k	
COMMUNITY INFRASTRUCTURE			£0 million			£0.3 million			£1 million
Verifiers & Curators Fund	○	£0		◐	£100k		●	£320k	
Recorders & Recording Group Fund	○	£0		◐	£100k		●	£320k	
Local Community Group Fund	○	£0		◐	£100k		●	£360k	
OTHER COSTS									
Events/education/promotion/legal fees		£0			[within UK Hub costs above]			[within UK Hub costs above]	
Income from sales/services/affiliation fees/grants		£0			-£125,000			-£250,000	
TOTAL EXPECTED ANNUAL COSTS		£0.369 million			£4.44 million			£6.43 million	
TOTAL FOR SCOTLAND @ 100% of UK Hub costs		n/a			£4.44 million			£6.43 million	
TOTAL FOR SCOTLAND @ 10% of UK costs		£0.369 million			£1.60 million			£2.85 million	

POTENTIAL RETURN ON INVESTMENT

Given that the monetised benefits of a transformed biological recording infrastructure for Scotland are in the region of £7 billion per annum (Table 14), the Net Present Value of a fully transformed Infrastructure over 30 years using the standard discount rate of 3.5% is £135.8 billion.

The total annual operating costs are in the region of £6.43 million per annum - reducing to £2.85 million per annum if other countries were to share the costs of supporting a UK Hub and UK Super Partners. The Present Value of Costs for transforming and operating the Infrastructure over 30 years (Table 17), again using the standard discount rate, are £124.9 million, reducing to £55.4 million if other countries were to contribute towards UK elements.

Given the great difference in the order of magnitude between the value of the biological recording infrastructure and its operating costs, taken at face value, the Benefit to Cost Ratio of 1086.8 is extraordinarily high. However, even if the Net Present Value is reduced by 99% to £1.358 billion (as the Infrastructure is only underpinning, rather than generating, the tangible economic value used to monetise its worth) the resulting Benefit to Cost Ratio of 9.9 would still be considered exceptional. Table 21 below compares the potential return on investment under each of eight scenarios (relating to scale of transformation, level of Net Present Value and level to which UK Hub and UK Super Partner costs are supported by Scotland). BCR for the Scottish Government is maximised through a full transformation when UK costs are shared with other countries. However, benefits may be jeopardised if Scotland waits for other countries to take a similar path.

Although under an Open Data business model the Infrastructure has no major cash-releasing benefits, significant revenue could potentially be generated from the interpretation and presentation of data. However, the immense value of the Infrastructure primarily comes from the scale of volunteer participation, the depth of taxonomic expertise and extent of knowledge about the ecology, occurrence and status of species, the openness of biological records (facilitating use for all sectors, purposes and generations), and the provision of a definitive evidence base for use in the prevention, detection or mitigation of environmental harms such as species extinctions or habitat loss or degradation.

Table 21: Summary of the return on each pound spent in terms of the Benefit:Cost to Government Ratio

TERM (using a standard discount rate @ 3.5%)		SCENARIO	**With NPV @ 100%**	**With NPV reduced by 99%**
Assuming Scotland covers 100% of UK Hub and UK Super Partner infrastructure costs:				
Net Present Value / 30 years	NPV	**Full Transformation**	£135.8 billion	£1.358 billion
Present Value of Costs / 30 years	PVC		£124.8 million	
Present Value of Benefits	NPV-PVC=PVB		£135.7 billion	£1.233 billion
Benefit-Cost to Government Ratio	PVB/PVC=BCR		**1086.78**	**9.878**
Net Present Value / 30 years	NPV	**Partial Transformation**	£73.34 billion	£0.7334 billion
Present Value of Costs / 30 years	PVC		£86.31 million	
Present Value of Benefits	NPV-PVC=PVB		£73.26 billion	£0.6471 billion
Benefit-Cost to Government Ratio	PVB/PVC=BCR		**848.75**	**7.50**
Assuming Scotland covers 10% of UK Hub and UK Super Partner infrastructure costs:				
Net Present Value / 30 years	NPV	**Full Transformation**	£135.8 billion	£1.358 billion
Present Value of Costs / 30 years	PVC		£55.41 million	
Present Value of Benefits	NPV-PVC=PVB		£135.8 billion	£1.303 billion
Benefit-Cost to Government Ratio	PVB/PVC=BCR		**2450.34**	**23.51**
Net Present Value / 30 years	NPV	**Partial Transformation**	£73.34 billion	£0.7334 billion
Present Value of Costs / 30 years	PVC		£31.02 million	
Present Value of Benefits	NPV-PVC=PVB		£27.16 billion	£0.2713 billion
Benefit-Cost to Government Ratio	PVB/PVC=BCR		**2363.71**	**22.65**

Comparisons with transport infrastructure schemes

By comparison with conventional infrastructure schemes (such as the road improvement or replacement programmes cited below with approximate costs sourced from Transport Scotland investment appraisal documentation), the transformation and operation of the biological recording infrastructure in Scotland could entail a fraction of the cost while delivering a massively greater potential return on investment over 30 years.

- **Dualling the A9**: £3 billion, 129 kilometres, £23.3 million per kilometre, BCR of 1.01
- **Aberdeen Bypass (AWPR)**: £0.75 billion, 58 km (£12.8 million per km), BCR of 4.7
- **Queensferry Crossing**: £1.35 billion, 2.7 km (£500 million per km), BCR of 4.31
- **Biological Recording Infrastructure**: £55.4 million to £124.8 million, BCR of ~9.9 to ~23.5

Given that the estimated annual operating cost of a fully transformed biological recording infrastructure for Scotland ranges from £2.85 million to £6.43 million (depending on the level of contribution made to UK costs), the level of expenditure on the lowest cost of the schemes above, the Aberdeen Bypass, could cover the operating costs of the biological recording infrastructure for between one and two and a half centuries.

Comparison with the Atlas of Living Australia

An assessment of the Atlas of Living Australia's impact and value (a report produced by Alluvium and published in 2016 by the Commonwealth Scientific and Industrial Research Organisation, CSIRO - an Australian Federal Agency) found that costs over a period of a decade (from 2007/08 to 2016/17) were in the region of AU$56.11 million with an annual cost of AU$8.15 million (c. £4.7 million); these costs were covered through public funding provided by the Australian Government.

The report estimated that the annual value of the Atlas of Living Australia (ALA) was in the region of AU$26.9 million based on a conservative estimate of economic benefits that only included direct user benefits (such as time and resources savings). Even so, the overall benefit:cost ratio was estimated to be in the region of 3.5:1 (ranging from 1.1:1 using pessimistic assumptions to 7.5:1 using optimistic assumptions), or 2.6:1 when applied solely to expenditure on biodiversity and national parks.

- **Atlas of Living Australia**: ~£135.7 million (based on annual costs of AU$8.15 million over 30 years amounting to AU$244.5 million), BCR of 1.1 to 7.5 (depending on the optimism of assumptions involved; only direct benefits included)
- **Biological Recording Infrastructure**: £55.4 million to £124.8 million over 30 years, BCR of 9.9 to 23.5 (depending on the level of contribution made to UK costs; wider benefits included)

The ALA is likely to offer the most useful comparison given its similarity in purpose and scale.

LIMITATIONS OF THIS APPRAISAL

This appraisal has been undertaken with limited time and resources and it relies on the assumptions and judgements of the authors rather than of experienced economists. The costings presented are based on professional knowledge of the competencies and capabilities entailed in agile product development, the NBN Data Flow Pathway and biological recording across all taxa and sectors.

Given the difficulty of monetising the benefits of the biological recording infrastructure, an unconventional approach using both qualitative and quantitative methods has been undertaken which may not allow direct comparison with more formal or thorough public sector investment appraisals. No adjustments have yet been made for sensitivity of assumptions, nor for optimism bias. For example, it is assumed that transformation would be rapid with at least a proportion of most of the benefits being realised from the outset. At this stage it is not possible to know how well or rapidly the recommendations of this Review could actually be implemented and so the pace and quality of benefit realisation is difficult to anticipate.

It will be necessary to develop i) a detailed implementation plan to determine more exact costings, and ii) an agreed suite of measures of the value of the Infrastructure to gain a clear (and appropriately monetised and monitored) understanding of its benefits.

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8. Recommendations

In seeking the optimum Infrastructure for biological recording in Scotland, we have designed our recommendations to achieve the following five outcomes:

1. TRANSFORMED DATA FLOWS - with clear data flows to a central data repository, with easy data submission and feedback on use.
2. TRANSFORMED SERVICE PROVISION - with full coverage for services across Scotland and an online Digital First approach.
3. TRANSFORMED GOVERNANCE AND CULTURE - with a Lead Governance Body working in partnership through a network of National and Regional Hubs.
4. TRANSFORMED FUNDING - with funding provided in perpetuity for Lead Governance Body, Super Partner and community activities.
5. TRANSITION BY 2025 - with a shared implementation plan to maintain the momentum of the SBIF Review.

We make 24 recommendations, organised by outcome, as follows:

OUTCOME 1: TRANSFORMED DATA FLOWS

With clear data flows to a central data repository, with easy data submission and feedback on use

RECOMMENDATION 1: PRIMACY OF THE NBN & NBN ATLAS

The National Biodiversity Network (NBN) and NBN Atlas platform remain the primary place for the submission, dissemination and discovery of biological records and added-value datasets and services.

The NBN Atlas is the single, central data repository for all sectors seeking to contribute, provide or use biological records and associated information for terrestrial, freshwater and marine environments alike. Biological records should be submitted via an affiliated route or directly provided to the NBN Atlas as soon as possible after their collection.

RECOMMENDATION 2: AFFILIATION OF DATA SUBMISSION ROUTES

All biological records should be submitted online and channelled to the NBN Atlas via standard, affiliated routes.

The NBN Trust should maintain a single, central NBN Directory of all affiliated routes facilitating data submission to the NBN Atlas. Each route should have a single point of submission (marked with an NBN Atlas 'Kitemark™') curated by a single Data Provider so that everyone has confidence that submitted records will be held with appropriate metadata and immediately disseminated for inclusion in National Recording Schemes and for general use and re-use (with restrictions as per national requirements to protect sensitive species). Some rationalisation and accreditation of National Recording Schemes may be necessary to ensure that these operate effectively and without duplication.

RECOMMENDATION 3: SINGLE, CENTRAL ROUTE FOR CASUAL RECORDS

iRecord should be the single, central affiliated channel through which to submit 'ad hoc' records for verification, inclusion in relevant National Recording Schemes and dissemination via the NBN.

All records with no particular affiliation to any National Recording Scheme, recording group, project or organisation should be submitted through iRecord for verification and dissemination. iRecord should be given special status as an NBN Platform Partner to facilitate access to funding in perpetuity towards the costs of its development and operation.

RECOMMENDATION 4: PRIMACY OF AFFILIATED DATA SUBMISSION ROUTES
Biological records for a specific National Recording Scheme, recording group, project or organisation should be submitted via their affiliated route.

The most appropriate affiliated route should always be used and no organisation should divert biological records from these routes in conflict with the NBN Atlas. To avoid duplication of effort and indirect data flows, biological records should not be submitted to any other third party. Any organisation wishing to aggregate biological records for their own use, or to provide services to others, should take records directly from the NBN Atlas so that all users access the same definitive version of each record with a unique NBN Atlas global record identifier. Where further assistance is needed to submit or provide records, Recorders should seek support from any NBN Regional Hub Partner.

RECOMMENDATION 5: PROVISION OF RECORDS COLLECTED UNDER LICENCE OR FOR CONSENT/STATUS
Biological records collected with public funding, under licence, for Environmental Impact Assessment or planning consent, or for an academic or professional qualification, should be provided to the NBN Atlas as a matter of good practice.

Licences, consents, funding or professional or academic status granted by a relevant professional or statutory body should facilitate the timely provision of relevant biological records (i.e. species occurrence records) to the NBN Atlas as a matter of good practice.

The NBN Trust should seek to facilitate digital interfaces with Local Authority ePlanning portals, public digital data repositories and other platforms or internal business systems so that, wherever possible, biological records can be deposited once in a way that also ensures effortless provision to the NBN Atlas.

NBN Trust Partner Liaison Officers should focus on supporting academic institutions, commercial companies and public bodies in Scotland to realise value from use of the NBN Atlas to share or access biological records.

RECOMMENDATION 6: RECOGNITION & RESOURCING OF A CENTRAL DATA MANAGEMENT PORTAL
Recorder 6 and Marine Recorder should evolve to become a common, central data management portal for data custodians to collate, view and manage their own biological records and datasets (unless a suitable internal business system is used).

All records curated through the central data management portal should be verified via iRecord and NBN verification processes and aggregated and openly disseminated via the NBN Atlas (with restrictions as per national requirements to protect sensitive species). The Recorder 6 Consortium (or any organisation that takes over management of Recorder 6 or its replacement) - and equivalent for Marine Recorder - should be given special status as an NBN Platform Partner to facilitate access to funding in perpetuity towards the full costs of its development and operation.

RECOMMENDATION 7: RECOGNITION & RESOURCING FOR SUPER PARTNERS
Super Partners should be fully recognised and sustained to a level that has the capacity to support verification on a major scale.

The contribution of Super Partners (including the National Recording Schemes, National Museums and Royal Botanic Gardens, the UK Species Inventory, the Non-Native Species Secretariat and the State of Nature Partnership) in the provision of key infrastructure (such as networks of expert Verifiers, curated reference collections, species taxonomies and bespoke databases enabling rich attribution of records) is essential to the success of the Infrastructure. Each such Super Partner should be given special status as an NBN Expert Partner and access to funding in perpetuity towards the costs of maintaining a network of expert Verifiers, reference collections, species taxonomies and status reports for use in Scotland.

Where National Recording Schemes provide bespoke platforms for the curation and verification of a major taxonomic group with major public participation (such as BSBI's Distribution Database for plants or BTO's BirdTrack for birds) that cannot be fulfilled by iRecord, these National Recording Schemes should also be given special status as NBN Platform Partners to facilitate access to funding in perpetuity towards the costs of their system's development and operation. Aside from funding, National Recording Schemes should continue to be supported by iRecord and NBN Hub staff to access back office services and other professional support (such as for website development, communications and assistance with data curation).

RECOMMENDATION 8: SYSTEM SIMPLIFICATION
The systems and tools available for collecting, curating, aggregating and disseminating biological records across all environments (terrestrial, freshwater and marine) and sectors should be rationalised.

A 'system simplification' exercise should be undertaken to rationalise systems and develop an integrated technical road map to maximise inter-operability and ease and speed of data flow to and from the NBN Atlas. The NBN Trust should aid NBN Platform Partners in co-creating an integrated technical road map to maximise the parsimony and synergy of systems in future. Where important aggregations of biological records exist in stand-alone systems without dissemination via the NBN Atlas, system owners should become NBN Data Partners or Platform Partners (as appropriate) and their funding should focus on mobilisation of their records to the NBN Atlas via automated harvesting of records and/or integration of each stand-alone system to 'put them on the grid'.

RECOMMENDATION 9: ESTABLISHMENT OF AN NBN NATIONAL HUB
An NBN National Hub for Scotland should be established to support a network of NBN Regional Hubs and to facilitate the flow of biological records into the NBN Atlas to create a definitive evidence base for Scotland.

The National Hub should act as a 'Product Owner' for the NBN Atlas and iRecord on behalf of all stakeholders in Scotland, collaborating with all sectors to encourage innovation and the development of added-value data products and tools. A 'business analysis' approach should be taken to understand Scottish requirements for the NBN Atlas and iRecord and added-value products and tools. The National Hub should work with Centre for Ecology and Hydrology, the State of Nature Partnership and Non-Native Species Secretariat (and others – such as the Habitat Map of Scotland Project Team) to realise the greatest possible value for Scotland from bespoke spatial layers, reports and alerts tailored to the needs of each community of interest, while developing capacity in Scotland to detect new arrivals and to monitor changes in habitats and species populations in Scotland. It should also work with national stakeholders to automate the supply of biodiversity information to inform environmental decision-making.

RECOMMENDATION 10: ESTABLISHMENT OF A NETWORK OF NBN REGIONAL HUBS
A network of NBN Regional Hubs operating in partnership with the NBN Trust covering the whole of Scotland should be created.

Each Regional Hub Partner should be required to use the NBN Atlas to aggregate and analyse data for their region or area of interest in order to provide local data services. Each Regional Hub Partner should also seek to ensure that all biological records for their region become available via the NBN Atlas, actively championing affiliated data submission routes and the NBN Directory of these, and providing support to Recorders and Data Providers from all sectors in pursuit of this. The national Product Owner for the NBN Atlas should gather and champion requirements from each Regional Hub Partner so that the NBN Atlas and tools provide the necessary capabilities for a Regional Hub to function effectively. NBN Trust should ensure that the boundaries of the Regional Hubs are complementary with no gaps or overlaps in cover. If no Regional Hub Partner can be found for an area, regional staff could be employed by the NBN National Hub instead.

RECOMMENDATION 11: AUTOMATED USE FEEDBACK & SHOWCASING
Use feedback for Recorders and Data Providers should be built into all automated processes facilitated by the NBN Atlas.

The NBN Atlas should provide a suite of reporting tools to report how and when records or datasets have been viewed, reported or downloaded, wherever it is feasible to do so. A 'Use Feedback' option for Data Users to volunteer details of how they have used records or datasets for a given purpose should also be available to facilitate the showcasing of high-value uses. Innovation around reporting the provenance and use of biological records, and the impact or value of use, should be encouraged and showcased.

OUTCOME 2: TRANSFORMED SERVICE PROVISION

With full coverage for services across Scotland and an online Digital First approach for service improvement

RECOMMENDATION 12: NBN REGIONAL HUB SERVICE FOCUS & BRANDING

NBN Regional Hub Partners should provide services that i) support the flow of biological records to the NBN Atlas for Open use, ii) raise the awareness of, engagement in, and support for biological recording, and iii) support the effective interpretation and use of biological records in local and regional decision-making.

Both new and existing organisations or partnerships should be encouraged to apply to become an NBN Regional Hub in order to access funding and/or tools to support the provision of these services to a particular community or geographic area. NBN Regional Hub Partners should be required to use NBN Regional Hub branding and/or an NBN Atlas 'Kitemark™' to facilitate public awareness of the Regional Hub services available in Scotland. Some rationalisation and accreditation of Regional Hub Partners may also be necessary to ensure that NBN Regional Hubs operate effectively and without duplication.

RECOMMENDATION 13: CONSISTENT SERVICE PROVISION ACROSS SCOTLAND

NBN Regional Hub Partners should offer a set of core services in a consistent way so that service users from across Scotland can access the same core service from any location in Scotland.

The design of each service provided through the network of NBN Regional Hubs should be refreshed using a digital service design approach involving service users to improve the user experience to the greatest extent. NBN Regional Hub Partners should be free to provide additional added-value services tailored to local demand and to charge for such added-value if necessary and if without detriment to the core services provided. All services should be accessible online, with the NBN National Hub maintaining a Service Catalogue for all services available in Scotland.

RECOMMENDATION 14: NBN REGIONAL HUB HOSTING ARRANGEMENTS

NBN Regional Hub Partners should be hosted by an organisation that can provide access to professional back office support (including finance, human resources and IT), line management and office facilities.

Any funding framework agreement should require that NBN Regional Hubs are hosted in this way as a condition of funding. The NBN National Hub should broker such arrangements to ensure that each Regional Hub Partner is matched with a suitable host. In return for payment for provision of back office support, each host should champion the wide use of services provided by the NBN Regional Hub to ensure that these services are equally available to all users across the region and not dominated by the needs and servicing of the host itself. Hosting arrangements with organisations that also facilitate reach into one or more key communities (e.g. local or national government, eNGOs, academia or the commercial sector) should be especially encouraged.

RECOMMENDATION 15: NATIONAL & REGIONAL HUB SERVICE STRATEGY

A national service strategy for the biological recording infrastructure in Scotland should seek to perennially grow the contribution of the Infrastructure in support of the National Outcomes for Scotland.

NBN National and Regional Hub Partners should report on their engagement across all sectors to demonstrate the extent to which active involvement in biological recording and the availability of a national biodiversity evidence base (through the NBN Atlas) aids the National Outcomes and provides value for Scotland. The NBN Trust should develop the use of performance reporting and data visualisation tools to support this.

OUTCOME 3: TRANSFORMED GOVERNANCE AND CULTURE

With a Lead Governance Body working in partnership through a network of National and Regional Hubs

RECOMMENDATION 16: RECOGNITION & RESOURCING OF A CENTRAL HUB FOR THE UK

The NBN Trust should be given special status as the Lead Governance Body for the biological recording infrastructure in Scotland.

This would facilitate access to funding in perpetuity towards the costs of the development and operation of the NBN Atlas and the supporting network of National and Regional Hubs in Scotland. The NBN Trust should be resourced to provide the following functions: User & Partner Services (covering NBN Atlas product ownership, partner account management and data and list curation), Central Services (covering governance, public relations and human resources) and Technical Services (covering system support, system development and digital content management). During any implementation phase, a small Programme Office (covering programme and project management, business analysis and communications) should also be maintained. The National Hub for Scotland should be resourced to cover partner liaison, GIS and data analytics and education. Regional Hubs should be resourced to cover engagement with Recorders and the general public and to support the use of biological records in local and regional decision-making.

RECOMMENDATION 17: GOVERNANCE OF NBN SCOTLAND

The NBN National Hub for Scotland should be established as a division of NBN Trust and should be known as NBN Scotland.

A permanent National Committee for Scotland should be established as an Advisory Body that can guide priorities on creating value for all stakeholders. Such a Country Committee should evolve from and replace the current SBIF Advisory Group. Similarly, Regional Committees should also be established to advise each Regional Hub Partner, continuing existing Advisory Body arrangements where appropriate. The NBN Trust should in due course undertake an open selection process to appoint Country Committee members as honorary, fixed term positions. Administration of each National and Regional Committee should be supported by NBN Scotland and Regional Hub Partner staff respectively. In Scotland, the NBN Trust should then operate through its NBN Scotland division and National Committee for Scotland, with risks and issues escalated to NBN Trust when appropriate.

RECOMMENDATION 18: UNIFICATION OF BRC & NBN TRUST DATA MANAGEMENT SERVICES

The data management services of the Biological Records Centre (within the Centre for Ecology and Hydrology) and the NBN Trust should be brought together either through amalgamation or through a formal partnership arrangement for maximum synergy.

The Biological Records Centre and the NBN Trust should co-create a strategy to bring relevant systems and staff together by 2025. This strategy should build on the already excellent relationship between National Recording Schemes and the Biological Records Centre to include the NBN Trust and its network of National and Regional Hubs with the same esteem. Through championing affiliated schemes to aid the flow of biological records, the Hub network should encourage local Recorders to support National Recording Schemes and to take interest in under-recorded sites or taxon groups.

RECOMMENDATION 19: TEAM BUILDING & PROFESSIONAL DEVELOPMENT

The NBN Trust should invest in a National and Regional Hub professional development programme to build rapport, to encourage common ways of working and to grow collective capacity through developing the skills and capabilities of everyone involved.

The NBN Trust should focus on team building for UK, National and Regional Hub staff and volunteers, using an annual conference and digital collaboration tools to encourage a sense of One Team across the whole network. All staff should receive training in Agile working to support the ongoing development of the NBN Atlas, and in species taxonomy/identification and leadership to have at least basic skills in each of these. Thereafter, a continuing professional development programme should be offered, with NBN Trust becoming an accredited 'Investor in People' (or equivalent). Where feasible, the NBN Trust should make available collaboration tools and learning resources to all affiliated partners to build capability and capacity across the entire network.

OUTCOME 4: TRANSFORMED FUNDING

With funding provided in perpetuity for Lead Governance Body, Super Partner and community activities

RECOMMENDATION 20: A SINGLE FRAMEWORK AGREEMENT

Sufficient public funding should be provided to cover the core operating costs of the NBN Trust and its network of National and Regional Hubs, Super Partners and community groups in perpetuity where these are providing public services as a public good in support of the National Outcomes for Scotland.

As originally recommended in response to Public Petition PE1229, Scottish Government should become the key subscriber to the NBN on behalf of the Scottish public sector. New funding should be made available through a single Framework Agreement with the Lead Governance Body (i.e. NBN Trust). Such a Framework Agreement should run to 2030 in the first instance, with a review point in 2025.

RECOMMENDATION 21: FUNDING DRAWN FROM THOSE WHO GAIN VALUE OR CAUSE HARMS

The source of public funding should be designed to i) share the core operating costs of the Infrastructure between the sectors who need to access biodiversity data and realise value from doing so and to ii) base the greatest burden of funding upon those whose activities are key drivers of biodiversity loss.

To this end, the Scottish Government could consider the hypothecation of an existing environmental levy, the introduction of a new Biodiversity Levy, or the addition of a Biodiversity Supplement to the poundage rate for business rates collected in Scotland, to generate an appropriate annual revenue stream to fund the biological recording infrastructure in Scotland in perpetuity.

RECOMMENDATION 22: A SINGLE APPROVED BODY TO DISBURSE FUNDS

The NBN Trust should be the Approved Body for the disbursement of funding provided through any Framework Agreement.

Funding would be provided to the NBN National Hub, NBN Regional Hub Partners, affiliated Super Partners and local communities or individuals as per the recommendations of this Review. Ongoing efficiencies should be sought to continually maximise the value and impact of funding. The NBN Trust should use an Annual Performance Review to report the funding disbursed and value achieved using performance metrics defined in the Framework Agreement. The annual spending plans of each funded Partner should be guided by the relevant National or Regional Committee to maximise the value of the funding contribution.

RECOMMENDATION 23: COMMUNITY FUNDS TO SUPPORT VERIFIERS, RECORDERS & OUTREACH

A Community Fund should be established to facilitate the scaling up of public participation in biological recording to ease current pressure points and to encourage participation and equal access for all.

Funding should be focused upon delivery of strategic priorities (e.g. encouraging biological recording of under-recorded species or sites especially in remote areas, promoting biological recording for associated health benefits, developing taxonomic expertise in species of conservation priority or other strategic interest, and supporting the costs of equipping and running a recording group or school group). A cross-sectoral stakeholder group such as SNH's Scientific Advisory Committee, or the Scientific Support Group for the Scottish Biodiversity Strategy, should be appointed to provide independent advice on the appropriate strategic priorities for Scotland each year. The relevant National or Regional Committee should act as an Investment Committee to direct funding in accordance with these priorities.

OUTCOME 5: TRANSITION BY 2025

With a shared implementation plan to maintain the momentum of the SBIF Review

RECOMMENDATION 24: AN IMPLEMENTATION PLAN TO ACHIEVE RECOMMENDATIONS BY 2025

The SBIF Review Working Group should develop a detailed Implementation Plan for the period from 2020 to 2025 that sets out how the transition from the current situation to the future situation in Scotland will be achieved and monitored.

Implementation should follow an agile approach focusing on areas of highest value first. The SBIF Advisory Group will need to continue to provide energy and leadership to maintain momentum and to guide the development of the Implementation Plan appropriately. The Implementation Plan should develop a phased timeline to build capacity and grow capabilities gradually over a five year period.

9. Conclusion

Our recommendations build upon those made almost a decade ago in the original response to Public Petition PE1229. They seek to resolve the long-standing issues around the flow of biological records from those who collect them to all who may use them.

We recognise that views vary on the exact way to remedy these issues, particularly on the pace and scale of the transformation required and whether an evolutionary or revolutionary approach may be best. However, the contributors to this Review have all emphasised that the current situation is precarious and untenable. Alas, despite all efforts to date (including advances in the use of technology and the advent of the National Biodiversity Network and NBN Atlas) the underlying issues remain largely unchanged. Today, they limit Scotland's contribution to the Aichi Targets and reduce collective performance against our National Outcomes for Scotland.

We believe that the case for investment in the biological recording infrastructure in Scotland is compelling. Our recommendations set direction through defining the style and scale of Infrastructure needed at UK, national, regional and community levels. Such an Infrastructure - at a fraction of the cost of dualling the A9 or building the Queensferry Crossing - is an essential enabler through the provision of an open biodiversity evidence base for Scotland, high levels of taxonomic expertise and an engaging network with great voluntary and community participation.

Through informing decision-makers and empowering communities, the UK and national elements of the Infrastructure underpin the sustainability of our economy and land management and the wealth, health and protection of our natural environment. This in turn enhances everyone's quality of life. Through encouraging people to go outdoors and to take interest in the natural world around them, the regional and community elements of the Infrastructure directly connect people with nature for all of the physical and mental health benefits and equality of access that this brings.

It is imperative that we maintain the momentum gained through this Review so that we can use its collective energy and goodwill to engender shared excitement and hope for the future. We provide our recommendations to the Scottish Government for consideration and we look forward to their response.

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Annex I: How the SBIF Review was undertaken

Background to the review

The Scottish Biodiversity Information Forum (SBIF) was formed in 2011 to provide strategic leadership following a public petition (PE1229) calling on the Scottish Parliament to:

"urge the Scottish Government to establish integrated local and national structures for collecting, analysing and sharing biological data to inform decision making processes to benefit biodiversity."

The objectives set out for SBIF were i) to develop a strategic approach (by consensus) to the collection, collation and sharing of biological data across Scotland; ii) to review the role, funding and coverage of local record centres - now called Local Environmental Records Centres (LERCs) - and other local options for biological data management across Scotland as part of the process to ensure that the necessary structures are in place to collect and disseminate biological information across Scotland; and iii) to review the means by which data for key and priority scottish species are provided to the NBN and made available to organisations that need them.

The SBIF Advisory Group acted as the steering group for the Review. The SBIF Review Working Group was delegated to undertake the day to day work of the Review through its members who each committed time to assist.

Remit

The purpose of the Review was to determine the optimum Infrastructure for biological recording in Scotland, an Infrastructure that in turn will attract the necessary belief, commitment and investment by stakeholders to be sustainable and successful in fulfilling the original vision of SBIF:

> *"High quality species and habitat data will be collected and managed through a sustainable, co-ordinated and integrated local and national framework of organisations, partnerships and initiatives. These data will be available to ensure that Scotland's biodiversity, ecosystems and people benefit."*

The Review aims to do this in such a way as to be cohesive across Scotland with support from all stakeholders and the willingness and energy to then make the transitions necessary to implement the new Infrastructure by 2025.

The SBIF Review Working Group has worked to the following remit:

1) To undertake a review of the biological recording infrastructure in Scotland in order to identify any improvements needed for the Infrastructure to be suitable, sustainable and successful, and to set out any transition arrangements necessary to achieve this.

2) To review the digital infrastructure and ensure that the new technologies for recording, managing, sharing, analysing and using data are being used as appropriate.

SBIF ADVISORY GROUP

Gill Dowse, Scottish Wildlife Trust
Andy Ford, Cairngorm National Park
Nick Fraser, National Museum of Scotland
Guy Harewood, Stirling Council
Sebastian Howell, Marine Scotland
Jo Judge, NBN Trust
Claire Lacey, CIEEM
Craig Macadam, BugLife
Ed Mackey, SNH
Sandra Marks, Scottish Government
Scot Mathieson, SEPA
Jo Porter, Heriot-Watt University
Glenn Roberts, NESBReC
David Roy, CEH/Biological Records Centre
Jonathan Willet, BRISC
Ellen Wilson, RSPB (Chair)

SBIF REVIEW WORKING GROUP

Lindsay Bamforth, Fife Nature Records Centre
Liz Edwards, RSPB
Christine Johnston, NBN Trust
Jo Judge, NBN Trust
Colin McLeod, SNH
Rachel Stroud, NBN Trust
Ellen Wilson, RSPB (Chair)

IN MEMORY OF JOHN SAWYER, 1968-2015
Whose vision and belief inspired this Review

Evidence gathering

To understand how the biological recording infrastructure is currently operating and to seek ideas for improvements, stakeholder engagement consisted of a literature review, interviews, a public questionnaire and four workshops which took place between December 2016 and December 2017. All outputs from these (listed in Annex VI) were made openly available online (via the SBIF Review section of the NBN website at https://nbn.org.uk/) along with all historic documents gathered for the literature review.

LITERATURE REVIEW

A literature review was undertaken to understand the historic context of the SBIF Review and to identify any similar work that had been undertaken previously to address related issues of interest.

KEY STAKEHOLDER INTERVIEWS

The Review Working Group identified 40 key individuals from across all sectors who were selected for one-to-one interviews due to their high level of influence and interest. Each interviewee was asked the same four questions to elucidate the perspectives from each role involved in the biological recording infrastructure. All the perspectives identified were grouped by community and presented as 'rich pictures' for each of three communities, the 'biological recording community' (Recorders, Verifiers, Recording Group Operators, Recording Scheme Operators and Collection Curators), the 'Services Community' (Service Providers, Service Users and Funders) and the 'Data Community' (Data Providers, Data Users and Data Developers).

PUBLIC QUESTIONNAIRE

The purpose of the questionnaire was to gather stakeholders' perspectives about what is working well and less well within the biological recording infrastructure and garner ideas for potential improvements. The questionnaire was open to anyone involved in biological recording and data use in all countries of the UK. Invitations to complete the questionnaire were also sent to key stakeholders and all major interested audiences. The questionnaire covered the role(s) played by each respondent (out of Recorder, Verifier, Collection Curator, Recording Group Operator, National Scheme Operator, Data Provider, Data Developer, Data User, Service Provider, Service User, Funder and Facilitator) and what was working well and less well for them in each role; their ideas and priorities for change; their happiness with their data being open and their motivation and morale, as well as recording the profile for all respondents (e.g. their involvement with recording, which sector they belonged to, where they were based etc).

WORKSHOPS

Four two-day workshops were held to co-design an improved Infrastructure for Scotland:

- *Data flow options* - this workshop aimed to understand how technology could facilitate changes in improving data flow from Recorder to Data User. The common tools, platforms, processes and user experiences required for effective data flow and areas of duplication or inefficiencies were identified. The attendees compared the effort and value of providing each common element in each possible way in order to produce a preferred data flow model.
- *Service provision options* - this workshop aimed to identify the added value services (e.g. data searches and interpretation for planning applications, statutory reporting etc.) that users of biodiversity data required, and, to identify which level (local, regional, national or central) provided the most effective service delivery mechanisms for each broad type of service.
- *Governance options* - this workshop aimed to identify the type and number of people, groups or organisations required to facilitate the preferred data flow and service provision models from workshops one and two. Different organisational structures were evaluated and a preferred option for effective organisation and governance of the biological recording infrastructure was agreed upon.
- *Funding options* - this workshop aimed to understand the motivations and priorities of funders and to identify and/or design the sustainable funding mechanisms that would support the preferred data flow, service provision and governance options produced by the previous three workshops.

List of contributors

INTERVIEW PARTICIPANTS

47 individuals from 42 organisations participated in 41 interviews (most interviews were with just one person, however some interviews were with two or three people together; most interviewees were associated with more than one organisation):

Association of Local Environmental Records Centres
Auchenorrhyncha Recording Scheme
Biological Records Centre
Botanical Society of Britain and Ireland
British Arachnological Society
British Dragonfly Society
British Trust for Ornithology
BugLife
Butterfly Conservation
Caddisfly (Trichoptera) Recording Scheme
Cairngorms National Park Authority
Caledonian Conservation Ltd
Centre for Environmental Data and Recording, Northern Ireland
Chartered Institute for Ecology and Environmental Management
Cumbria Biodiversity Data Centre
Edinburgh University
Field Studies Council
Fife Nature Records Centre
Glasgow Museums
Greenspace Information for Greater London
Heriot-Watt University
Highland Biological Recording Group
Joint Nature Conservation Committee
Ladybird Recording Scheme
London Natural History Museum
National Biodiversity Network Trust
National Earthworm Recording Scheme
National Museums Scotland
Natural England
Natural Resources Wales
North East Scotland Biological Records Centre
North Wales Environmental Information Service
Scottish Environment Protection Agency
Scottish Natural Heritage
Scottish Wildlife Trust
Snowdonia National Park Authority
South Lanarkshire Council
South West Scotland Environmental Information Centre
St Andrews University
Stirling Council
The Wildlife Information Centre

Thank you to all participants for your time and contributions in these interviews.

WORKSHOP PARTICIPANTS

66 individuals from 39 organisations attended at least one workshop each, with an average of 26.5 attendees per workshop:

Aberdeenshire Council
Association of Local Environmental Records Centres
Angus Council
Argyll & Bute Council
Bat Conservation Trust
Biological Records Centre
Biological Recording in Scotland
Botanical Society of Britain and Ireland
British Arachnological Society
British Trust for Ornithology
Butterfly Conservation
Cairngorms National Park Authority
Chartered Institute for Ecology and Environmental Management
Earthworm Society of Britain
Fife Council
Fife Nature Records Centre
Forestry Commission Scotland
Glasgow Museums
Highland Biological Recording Group
Leisure & Culture Dundee
Napier University
National Museums Scotland
National Trust for Scotland
Natural England
National Biodiversity Network Secretariat
North East Scotland Biological Records Centre
Orkney Wildlife Information & Records Centre
Royal Botanic Garden Edinburgh
Royal Society for the Protection of Birds
Science and Advice for Scottish Agriculture
Scottish Borders Council
Scottish Water
Scottish Wildlife Trust
Scottish Environment Protection Agency
Scottish Natural Heritage
South Lanarkshire Council
South West Scotland Environmental Information Centre
Tayside Biodiversity Partnership
The Wildlife Information Centre

Thank you to all sponsors and participants for your time and contributions in these workshops. In particular, we thank Scottish Natural Heritage for providing a venue at their Battleby Conference Centre and we thank the following organisations for sponsoring each workshop:

Workshop 1 on Data Flows - BRISC
Workshop 2 on Service Provision - RSPB
Workshop 3 on Governance - Scottish Natural Heritage
Workshop 4 on Funding - Scottish Wildlife Trust

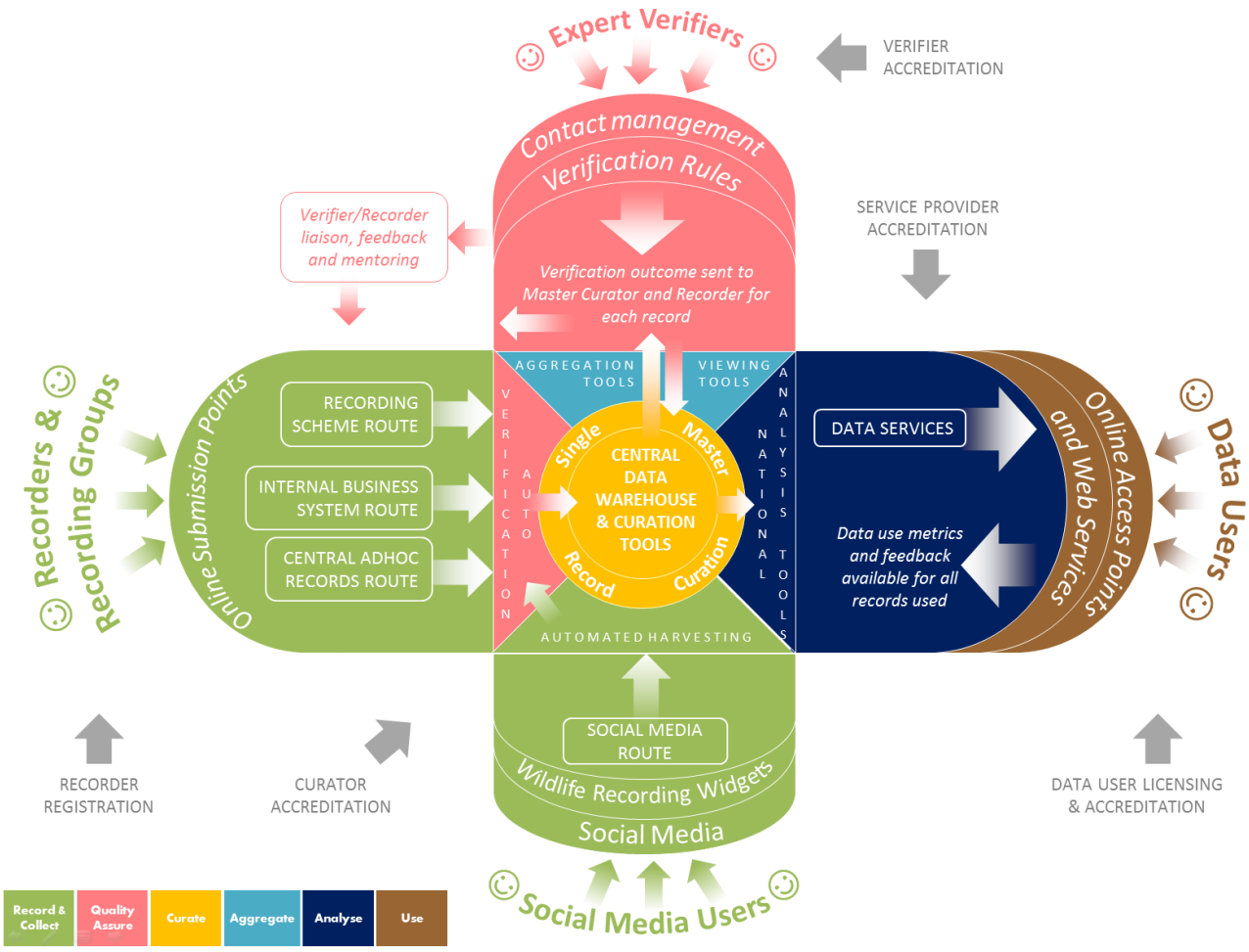
QUESTIONNAIRE PARTICIPANTS

290 people responded in total, with 134 individuals from 95 organisations plus 156 individuals who were either participated anonymously or were not associated with a particular organisation:

Aberdeen City Council Countryside Ranger Service
Aberdeenshire Council
Aberdeenshire Council Ranger Service
Agroecosystems Ltd
Allen & Mellon Environmental Ltd
Angus Council
Bat Conservation Trust
Bedfordshire Natural History Society
Bedfordshire Invertebrate Group
Biodiversity Solutions
Blue Leaf Nature
Botanical Society of Britain and Ireland
Biological Recording in Scotland
Botanical Society of Britain and Ireland
Bristol Culture (Bristol Museums, Galleries & Archives)
Bristol Regional Environmental Records Centre
British Trust for Ornithology
Bumblebee Conservation Trust
Butterfly Conservation
Caledonian Conservation
Central Scotland Mammal Group
Centre for Stewardship, Falkland Estate, Fife
Chartered Institute for Ecology and Environmental Management
Chorley Natural History Society
Clearwing Ecology
Clyde Amphibian and Reptile Group
Clyde Porpoise CIC - Clyde Marine Mammal Project
Cofnod
Dawlish Warren Recording Group
Devon Birds
Dumfries & Galloway Council
Dumfries & Galloway Environmental Records Centre
Dunnock Environmental Services
East Haven Together
EDF Energy
Falkirk Council
Fife Coast & Countryside Trust
Fife Coast and Countryside Trust Ranger Service
Fife Council
Fife Nature Records Centre
Glamorgan Moth Recording Group
Glasgow City Council
Glasgow Museums
Hertfordshire Environmental Records Centre
Hertfordshire and Bedfordshire Fungus Group
Highland Aspen Group
Highland Biological Recording Group
Joint Nature Conservation Committee
Landcare North East
Leisure & Culture Dundee
Littlewood Ecology
Lothians & Fife Swan and Goose Study Group
National Museums Northern Ireland
National Museums Scotland
National Trust for Scotland
NBN Trust
NE Scotland Local Biodiversity Partnership
Norfolk Biodiversity Information Service
Norfolk County Council
North Ayrshire Council
North East Scotland Biological Records Centre
North Yorkshire Bat Group
Northern Highlands Ecological Research Centre
Outer Hebrides Biological Recording
Plantlife Scotland
Renfrewshire Council
Royal Society for the Protection of Birds
RSPB Centre for Conservation Science
RSPB Scotland
Scarabaeoidea Recording Scheme
Scottish Natural Heritage
Scottish Ornithologists' Club
Scottish Ornithologists' Club (Lothian branch)
Shetland Islands Council
Soldierflies and Allies Recording Scheme
South Ayrshire Council
South East Wales Biodiversity Records Centre
St Andrews Botanic Garden
Staffordshire Mammal Group
Stirling and Clacks Scottish Wildlife Trust Group
Sussex Biodiversity Record Centre
Sustrans
Sustrans Scotland
Tachinid Recording Scheme
Tayside Biodiversity Partnership
TCV Scotland
The Mammal Society
The Southern Uplands Partnership
The Wildlife Information Centre
True Harvest Seeds
Tweed Ecology Limited
University of Glasgow
Whale and Dolphin Conservation Shorewatch Programme
Weevil Recording Scheme
West Wales Biodiversity Information Centre

Thank you to all respondents for your time and contributions to this questionnaire.

Annex II: Our potential data flow model



NOTE:

The model above is coloured in accordance with the NBN Data Flow Pathway stages of:

RECORD & COLLECT > **QUALITY ASSURE** > **CURATE** > **AGGREGATE** > **ANALYSE** > **USE**

It is assumed that NBN National and Regional Hubs would submit and manage their own records via the internal business system route with Recorder 6+, Marine Recorder and the NBN Atlas providing the suite of systems for this purpose.

Annex III: Our potential service provision model

UK Hub Services

1. Governance, performance and insight reporting
2. Programme and project management
3. Financial management
4. IT and internal infrastructure support
5. HR advice and training
6. Communications and events management
7. Accreditation and standards
8. Technical product, platform, data warehouse and website development
9. UK product ownership via Business Partners and Account Managers
10. User support via a central HelpDesk
11. UK Species Inventory and habitat dictionary management and development
12. Data submission/curation support for schemes and recording group records
13. Data submission/curation support for commercial and academic records
14. Data submission/curation support for adhoc records
15. Data submission/curation support for non-native species records
16. Community Fund management and disbursement - subject to community funding availability
17. Subscription sales and account management - if a subscription-based funding model

National Hub Services

1. National product ownership
2. Education and outreach
3. Advanced or specialist taxonomic training
4. Bespoke reporting and analysis tools
5. Locally important site designation and registration
6. Automated planning screening tools
7. Data driven local and national species lists
8. Gap analysis for species and habitat monitoring
9. Composite habitat map data curation
10. Archiving and management of voucher specimens and collections
11. Ecological training to support delivery of biodiversity duty
12. Fast-tracking/backlog management for verification/digitisation

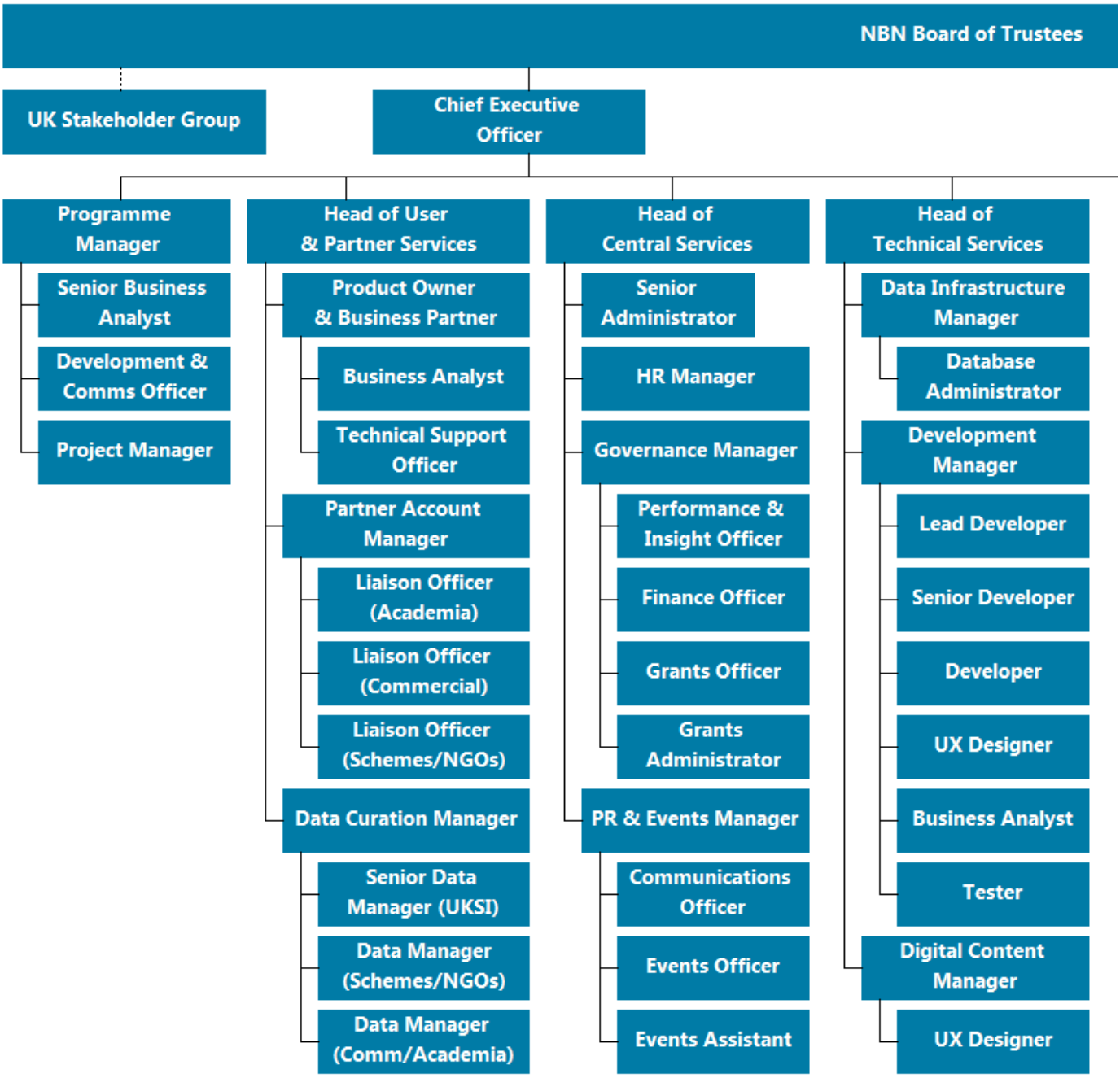
Regional Hub Services

1. Local Authority engagement and support
2. Enhanced data search/bespoke reports
3. Expert interpretation of biodiversity records for a geographic area
4. Local Recorder engagement and support
5. Recording Group engagement and support
6. Loan of/access to field or lab equipment
7. Entry level taxonomic training and mentoring
8. Entry level engagement and small events for the general public

Super Partner Services

1. Taxonomic reference collection management and digitisation
2. Verification process management and support
3. Invasive species alerts and reporting tools and services
4. UK and national state of nature reporting tools and services
5. Expert interpretation of biodiversity records for taxonomic groups
6. Data submission/curation support for National Recording Schemes
7. Technical product, platform and website development for National Recording Schemes
8. Advanced taxonomic training and mentoring
9. Bespoke engagement for the general public and National Recording Scheme participants

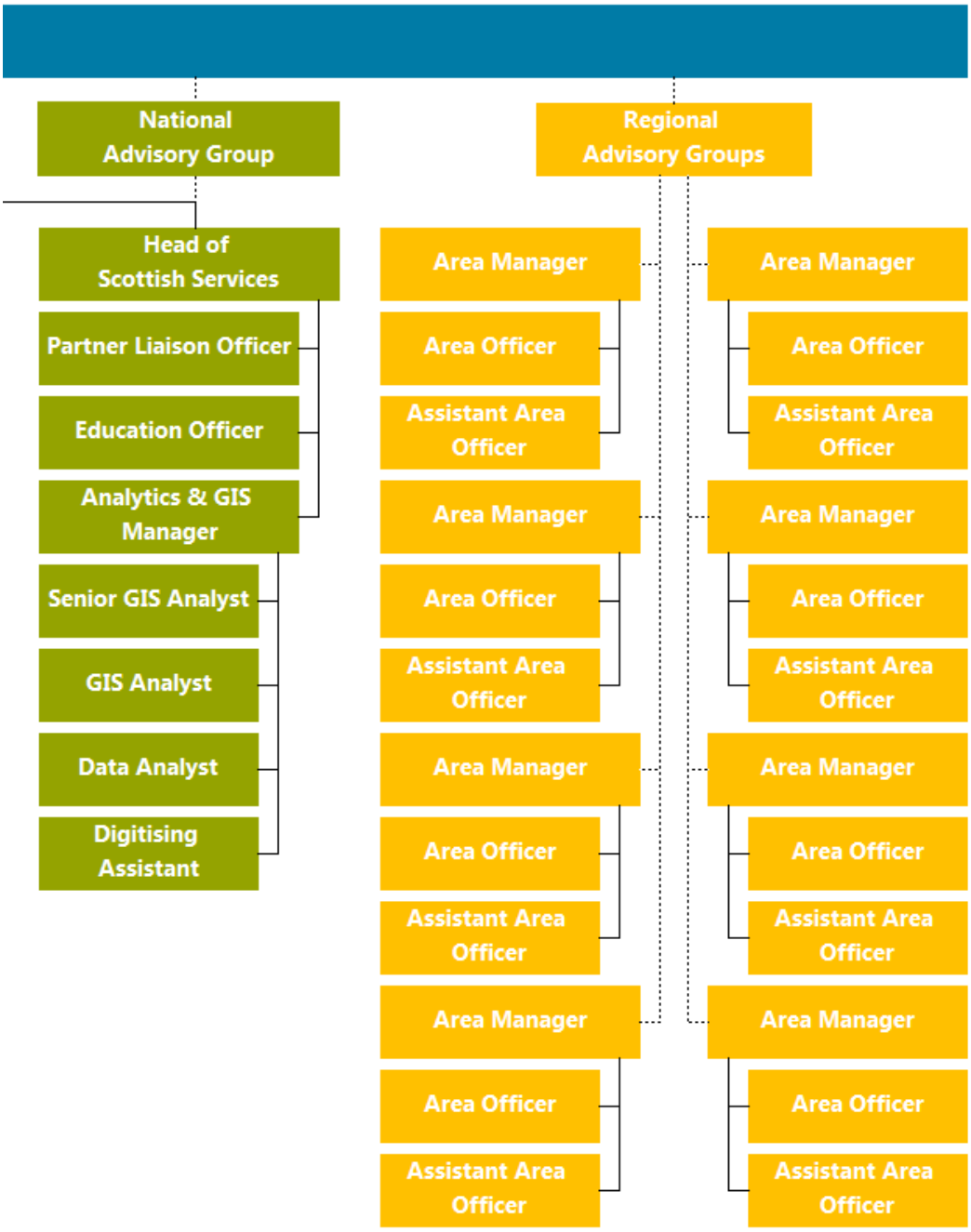
Annex IV: Our potential governance model



NOTES:

The roles listed were used to develop the costings presented in Annex V; the actual roles necessary in future may differ from these.

Some additional posts may also be funded and hosted in Super Partners (e.g. National Recording Schemes, museum and garden collections, State of Nature Partnership, Non-Native Species Secretariat, iRecord and Recorder 6+).


National Advisory Group
Regional Advisory Groups
Head of Scottish Services
Partner Liaison Officer
Education Officer
Analytics & GIS Manager
Senior GIS Analyst
GIS Analyst
Data Analyst
Digitising Assistant
Area Manager
Area Officer
Assistant Area Officer
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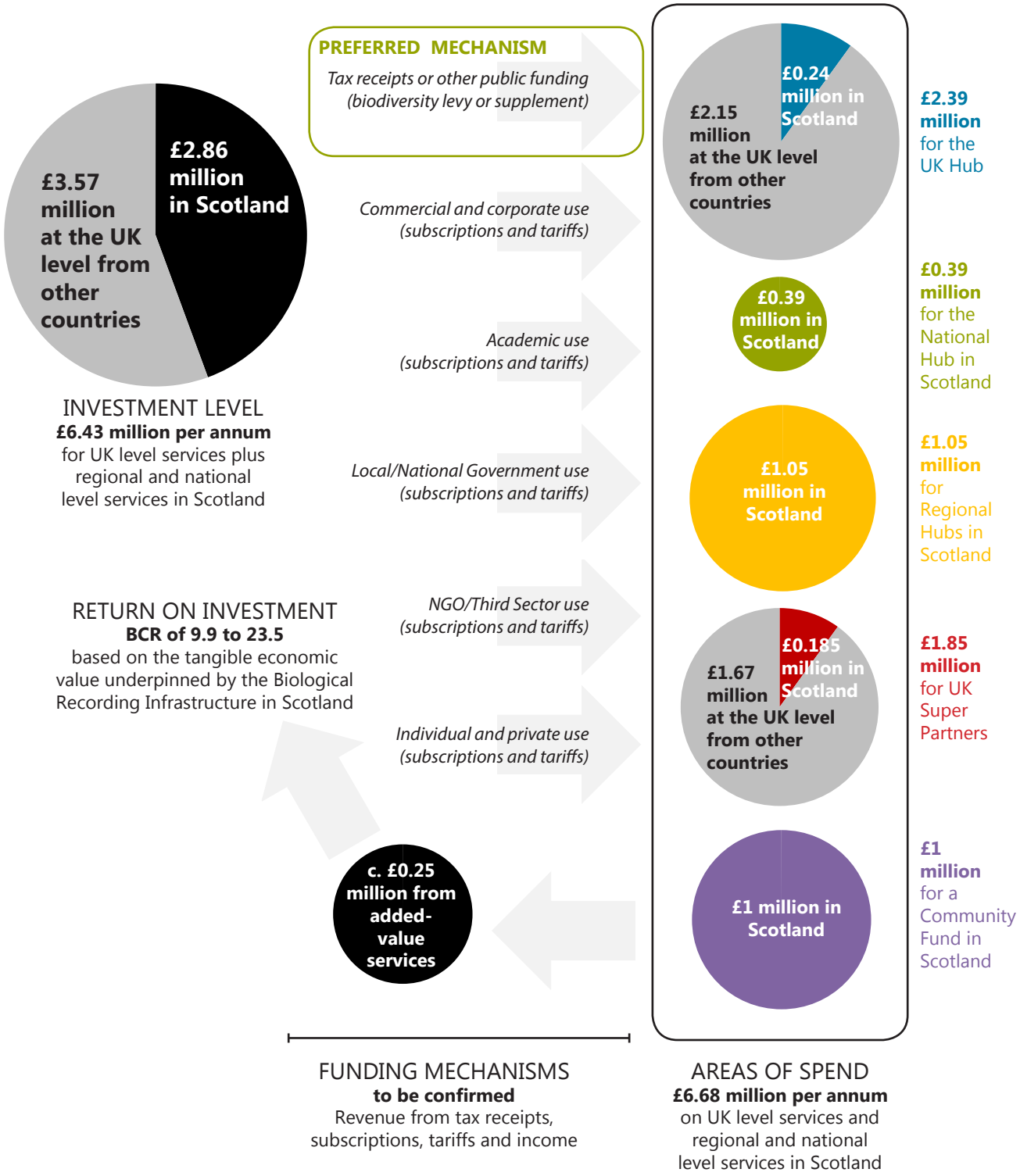
Annex V: Our potential funding model



Please refer to the tables on pages 73 and 74 for details of the costings and overheads used.

Table A showing detailed costings for each investment option (per annum with full cost recovery)

		NO TRANSFORMATION			PARTIAL TRANSFORMATION			FULL TRANSFORMATION		
CENTRAL HUB FOR THE UK		*LEVEL*	*FTE*	*£*	*LEVEL*	*FTE*	*£*	*LEVEL*	*FTE*	*£*
CENTRAL SERVICES	CEO	●	1	£58,700	●	1	£83,250	●	1	£83,250
	Programme Office	○	0		●	4	£182,600	●	4	£182,600
	Head of Central Services	○	0		●	1	£71,250	●	1	£71,250
	Administration & HR	◐	0.6		●	2	£79,400	●	2	£79,400
	Finance & Governance	○	0		●	5	£226,850	●	5	£226,850
	PR, Events & Communications	◐	1.2		●	4	£160,200	●	4	£160,200
USER & PARTNER SERVICES	Head of User & Partner Services	○	0	£0	●	1	£71,250	●	1	£71,250
	Product Development & Support	○	0	£0	●	3	£150,150	●	3	£150,150
	Partner Development	◐	0.5	£18,100	●	4	£180,200	●	4	£180,200
	Data Curation	○	0	£0	●	4	£159,800	●	4	£159,800
TECHNICAL & DIGITAL SERVICES	Head of Technical Services	○	0	£0	●	1	£83,250	●	1	£83,250
	Technical Development	◐	0.25	£0	●	7	£373,950	●	7	£373,950
	Data Infrastructure	○	0	£0	●	2	£92,500	●	2	£92,500
	Digital Content	○	0	£0	●	2	£97,300	●	2	£97,300
OTHER	Other overheads/Contingency @ 10%	○	0%	£0	●	10%	£201,195	●	10%	£201,195
	Legal/professional/promotional fees	○	n/a	£0	◐	n/a	£85,000	●	n/a	£172,000
	SUB-TOTAL		**3.55**	£76,800		**41.0**	**£2,298,145**		**41.0**	**£2,385,145**
NATIONAL HUB FOR SCOTLAND										
NATIONAL SERVICES	Head of Scottish Services	○	0	£0	●	1	£71,250	●	1	£71,250
	Partner Liaison	○	0	£0	●	1	£43,850	●	1	£43,850
	Education & Outreach	○	0	£0	○	0	£0	●	1	£43,850
	Data Development & Services	○	0	£0	◐	2	£92,500	●	5	£193,850
OTHER	Other overheads/Contingency @ 10%	○	0	£0	●	10%	£20,760	●	10%	£35,280
	SUB-TOTAL		**0.0**	**£0**		**4.0**	**£228,360**		**8.0**	**£388,080**
REGIONAL HUBS WITHIN SCOTLAND										
REGIONAL SERVICES	Area Managers	◐	10.57	£291,767	●	8	£389,200	●	8	£389,200
	Area Officers	◐			◐	4	£161,000	●	8	£322,000
	Assistant Area Officers	◐			◐	4	£123,000	●	8	£246,000
OTHER	Other overheads/Contingency @ 10%	?	?	?	●	10%	£67,320	●	10%	£95,720
	SUB-TOTAL		**10.57**	**£291,767**		**16.0**	**£753,280**		**24.0**	**£1,052,920**
UK SUPER PARTNERS										
SUPER PARTNER SERVICES	Affiliated Scheme Services	○	0	£0	●	n/a	£520,000	●	n/a	£520,000
	Museum & Garden Services	○	0	£0	◐	n/a	£350,000	●	n/a	£1,000,000
	Non-Native Species Services	○	0	£0	○	n/a	£0	●	n/a	£100,000
	State of Nature Services	○	0	£0	○	n/a	£0	●	n/a	£100,000
	iRecord Services	○	0	£0	●	n/a	£80,000	●	n/a	£80,000
	Recorder 6+ Services	○	0	£0	●	n/a	£50,000	●	n/a	£50,000
	SUB-TOTAL		**0**	**£0**			**£1,000,000**			**£1,850,000**
COMMUNITY FUNDING FOR SCOTLAND										
LOCAL PARTICIPATION	For Verifiers/Collection Curators	○	n/a	£0	●	n/a	£100,000	●	n/a	£320,000
	For Recorders & Recording Groups	○	n/a	£0	●	n/a	£100,000	●	n/a	£320,000
	For Community & School Groups	○	n/a	£0	○	n/a	£100,000	●	n/a	£360,000
	SUB-TOTAL			**£0**			**£300,000**			**£1,000,000**
TOTAL @ 100% UK Hub and Super Partner costs		**n/a**			**£4,567,025**			**£6,676,145**		
TOTAL @ 10% UK Hub and Super Partner costs		**£368,567**			**£1,598,695**			**£2,864,515**		
NUMBER OF FTE STAFF		**14.12**			**61**			**73**		

NOTES

1. These costings assume eight Regional Hubs each hosted within an appropriate host organisation such as a Local Authority or wildlife NGO to facilitate the provision of line management and office space in return for services to support biodiversity duty and/or public engagement.

2. The total cost of £6.68 million includes the costs for a UK Hub and key Super Partner infrastructure to fulfil the full range of services and support needed by Scotland. With 8.2% of the UK population (based on the mid-2017 population figures from the Office of National Statistics), it is assumed that Scotland's contribution towards UK costs could be around 10% rather than 100% once the UK infrastructure is established and once other countries also contribute.

Table B showing salary costs and other overheads for estimating full cost recovery amounts

GRADE	OPERATIONAL	SPECIALIST	ADMIN/PROGRAMME	GRADE	TECHNICAL
9	Chief Executive Officer			T8	Head of Technical Services
8	Head of National Services	Head of Specialism		T7	Lead Developer
7	Senior Area Manager	Principle Specialist		T6	Senior Developer/Senior BA
6	Area Manager	Lead Specialist	Strategic Business Partner	T5	Developer/BA/Team Manager
5	Senior Area Officer	Senior Specialist	Programme Manager	T4	Infrastructure Engineer
4	Area Officer	Specialist	Project Manager	T3	Junior Developer/Tester
3	Assistant Area Officer	Senior Specialist Assistant	Lead Administrator	T2	Content Manager
2	Senior Administrator	Specialist Assistant	Senior Administrator		
1	Administrator	Apprentice	Administrator		

GRADE	SALARY RANGE	MIDPOINT	NI 13%	PENSION 7%	TOTAL
9	£60,000-£70,000	65000	8450	4550	78000
8	£50,000-£60,000	55000	7150	3850	66000
7	£40,000-£50,000	45000	5850	3150	54000
6	£32,000-£42,000	37000	4810	2590	44400
5	£28,000-£38,000	33000	4290	2310	39600
4	£25,000-£35,000	30000	3900	2100	36000
3	£21,000-£28,000	24500	3185	1715	29400
2	£19,000-£26,000	22500	2925	1575	27000
1	£16,500-£22,000	19750	2567.5	1382.5	23700

GRADE	OFFICE/DESK SPACE	KIT	TRAINING	T&S	TOTAL WITH FCR
9	1500	750	1000	2000	83250
8	1500	750	1000	2000	71250
7	1500	750	1000	1000	58250
6	1500	750	1000	1000	48650
5	1500	750	1000	1000	43850
4	1500	750	1000	1000	40250
3	1500	750	1000	1000	33650
2	1500	750	1000	500	30750
1	1500	750	1000	500	27450

Annex VI: List of Outputs from the SBIF Review

The following documents and diagrams are available from the SBIF Review section of the NBN website via https://nbn.org.uk/about-us/where-we-are/in-scotland/the-sbif-review/ and are listed here for ease of reference:

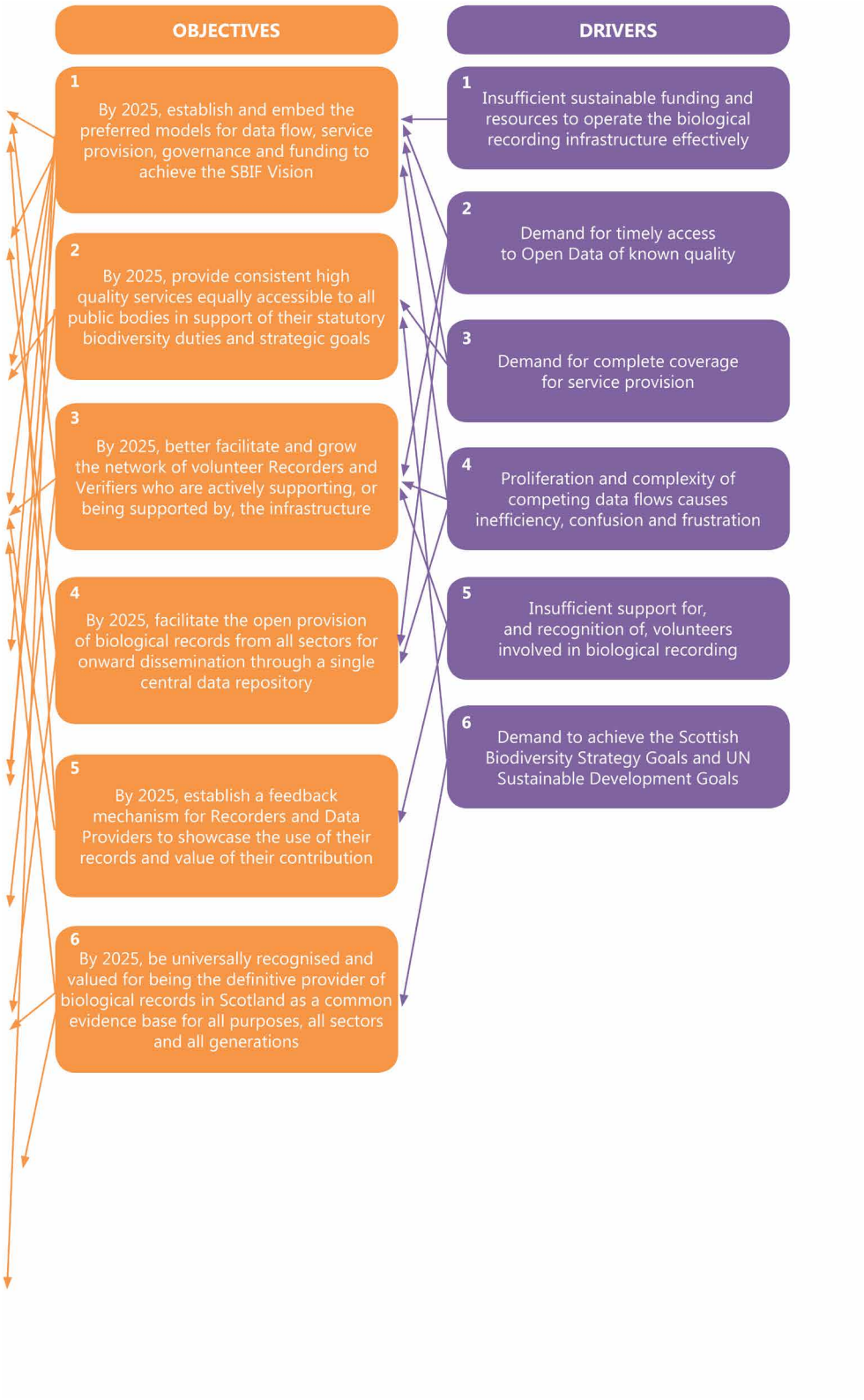
- **SBIF Value Model Diagram** illustrating key value areas of value from the Infrastructure.
- **SBIF Review Workshop Outputs** documenting the key messages from each workshop.
- **SBIF Literature Review Outputs** documenting the key findings from the literature review.
- **SBIF Review Interview Findings** documenting the results of key stakeholder interviews.
- **SBIF Review Questionnaire Findings** documenting the results of the questionnaire.
- **SBIF Review Benefit Dependency Network Diagram** mapping benefit dependencies.
- **SBIF Review Highlight Reports** documenting objectives and progress against milestones.

An archive of all reports gathered to inform the literature review is also available.

For informal updates follow **@sb_info_forum** on Twitter.

Annex VII: Benefits Dependency Network Diagram

A downloadable version of this diagram is available from the SBIF Review pages of the NBN website (see Annex VI).


OBJECTIVES
1
By 2025, establish and embed the preferred models for data flow, service provision, governance and funding to achieve the SBIF Vision
2
By 2025, provide consistent high quality services equally accessible to all public bodies in support of their statutory biodiversity duties and strategic goals
3
By 2025, better facilitate and grow the network of volunteer Recorders and Verifiers who are actively supporting, or being supported by, the infrastructure
4
By 2025, facilitate the open provision of biological records from all sectors for onward dissemination through a single central data repository
5
By 2025, establish a feedback mechanism for Recorders and Data Providers to showcase the use of their records and value of their contribution
6
By 2025, be universally recognised and valued for being the definitive provider of biological records in Scotland as a common evidence base for all purposes, all sectors and all generations
DRIVERS
1
Insufficient sustainable funding and resources to operate the biological recording infrastructure effectively
2
Demand for timely access to Open Data of known quality
3
Demand for complete coverage for service provision
4
Proliferation and complexity of competing data flows causes inefficiency, confusion and frustration
5
Insufficient support for, and recognition of, volunteers involved in biological recording
6
Demand to achieve the Scottish Biodiversity Strategy Goals and UN Sustainable Development Goals

Annex VIII: National Outcomes for Scotland

Five Strategic Objectives for Scotland describe where Scottish Government will focus action:

■ WEALTHIER & FAIRER

Enable businesses and people to increase their wealth and more people to share fairly in that wealth.

■ SMARTER

Expand opportunities for Scots to succeed from nurture through to life long learning ensuring higher and more widely shared achievements.

■ HEALTHIER

Help people to sustain and improve their health, especially in disadvantaged communities, ensuring better, local and faster access to health care.

■ SAFER & STRONGER

Help local communities to flourish, becoming stronger, safer places to live, offering improved opportunities and a better quality of life.

■ GREENER

Improve Scotland's natural and built environment and the sustainable use and enjoyment of it.

Eleven National Outcomes describe what the Scottish Government wants to achieve:

■ WE HAVE A GLOBALLY COMPETITIVE, ENTREPRENEURIAL AND SUSTAINABLE ECONOMY

We have a strong, dynamic and productive economy which creates wealth and employment across Scotland. Our economy is competitive and we have good internationaltrade, investment and export networks. We are considered an attractive place to do business. We successfully attract and retain new talent and fully support business and social enterprise. Our achievements are underpinned by a strong culture of research, innovation and development. Our economy is inclusive and focused on improving the lives of all our people. We ensure the benefits of economic growth, wealth and opportunities are fairly shared. Access to labour markets and jobs is evenly shared between us. We take seriously the wellbeing and skills of our workforce and provide good quality, fair work, training and employment support for all. Employers actively fulfil their corporate responsibilities. Our sustainable economic growth is not achieved at the expense of our social interests or those of the environment. As such, our economy is ecologically accountable as well as socially responsible. We regard the green economy and our rich ecological capital as a valuable development opportunity and actively progress advancements in these areas.

■ WE ARE OPEN, CONNECTED AND MAKE A POSITIVE CONTRIBUTION INTERNATIONALLY

We pursue happiness and quality of life as legitimate social goals. Our family, communities and people are important to us and we are committed to being fair and socially just. We are respectful of all who chose to visit, live and work in Scotland and acknowledge the positive contribution they make. Our visitor economy is thriving. We are proud of our achievements and are confident, ambitious and positive about the future. We are regarded as a vibrant, modern country and have positive international relations, influence and exchange networks. We recognise the inter-connectedness of people and the obligations which flow from this and play a valuable role in providing aid and supporting developing countries.

■ WE TACKLE POVERTY BY SHARING OPPORTUNITIES, WEALTH AND POWER MORE EQUALLY

We are committed to eradicating poverty and hunger in Scotland. We are addressing the links between poverty and income, housing, ethnicity, gender, health, disability and age. Our achievements, potential and life choices are not decided at birth or by class or background. We are all able to enjoy financially security, have a decent job, home and a good life.

■ WE LIVE IN COMMUNITIES THAT ARE INCLUSIVE, EMPOWERED, RESILIENT AND SAFE

Our communities are pleasant places to live where everyone has a warm, appropriate, efficient and affordable home. We value excellent and innovative design and are committed to sustainable planning and transport. We believe that access to greenspace, nature and other leisure activities positively enhances our lives and health. We have high quality, affordable and accessible public services and facilities that positively enhance our lives. We focus our investment on deprived communities and disadvantaged rural areas. We live in friendly, vibrant and cohesive communities which value diversity and support those in need. We are encouraged to volunteer, take responsibility for our community and engage with decisions about it. Our communities are resilient, safe and have low levels of crime.

■ WE GROW UP LOVED, SAFE AND RESPECTED, SO THAT WE REALISE OUR FULL POTENTIAL:

We do all we can to ensure our children grow up in an atmosphere of happiness, love and understanding. We enhance their life chances through our early years provision and by supporting families when they need it. We ensure childhood is free from abuse, tobacco, alcohol, drugs, poverty and hunger. Our children are not left worried or isolated. We include and involve children in decisions about their lives and world, and protect their rights, dignity and wellbeing. Our communities are safe places where children are valued, nurtured and treated with kindness. We provide stimulating activities and encourage children to engage positively with the built and natural environment and to play their part in its care. We provide the conditions in which all children can be healthy and active. Our schools are loving, respectful and encouraging places where everyone can learn, play and flourish. We provide children and young people with hope for the future and create opportunities for them to fulfil their dreams.

■ WE ARE WELL EDUCATED, SKILLED & ABLE TO CONTRIBUTE TO SOCIETY

We have an education system we can all take part in and which inspires us to reach our potential whatever that may be. We understand that the desire to learn continues throughout life and that being curious, creative, skilled and knowledgeable is good for us, our society and economy. We value our teachers, educators and academics and do all we can to achieve the highest standards across our learning and research. We work with partners in business, industry, science and academia to ensure we lead the world in new thinking and have the talents and abilities to flourish in future.

■ WE ARE HEALTHY & ACTIVE

We regard the health of all our people as being of upmost importance. Consequently, we live long, healthy and active lives regardless of where we come from. We are all able to access world class, appropriate and free/affordable health, social care and dental services. We cherish and protect the NHS as a force for good in our lives and provide the necessary investment and planning to ensure our health and social care systems are viable over the long term. We prioritise health and wellbeing at national and local government levels and actively implement healthy public policy. We use evidence intelligently to continuously improve and challenge existing healthcare models. Our approach is integrated, preventative and person-centred. We are focused on resolving needs in order to achieve positive health, care and wellbeing outcomes. We implement a whole system approach to health and wellbeing which targets harmful health behaviours early on and from different angles. We have revolutionised our food culture and prioritise affordable, healthy food and local food production. We have addressed the availability of unhealthy food options and are combatting food and drink industry facilitation of ill-health. We have developed a healthier, responsible attitude to smoking, alcohol and drug use. We are active and have widespread engagement with sport and exercise. Our awareness of mental health and suicide has resulted in more immediate, comprehensive and successful support for those in need.

■ WE VALUE, ENJOY, PROTECT AND ENHANCE OUR ENVIRONMENT

We see our natural landscape and wilderness as essential to our identity and way of life. We take a bold approach to enhancing and protecting our natural assets and heritage. We ensure all communities can engage with and benefit from nature and green space. We live in clean and unpolluted environments and aspire to being the greenest country in the world. We are committed to environmental justice and preserving planetary resources for future generations. We consume and use our resources wisely, ethically and effectively and have an advanced recycling culture. We are at the forefront of carbon reduction efforts, renewable energy, sustainable technologies and biodiversity practice. We promote high quality, sustainable planning, design and housing. Our transport infrastructure is integrated, sustainable, efficient and reliable. We promote active travel, cycling and walking, and discourage car reliance and use particularly in towns and cities.

■ WE ARE CREATIVE & OUR VIBRANT & DIVERSE CULTURES ARE EXPRESSED & ENJOYED WIDELY

We take pride in being a vibrant and creative country. We see our culture, humour and heritage as essential to who we are and to our appeal as a place to live and visit. We recognise that the arts and culture bring us pleasure as well as other social and economic benefits. We cherish and protect our history, traditional and rural cultures, and embrace those from elsewhere. Everyone is encouraged to enjoy culture in all its forms and we support our creative sectors and those working in them.

■ WE RESPECT, PROTECT & FULFIL HUMAN RIGHTS & LIVE FREE FROM DISCRIMINATION

Vision details not yet available; [relating to: public services treat people with dignity and respect, quality of public services, influence over local decisions, access to justice]

■ WE HAVE THRIVING AND INNOVATIVE BUSINESSES, WITH QUALITY JOBS AND FAIR WORK FOR EVERYONE

Vision details not yet available [relating to: number of businesses, high growth businesses, innovative businesses, economic participation, employees on the living wage, pay gap, contractually secure work, employee voice, gender balance in organisations]

National Performance Framework

http://nationalperformance.gov.scot/

Enabling Scotland to be a global leader for biodiversity

SCOTTISH BIODIVERSITY INFORMATION FORUM