Digital Enablers for Natural Capital Survey Results

February 2024

Digital
Enablers
for Natural Capital

To launch a new topic hub within the Scottish Forum on Natural Capital, and new discussion platform on our Basecamp site, we asked our existing networks for their thoughts and ideas on the current state-of-play for digital developments relevant to natural capital, including digital approaches to the collection of biodiversity data and the key issues for using digital tools to interpret, distribute and give meaning to this data.

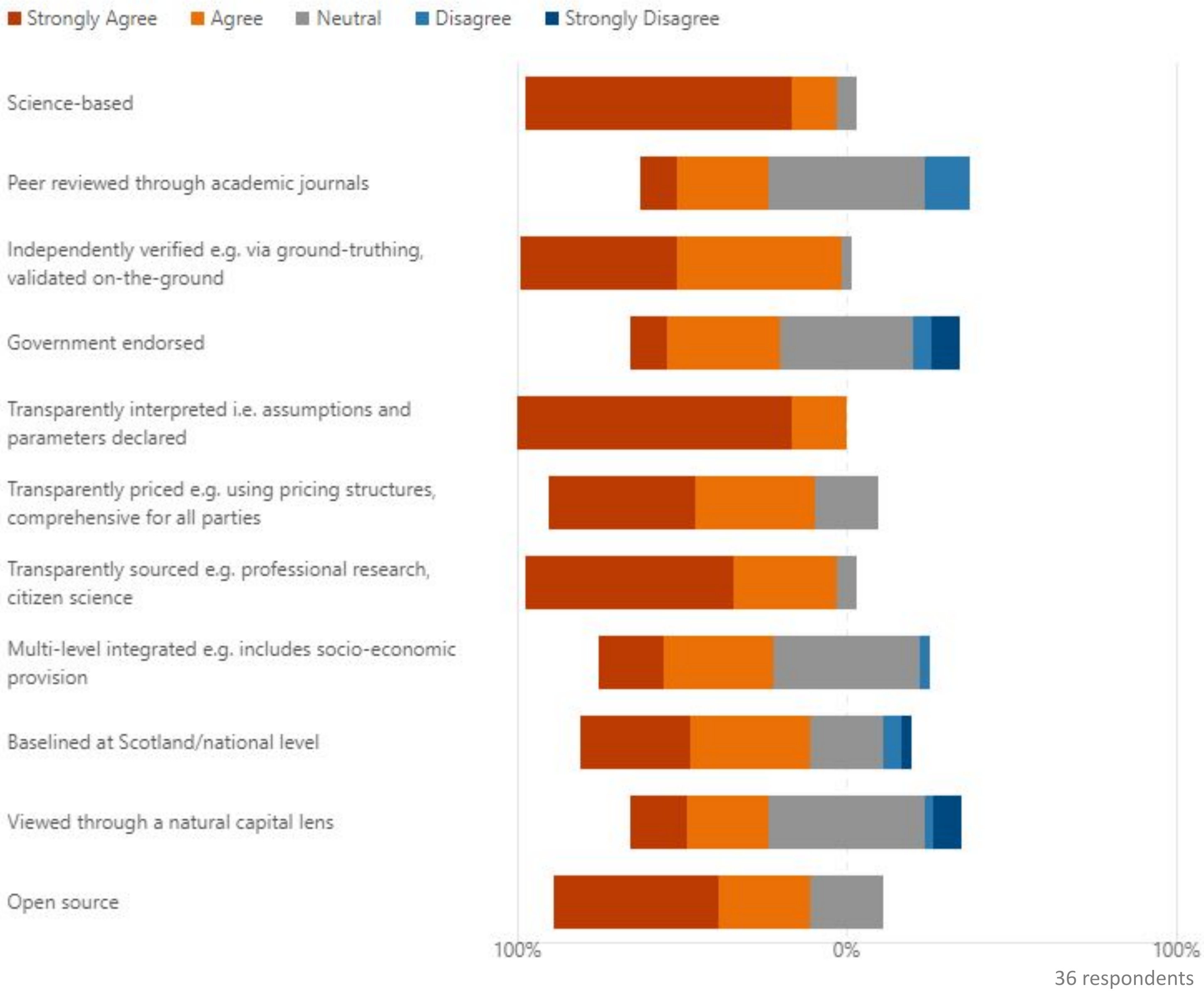
The ideas and issues raised in the survey are a starting point for the conversation and a guide for the avenues the new hub can explore.

With thanks to all who participated.

Interactive results are available here

Shetland Islands - European Space Agency CC2.0

1. Good biodiversity data is...



Key Findings

100% of respondents strongly agreed or agreed **good biodiversity data is transparently interpreted**

97.2% of respondents strongly agreed or agreed **good biodiversity data is independently verified**

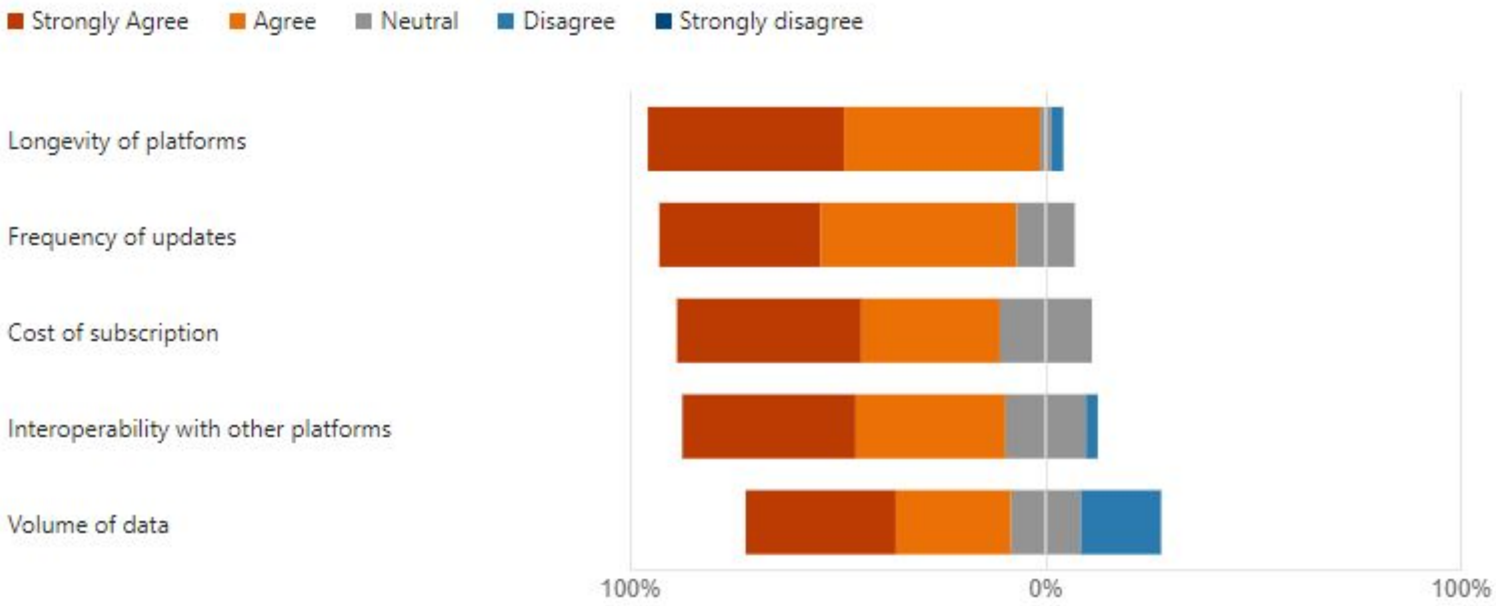
94.5% of respondents strongly agreed or agreed **good biodiversity data is science-based**

94.3% of respondents strongly agreed or agreed **good biodiversity data is transparently sourced**

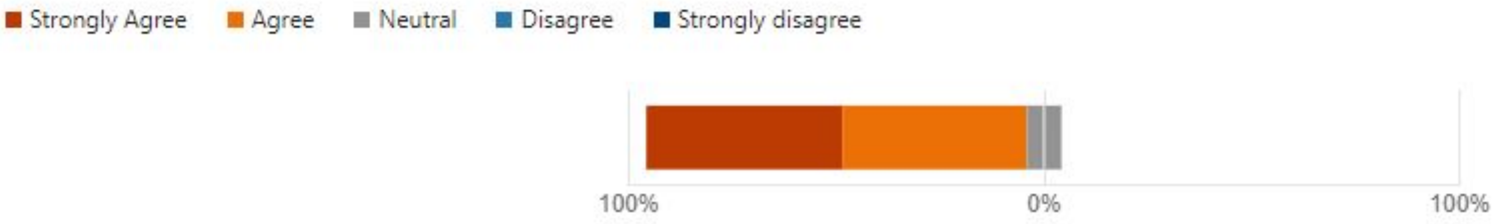
77.8% of respondents strongly agreed or agreed **good biodiversity data is open-source**

Transparently interpreted
Independently verified
Science-based
Transparently sourced
Open-source

2. **The risks of digital measurement, analysis and interpretation of biodiversity data include:**



4. **Validated data can connect investors, project developers and the wider community.**



Key Findings

Longevity of platforms is a risk of digital management of biodiversity data (84.4% strongly agree or agree)

Cost of subscription is a risk of digital management of biodiversity data (77.7% strongly agree or agree)

Validated data can connect interested parties (91.7% of respondents strongly agree or agree)

3. Are there other risks of digital measurement, analysis and interpretation of biodiversity data?

Key topics from responses

Accessibility
- Lack of digital skills and infrastructure
- Complexity of data for non-specialist use
- Multiple sources for similar data

Accuracy
- Remote data accuracy
- Scalability and loss of detail
- Incomplete coverage data
- Reduction of physical monitoring
- Consistency of models
- Data collection islands
- Comparability of data
- Validation & verification of citizen science data

Integrity
- Bias of data collection and interpretation
- Appropriateness of models
- Misuse of data for commercial profiteering
- Accountability for updating data and analysis
- Trustability of AI algorithms
- Lack of data standards and standardised processes

Technology issues
- Cyber security
- Tech adoption delays - scientific confidence
- Transferability as systems evolve
- Lack of fit for purpose sensors

Human factors
- Uncertainty of value to decision makers
- Disconnection of communities from data gathering
- Disconnection in relationships with landowners/land managers

Climate impacts
- Climate impact of cloud storage
- Power requirements for remote measurement
- Electronic waste

5. What kind of digital technologies are going to be increasingly important to help us analyse and understand data on natural capital?

AI
- for augmented analysis, validation and verification

Apps
– multi-user access for ground-truthing, auditing, baselining, monitoring over time

Automatic data loggers

Bioacoustics
- low cost for long term monitoring

Citizen science
information through apps; open-source map-based platforms for data sharing

Cloud-based access
to customised views

Comms solutions

Database management
at scale, with local level accessibility

Data-lake approaches

Digital technologies combined
with field assessment/site surveys

Drone surveys/UAV

Earth observation

eDNA
- automated regular screening

GIS
- map layers, location analysis at local scale

Ground sensors - hyperlocal nature tech sensors

Increased network coverage

Increased resolution of data

Internet of Things IoT

LiDAR habitat surveys

LLMs
applied to data queries and visualisation

Real time

Reduced latency

Remote sensing - all types

Satellite imaging

Species ID via video

Technology to capture data on specific events
- with different data capture rates

Definitions	
AI	Artificial Intelligence
Citizen science	The collection and analysis of data relating to the natural world by members of the general public, typically as part of a collaborative project with professional scientists.
Data-lake	A repository that stores, processes, and secures large amounts of data
Earth Observation (EO)	The use of remote sensing technologies to monitor land, marine (seas, rivers, lakes) and atmosphere.
eDNA	Environmental DNA describes the genetic material present in environmental samples such as sediment, water, and air, including whole cells, extracellular DNA and potentially whole organisms.
Internet of Things (IoT)	Devices with sensors, processing ability, software and other technologies that connect and exchange data with other devices and systems over the Internet or other communications networks.
LiDAR	Light Detection and Ranging, is a remote sensing method that uses light in the form of a pulsed laser to measure ranges (variable distances) to the Earth.
LLM	Large language model (LLM) - a specialized type of artificial intelligence (AI) that has been trained on vast amounts of text to understand existing content and generate original content.
UAV	Unmanned aerial vehicle
Remote sensing	Remote sensing is the acquisition of information about an object or phenomenon without making physical contact with the object

6. What are the new sources of data that are going to be increasingly important?

Audio - many taxa can be analysed

Automated monitoring data - from drone surveys

Big data - through data analytics; machine learning and AI

Citizen owned data - community observation/community sourced, social media

Climatic and environmental condition data - from IoT

Ground truth survey data – role of soil to be considered further

High resolution local data

Large scale assessment data – from combined sources

Model output data - predictive scenarios (with caution)

On-Farm data from machinery and GPS traces

Presence absence and relative abundance data - from eDNA

Private data on land management - held by RPID (Scottish Government's Rural Payments and Inspections Division)

Project derived data

Remote habitat surveys


Forsinard Flows NNR -checking peatland dams ©Lorne GillSNH NatureScot

7. What technologies will be important for transparency within biodiversity data, from collection to analysis to publication?

AI - to make the processes of finding metadata can more efficient (if properly provided by people)

Apps with map layers

Better stock and collaboration of data analytics scripts on platforms such as Git

Blockchain and NFT

Clear pipelines, open data at all stages

Corroboration of evidence through multiple sources

Easily accessible metadata with good, coherent metadata standards - UAVs are making metadata more consistent and transparent

eDNA - diversity within species can be identified (the number of individuals making a data set)

Flexible platforms that enable monitoring to be prioritised and to share data via APIs with high quality metadata

Historic changes in land use cover linked to species

Machine Learning and other AI approaches

More automated and digital ways to collect data by people - community involvement using apps etc

Natural Language Generation to support informed feedback to users

Open-source platforms

Similar data collected at different scales and then compared

Verification of records through digital fingerprinting

Definitions	
API	A set of functions and procedures allowing the creation of applications that access the features or data of an operating system, application, or other service.
Blockchain	A blockchain is a distributed ledger with growing lists of records (blocks) that are securely linked together to form a chain. Once recorded, the data in any given block cannot be altered retroactively without altering all subsequent blocks.
Git	Git is a version control system (VCS) that stores its data in a series of snapshots of a miniature filesystem.
Metadata	A set of data that describes and gives information about other data.
Natural Language Generation	Natural language generation (NLG) is a subfield of artificial intelligence that produces natural written or spoken language. NLG enhances the interactions between humans and machines, automates content creation and distils complex information in understandable ways.
NFT	A non-fungible token (NFT) is a unique digital identifier that is recorded on a blockchain and is used to certify ownership and authenticity. It cannot be copied, substituted, or subdivided. The ownership of an NFT is recorded in the blockchain and can be transferred by the owner, allowing NFTs to be sold and traded.

8. Do you have any good examples of tools for measuring ecosystem health you'd like to share?

SmartLoop - Sensor-based Solutions for Rural Scotland

Environment Systems SENCE (Spatial Evidence for Natural Capital Evaluation)

LoRaWAN - Long Range Wide Area Networking

peatscope.com

RIVERTOOL (Riparian Vegetation Ecosystem Services-based Ranking Tool)

IoT devices

SEPA Water Classification Hub

Camera traps

AI

Photogrammic UAV flights

Rewilding Europe rewilding score

Electrofishing

JHI Natural Resource Datasets

Invertebrate surveys

ECOFOREST - Spatial Multi-Criteria Analysis

Audio recorders

Remote sensors

Satellite imaging

Wildlife cams

Soil Mentor

Phase 1 habitat surveys

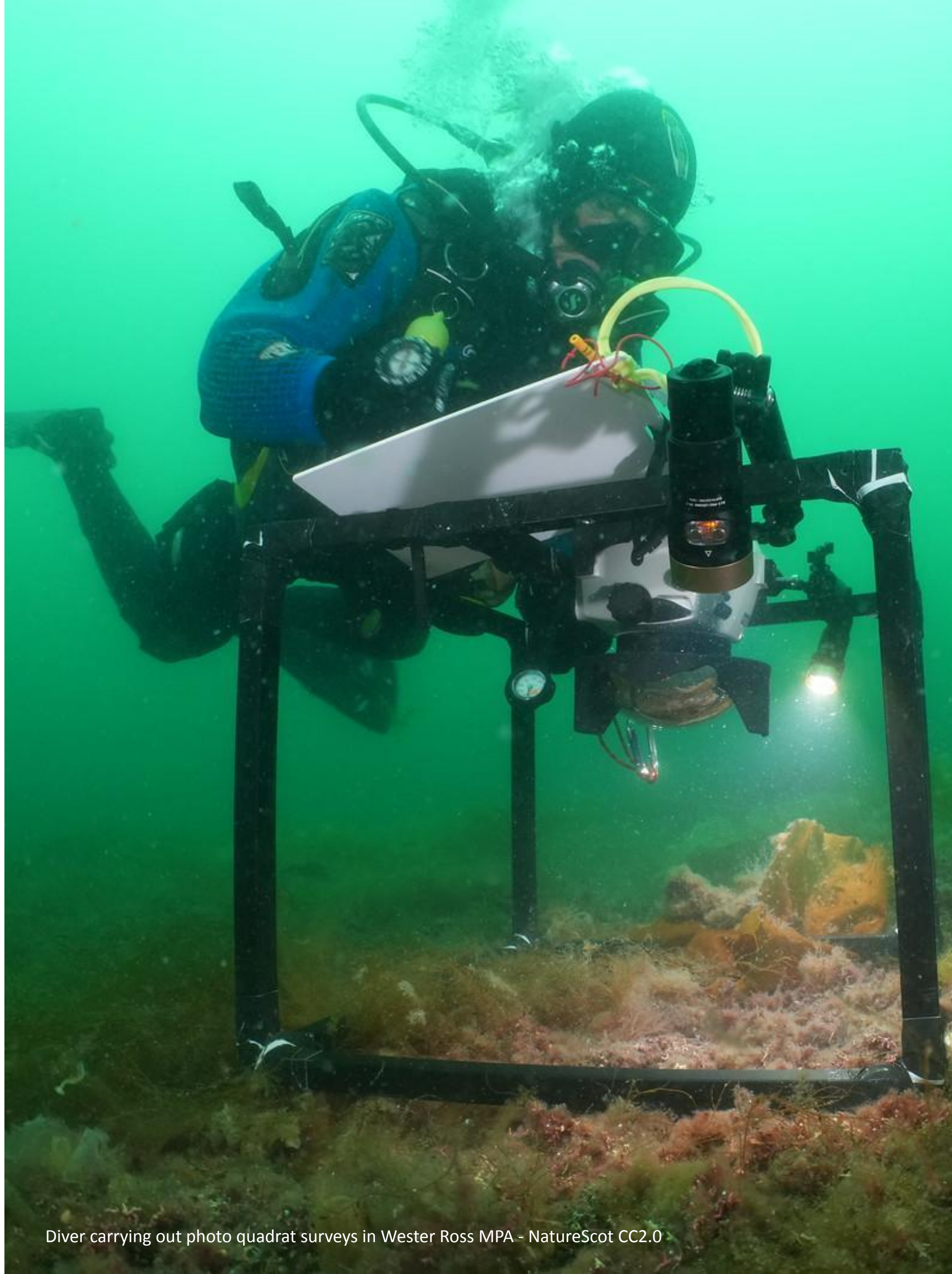
eDNA

CreditNature NARIA framework

River Habitat Surveys (RHS)

LiDAR UAV flights

Netting/trapping/tagging/tracking



Diver carrying out photo quadrat surveys in Wester Ross MPA - NatureScot CC2.0

9. Do you have any good examples of data applications and use cases you'd like to share?

Union Island Climate Change Vulnerability

ACE Nature's WildMaps

Mergin Maps

A Natural Capital Evaluation of the Cotswolds National Landscape

RIVERTOOL (Riparian Vegetation Ecosystem Services-based Ranking Tool)

NatureScot InformedINSIGHT (in development) - multiple data sources mapped at multiple scales

Rethink Carbon

Derbyshire's Natural Capital Strategy

Weather and water level data facilitating when and where to survey

Citizen science data pushing for better sewage control

Land management automation

Electrofishing data evidencing impassability of barriers to fish migration

Invertebrate data evidencing pollutant levels; RHS and Phase 1 habitat surveys showing habitat degradation or progress (after interventions) over time

LiDAR derived elevation data for flow modelling and design of implementations (e.g. flood, droughts, erosion, leaky dams, etc)

Using Biodiversity data to match landowners' nature-appetite to a third party's development footprint which needs to comply with Biodiversity Enhancement (voluntary or regulatory) in a planning application.

Carbon capture in peatland restoration

Species abundance and diversity in habitats

A Natural Capital Evaluation of the Cotswolds National Landscape

10. What else do you think needs to be highlighted and discussed in the Digital Enablers for Natural Capital hub?

Key topics from responses

Access Issues

- Access to open-source data
- Data ownership -use of proprietary software/platforms, digital commons
- Digital translations of proprietary/bespoke metrics against national standards
- Lack of communication towards data users regarding updates, newly published data-sets, changes, updates, etc
- Streamlining time it takes to update current data-sets for users
- User-friendliness in acquiring data licenses
- Pricing and licensed data
- Budget allocation for data collection

Standards and Integrity

- Understanding bias
- Openness around tools' aims and objectives
- Standards both for species recognition and metadata
- Biodiversity credit schemes and communities

Data Sharing/ Coordination

- Interoperability of tools
- How do we maximise data sharing and an understanding of how commercial, government-led and open model tools complement each other?
- Coordination and integration of outcomes across policy areas

Methodologies

- Monitoring on sites post habitat restoration
- Water and soil as key indicators of ecosystem health

Collaboration and Learning

- Collaboration hub/collaboration opportunities
- Learning from other platforms mistakes and success
- Useful and interesting work being undertaken overseas to improve environmental performance of projects
- Data sharing processes and examples of good practice

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