CENTRE OF EXPERTISE FOR WATERS

Appendix 4: Focus Group Report – The role of monitoring in advancing the evidence for river woodland benefits: an expert position statement

Susan L. Cooksley, Julia McCarthy, Jennifer Dodd, Richard Gosling, Rebecca Lewis, Roberto Martinez, Tommy McDermott, Ewan McLaughlin, Roger Owen, Julie Rostan, Marc Stutter

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1 Introduction

The creation of native woodlands in river corridors is widely advocated and extensively implemented within freshwater ecosystem restoration projects. The expectations for the benefits are wide-ranging, including creating resilient ecosystems, reversing biodiversity loss, reducing flood and drought risk, storing carbon, and bringing health and wellbeing benefits. Given the long-term nature of woodland establishment, it is essential to get projects right first time and to do this, we need to fully understand hydrological and ecological responses against the background of a changing environment. Yet (as with wider river restoration projects) evidence is lacking (England *et al*., 2021) and improving approaches to monitoring is critical to provide evidence-driven decisions to strengthen the case to funders and landowners, as well as guiding government strategy and policy.

Here, experienced experts in environmental monitoring present our collective recommendations for how monitoring practices must be implemented, coordinated and promoted to provide the much-needed robust information. This focus group included academics, practitioners, consultants and water policy regulators. All have extensive experience of designing, implementing or using data from monitoring programmes in freshwater restoration. The group worked through a staged process (Figure 1) to develop this agreed position statement. This was part of the RivyEvi project on river woodland evidence (Figure 2) commissioned by Scotland's Centre of Expertise for Waters (CREW). The main report and all project outputs can be found on the CREW website.

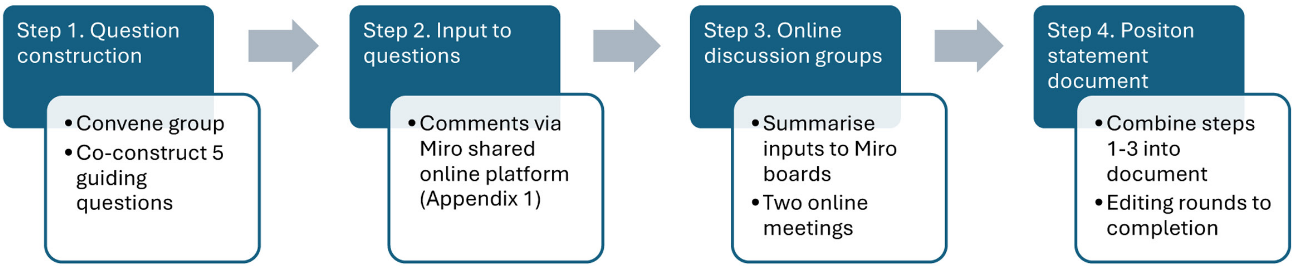

Figure 1: Focus group activities (October 2024 to January 2025).

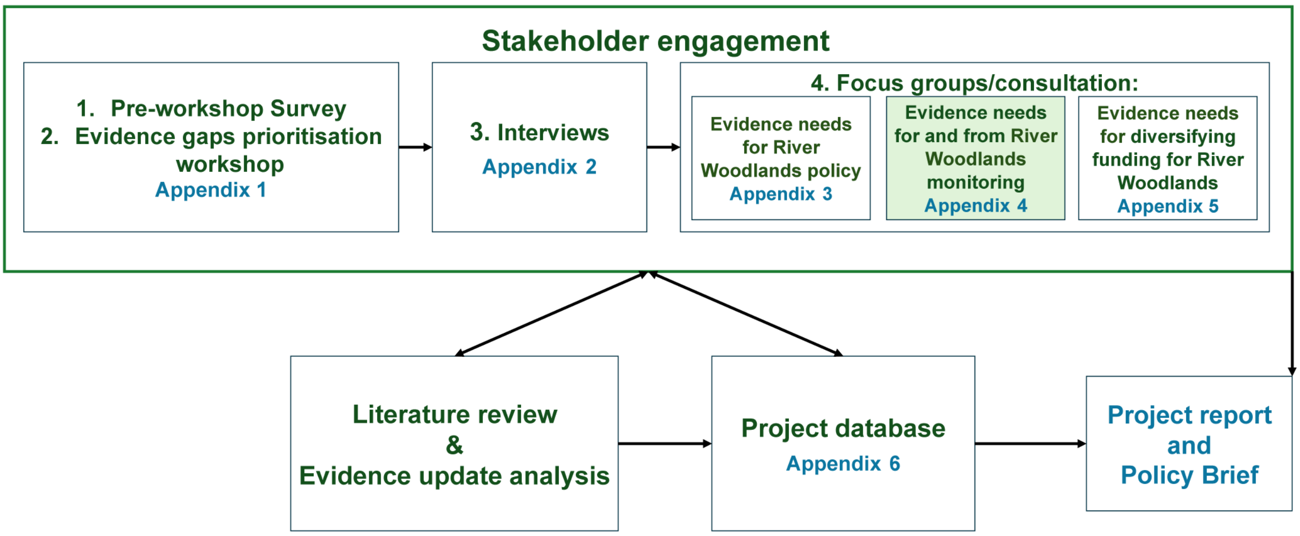

Figure 2: Overall project structure.

2 Scope

The monitoring focus group considered all current activities that increase native woodland in river corridors, including the introduction of dead wood instream and on floodplains. Discussions were structured around five questions:

1. Which areas of evidence would benefit from improved monitoring?
2. How can we improve the way we monitor?
3. How can citizen science contribute to monitoring?
4. How can we achieve synthesis of knowledge across monitoring sites/databases?
5. What areas of policy and funding can be unlocked by riparian woodland – and vice versa.

Monitoring and assessment in river restoration are undertaken for many purposes, which are often confused and conflated. Here we distinguish between monitoring for:

a. management i.e. evaluating project progress (e.g. browsing pressures),

b. accountability i.e. auditing project deliverables (e.g. tree numbers and species planted, length of fencing), and

c. effectiveness i.e. evaluating project outcomes (e.g. effects of restoration on ecosystem development).

As these three purposes are closely related, there is a tendency to refer to these interchangeably, but they are different activities and should be planned separately (Sutherland 2022). This document mainly focuses on the third, the effectiveness of river woodland creation.

3 Which areas of evidence would benefit from improved monitoring?

This section explores which area would benefit from further monitoring and underlines the type of monitoring and techniques that could be suitable (Table 1).

3.1 Evidence for effectiveness in achieving desired outcomes

3.1.1 Biodiversity effects: instream large wood structures

In general, the biodiversity benefits of riparian woodland are well established (e.g. Broadmeadow *et al*., 2010), although there are many complex pathways between processes and biological responses, and care is needed when attempting to isolate specific impacts. There is also good evidence for the hydromorphological and biodiversity benefits of natural wood in rivers. However, the published evidence for the benefits of introducing large instream woody structures (LWS) is lacking. This is especially the case for energetic Scottish upland rivers (Soulsby *et al*., 2024) where the ecological effects across multiple scales need investigation. Roni *et al*. (2015) found that fish were attracted by the structurally complex woody habitats but did not respond with increased abundances on larger scales. Angler *et al*. (2022) argue for more coordinated restoration projects that incrementally increase large wood and are followed by a rigorous assessment of hydromorphological, biological, and functional effects. A collaboration through NERC led by Exeter University, working with Edinburgh University and SEPA includes study sites in Scotland and England (starting in November 2025, 3 years). Guidance on wood placement is being developed (SEPA).

3.1.2 Shading and water-cooling effects

Riparian trees can shade river channels, reducing the amount of solar radiation reaching the water surface. By increasing the number of trees on riverbanks it is possible to reduce river temperatures and mitigate some of the effects of climate change, however, the temperature consequences have not been quantified (Jackson *et al*., 2021). The Scotland River Temperature Monitoring Network (SRTMN) (Marine Directorate) aims to prioritise efforts to river reaches where they can deliver the greatest benefits in terms of climate change adaptation.

3.1.3 Flood peak magnitude effects

Trees contribute to reduced and delayed flooding in several ways. Their canopies intercept rainfall, roots improve rainwater infiltration through improved soil structure, and woodland structure increases ground roughness, slowing overland runoff. Empirical evidence from Australia shows positive effect of 'regreening' river corridors on slowing flood peaks, however, how riparian/ floodplain woodland expansion (and in channel large wood) affects hydraulic roughness (and the knock-on effects on flood depths/extents and flood peaks) remains a key question. More widely, integrated understanding of a network of combined natural flood management interventions at a large catchment scale is necessary for future nature-based flood mitigation strategies (Zhu *et al*,. 2024).

3.2 Evidence for timescales for effect

Timescales for the benefits of riparian woodland to take effect have not been investigated (e.g. bank stabilisation, canopy shade, large wood inputs). It is useful to think of not only of time taken to reach the endpoint (ultimate target condition) but also what could be shown at interim timescales to demonstrate that a site is 'on track' to achieving this benefit. Woody vegetation is the key example. It can take a very long time to establish canopy cover that shades a stream. However, if one goal is a naturally regenerating woodland, then a site ca be shown to be 'on track' by recording that there are multiple age classes present, natural regeneration, etc. Therefore, it would be helpful to understand how long it takes for a measurable/detectable change in response indicators. Initial assessments suggest that 10+ years is needed for many benefits to accrue, up to 50 years for others. Moreover, trade-offs may be delayed as ecosystem processes occur at a variety of timescales (Brauman *et al*., 2007).

Key timescales questions:

- How does the influence of riparian forest change as it grows?
- What are the timescales of recovery of different functions?
- What are the maturity thresholds for establishing sustainable large woody material input?

3.3 Evidence for woodland creation methods

Riverbank ecosystems (and the floodplain beyond) are an integral component of functioning stream ecosystems yet riparian restoration is often restricted to a narrow zone of just a few metres wide. Species selection, placement and protection determine the level of function of the river/riparian area.

Key woodland creation questions:

- What are the best approaches for establishment, tree protection and placement design?
- What is the likely future effectiveness of small enclosures in achieving river woodland objectives?
- What minimum riparian areas are required in different situations?
- How to link this to policy and planning?

3.4 Evidence relating to potential conflicts

There is a need for evidence to inform guidance on potential conflicts between riparian woodland and other interests. These include other biodiversity targets (e.g. beaver, species rich grassland, waders, peatland), access (e.g. fishing, canoeing) or infrastructure (bridges, culverts). There is also the question of land conversion and the loss of this land for other purposes, which throws up some conflicts when perceived as land "grabbing" by large companies for carbon offsetting. Key conflicts questions:

- How to integrate river woodlands with biodiversity, access and infrastructure?
- Can a rewilding approach (which is less prescriptive) be more effective in managing potential conflicts?

Table 1: Evidence areas that require monitoring data.		
Monitoring	**Improvements needed**	**Key evidence areas leveraged**
Effectiveness	Biodiversity (LWS). Shading and cooling. Flood peak.	Strengthened case for ecosystem scale benefits.
Timescales	Monitoring timescales of processes and ecosystem benefits.	Overall appreciation of timescales to various benefits. Linking woodland stages to functional changes.
Monitoring & assessment methodologies	Use analytical advances. More, more consistent, baseline reporting.	Success of differing woodland design, implementation and management options. Support for overall benefits and function assessments.
Use new monitoring technologies	Developments in eDNA. National Scale LiDAR in Scotland. Eco acoustics.	Potentially better indicator of effects on watercourse biodiversity but requires further development of techniques.
Reference conditions	Setting reference conditions and use of ecosystem functional approaches.	Ultimate functional restoration goals to be representative of the type of riparian ecosystem within attainable catchment improvements.
Methodologies and metrics	Improved and consistently applied response metrics.	Metrics target responsive parameters according to river/woodland types. Consistent methods improve evidence translation to policy, businesses and communities.
Ecosystem resilience		Synthesis of current approaches to assess resilience and application to existing and emerging monitoring information.
Data synthesis	Data collation to improve knowledge outcomes recognising resource intensity of monitoring done well.	Improved understanding of response typologies, model development and prediction ability.
Communication	Communication of what's known, what's not and uncertainties.	Build confidence in data and evidence generally, identify and prioritise evidence gaps.

4 How can we improve the way we monitor?

4.1 Establish monitoring methodologies based on analytical advances

Standard monitoring protocols for widespread use need to be streamlined and more powerful. To achieve this, assessment of what we should be monitoring is foundational to improving how we monitor in stream restoration' more and better-planned monitoring is not the only route to improving evidence. Monitoring design improvements include the selection of relevant response variables, which need to be both relevant and responsive to change at the relevant scales (temporal/spatial). There is a need to plan for the collection and analysis of the "raw" data and not only analysis of the summary metrics (like richness, substrate phi) as the advances in analytical techniques means there are opportunities do develop new methodologies. An ongoing long-term RESAS research project is developing this approach as part of the Achieving Nature Based Solutions workstream within the 2022-2027 Programme.

There is a need to develop assessments which can be employed and are repeatable by non-specialists, that evaluate a suite of function-based metrics/indicators, either specific to riparian areas or included as part of a broader stream assessment (e.g. RCA/MoRPH). It would be useful to include the standardised collection of project-related metadata e.g. extent, interventions etc. Agreed standardisation monitoring protocols should be required of developments that include riparian planting as part of BNG/mitigation.

4.2 Set project-specific monitoring strategies

Within the context of deploying up to date monitoring methodologies, stream restoration projects need to set monitoring plans that will evaluate the stream functions of interest to them. Therefore, the start of a restoration project needs to identify the aims of monitoring required (accountability, effectiveness, management?), anticipated timescales of recovery (what are the stepping stones to success?) and resources available (who will collect what data and how it will be managed, analysed and shared?). These factors will determine the scale of the monitoring strategy employed (Figure 3).

The appropriate study scale also needs to be considered. What is important is to monitor ecosystem attributes that are meaningful at the relevant spatial/temporal scale. This document advocates a need for both project/reach-scale and larger-scale monitoring studies; not all reach scale changes will be detectable at a catchment scale, particularly if there are significant pressures acting within the catchment that may limit large-scale improvements. Two scales of effect need to be considered: space (monitoring of the benefits of river woodlands at whole catchment scales is lacking) and time: (different woodland functions and subsequent recovery of river functions depend on tree growth and maturity thresholds, plus additional process lag times and resilience to change).

4.3 Set evidence-based monitoring targets/objectives

It is important to agree from the start what success will look like i.e. define the reference expectations and condition gradients and set targets based on that. While the pre-industrial condition is often the benchmark for a high-functioning river corridor, in many areas loss of original woodland often occurred well before this. For each any measure, what range of values reflects a poor condition versus the range of values that would be expected in a high functioning system, and how do these expectations/gradients vary across stream types?

Restoration potential is affected by the catchment and site context - even if the reference expectation for that type of stream is x, this may not be achievable if there are pressures acting outside the project area or constraints within the project area that will limit restoration potential. This decision-making process may moderate the reference expectation for a particular stream in that setting, as it may not always be achievable (FAO, 2024). This requires defining reference conditions across a gradient of stream types, linked to responsive indicators (see RICT and RIVPACS). This is complicated by river functional gradients and restoration expectations, shifting baselines for many potential monitoring receptors and bio-geomorphic feedbacks with riparian regeneration. For a discussion of the importance of stratification/classification, selecting relevant metrics and reference expectations see Gabrielle *et al*. (2021).

The ability of the system to recover and evolve in the rapidly changing environment should also form part of the assessment and monitoring priorities. Resilience has been defined from two different viewpoints, which highlight different aspects of how stability can perpetuate within a system. One definition focuses on stability near an equilibrium steady state, the systems resistance to disturbance, and the speed of return to the equilibrium. The other definition considers the ability of the system to flip into a different regime of behaviour and resilience is a measure of the magnitude of disturbance that can be absorbed before a system changes into another state. Both of these should be considered.

4.4 Utilise advances in science and technology

Technological developments have the potential to improve monitoring. Examples include:

a. New devices that measure dead wood transported in rivers using AI image analysis software to analyse camera footage from rivers.

Figure 3: Riverwoods Initiative monitoring scale

As with environmental flows, this technique is based on a reference catchment for typology and links results of wood passage to the catchment and flows (Ghaffarian *et al.,* 2020). This could be used to advance field-based monitoring approaches. For example, the Large Woody Debris Index.

b. eDNA techniques and capabilities are constantly improving and are more widely used.

c. AI to scale up analysis of remote sensing data e.g. using object detection algorithms on satellite, aerial, and drone imagery/lidar to monitor changes in the catchment. These changes may include woodland regeneration, bank erosion, deposition, habitat creation, surface runoff changes.

d. National Scale LiDAR in Scotland could benefit the way riparian vegetation is assessed. SEPA is in discussion with ScotGov about this.

e. Developments in the field of acoustic monitoring should be investigated to the measurement of physical and biological responses.

5 How can citizen science contribute to monitoring woodland creation?

5.1 Examples of citizen science in freshwater monitoring

Citizen science can be a useful and affordable approach to monitoring and techniques exist for ecological, physical and chemical health assessments. Aquatic invertebrate monitoring is undertaken by the Riverfly Monitoring Initiative established in 2002 (delivered by Buglife's Guardians of our Rivers – Buglife projects in Scotland), and the new SmartRivers initiative (Wildfish). Environmental DNA sampling by citizen scientists is currently being trialled. While Riverfly and Smartrivers both generate water quality indicators, water chemistry is also assessed directly by Earthwatch's FreshWater Watch which is popular with volunteers because it provides direct results.

The citizen science framework for hydromorphology is Modular River Survey (MoRPH), a comprehensive system for understanding the stability and function of rivers at multiple spatial scales, from local habitat to whole-catchment analysis. The MoRPH survey method was designed to enable citizen scientists to monitor physical habitat mosaics and human pressures within short (up to 40 m) river reaches. The MoRPH method can be made robust using a BACI format. It has been applied to in-stream large wood monitoring in a suburban river restoration case study (Shuker *et al*., 2024) but there is a need to derive appropriate methods for active highland rivers. MoRPH is currently being modified for Scotland (Buglife and SEPA are involved in this).

Together, these 3 techniques (Riverfly, MorPH and Freshwater Watch) help to build comprehensive understanding and provide a citizen science equivalent of the WFD testing for River Health.

5.2 Ensure robust and useful data

The keys to ensuring utility of data gathered by citizen scientists are the same as within mainstream research and regulation: data availability, collation, quality control and standardisation. Quality accredited citizen science data is becoming available (e.g. RiverFly 'trigger levels' and SmartRivers quality accredited data). Consequently, research and policy are starting to use citizen science monitoring data for taking action/decisions. Both Riverfly (and Extended Riverfly) and SmartRivers data are used to generate water quality indicators. Whether these are responsive at a project scale will be, at least in part, dependant on the contributing catchment context.

5.3 Ensure consistency over time

Volunteers needs consistent training, engagement and support. Maintaining volunteering networks requires development of the programs to provide ongoing learning opportunities to promote long term engagement (low volunteer turnover helps to increase data consistency), as well as feedback from research, policy and practice to maintain capabilities and remain engaged long term. However, long-term funding is difficult to achieve. In addition, upholding standards, data validation, consistency, communication (analysis and reporting) require time from supporting organisations.

6 How can we synthesise knowledge across monitoring sites/databases?

6.1 Identify and signpost existing data sets

Overall, the picture of River Woodlands monitoring is complex (Figure 4). Extensive data are collected but most are not widely available. It would be helpful to build an understanding of what is/is not currently being reported on centralised or open-source platforms/datasets e.g. species are reported on NBN Atlas, data from individual biodiversity net gain/mitigation monitoring programmes, no centralised reporting for morphology. A review of major monitoring schemes, e.g. by fisheries bodies, would be useful to harmonise efforts. Considerable data are gathered by private consultants, and it would be useful to find a way to bring these together (similar to farm soil sampling done by agri-consultants).

The next step would be to investigate setting up, managing and promoting a data repository hub.

This is a large long-term commitment. Existing open access data platforms (Table 2) need to be visible and able to integrate as vehicles for collating and integrating disparate monitoring data into digestible content for stakeholders and advocates. SEPA has looked at options for project-specific data collection and best practice recommendations – and whether e.g. RRC or Riverwoods Digital Centre of Excellence could assist. Projects including River Woodlands monitoring are shown in Table 3.

6.2 Consider options for standardisation

Knowledge synthesis is essential to understanding the accumulated effects of afforestation at larger catchment scales and lengthening times. The scattergun situation of monitoring means that data are not used being effectively. Standardisation across projects would enable meta-analyses. Although this may not be realistic, establishing a suite of standardised projects may be possible.

6.3 Promote the value of data sharing

a. Supporting data needs to match across scales – from larger scales like WFD monitoring to smaller scale project measures.

b. Promote shared protocols, indicators, metrics.

c. It is essential to establish indicators and metrics that are appropriate and repeatable, create protocols and share them and select the scale. This needs protocol development with training, QA/QC procedures (good example is data forms) or ideally apps/digital forms. David *et al.* provide a process framework for the elements needed to develop an assessment approach.

d. There is a need for communication of spatial configuration of site layout, methods and results relationships in space and time. Studies at larger spatial- and time- scales often have differing methods and probabilistic data collection. There has been work in the US dividing up the system for separate methods This reference provides an example of a reach-scale assessment, with info on how to delineate assessment reaches within a project area and an illustration of the sampling layout for different metrics within each assessment reach: https://usace.contentdm.oclc.org/utils/getfile/collection/p16021coll11/id/6832

e. River woodland projects should include a communication plan about the importance of monitoring riparian woodland and sharing knowledge. The planned audience should include restoration communities, river trusts, etc. and training provided.

6.4 Understand barriers to data sharing

There is a need to understand the barriers to data sharing (practicalities, data sensitivity, lack of awareness, bias to hide negative trends) and make it easy and rewarding to do so. Examples of projects designed to enable meta-analyses include:

- The IUCN River restoration and Biodiversity initiative led by NatureScot (Addy *et al.*,) which aims to bring together projects, using standardised metrics.
- The Riverwoods Digital Centre of Excellence being developed.
- The Scottish Freshwater Group data hub.

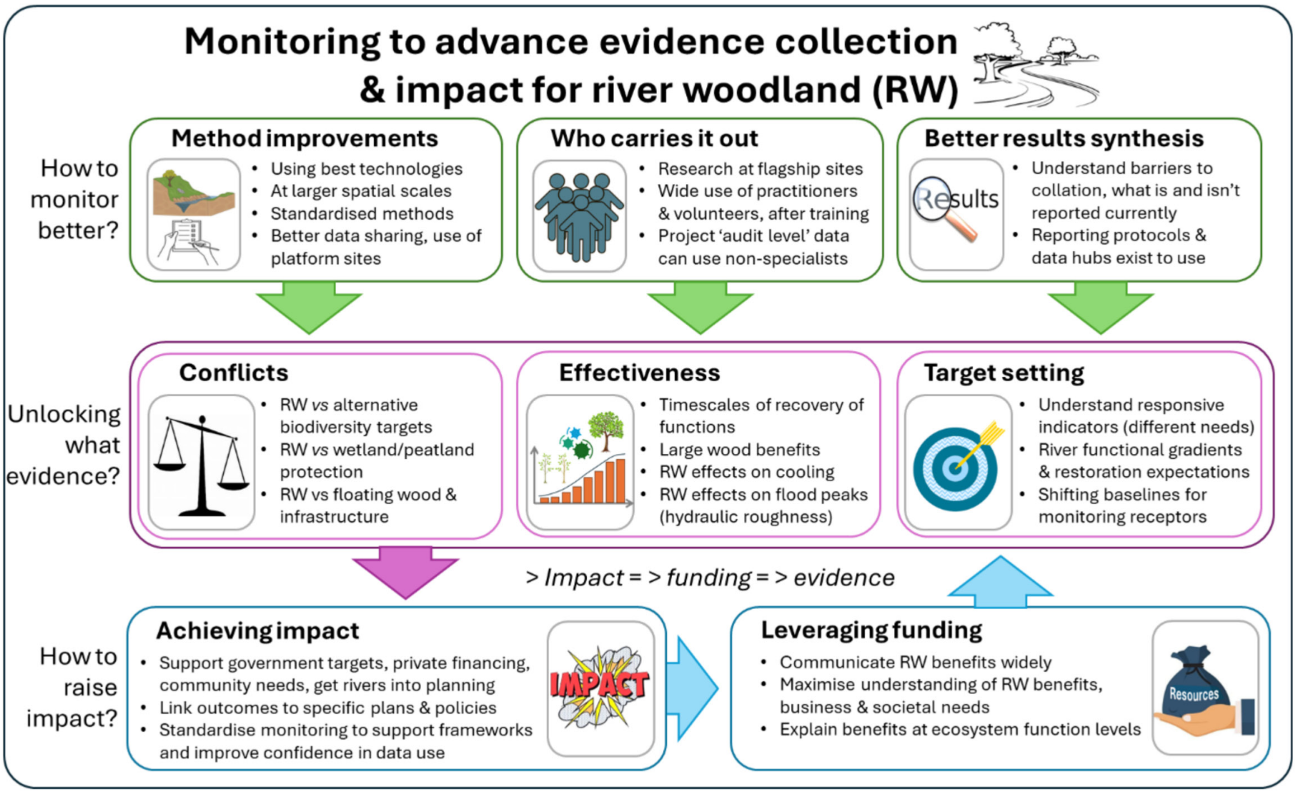

Figure 4: Relationships between different aspects of river woodland monitoring.

Table 2: Databases relevant to river woodlands.

Project	Access	Link
Riverfly Partnership	Open access citizen science databases	Scottish Freshwater Group
SmartRivers	Open access citizen science databases	Scottish Freshwater Group
SFG webpage that integrates datasets	Open access	Scottish Freshwater Group
Controlled Activities Regulations (CAR) register	Open access	CAR register
Riverwoods Digital Centre of Excellence	Open access	Riverwoods website (please then navigate to the Digital Centre)

Table 3: Examples of projects that include river woodland monitoring.		
Project (lead)	**Summary**	**More information**
Eddleston Water (Tweed Forum)	Found responses in headwaters but no effects to main stem. Leaky dams and woody debris additions differ from natural wood from riparian forest growth.	
Easter Beltie restoration (James Hutton Institute)	Full BACI long-term research on impacts of restoration. Includes sampling around large wood structures. RESAS-funded.	
Temperature effects on Atlantic salmon (Glasgow University)	Found that salmon are poor receptors in monitoring due to impact of fish returns on the data	
US research looking at riparian benefits	Found many links to water quality benefits, where another challenge for a functioning riparian corridor was wider interactions with the river, functional connectivity etc, challenging to develop that and based on expert judgement. This defines an important gap.	See works by Ellen Wohl, Dave Merritt and others. Also, the decision-making process and key references used to develop riparian metrics in the Wyoming Stream Quantification tool here. Note that these types of science support documents are available for all SQTs that have been developed to date.
Forest Research work on shading of pools in the New Forest	Ongoing work on confined and unconfined riparian situations and species expectations. This is complex and depends on the quality of datasets – needs to develop through expert process.	
	River condition assessment (in MoRPH) uses reference conditions.	

7 What areas of policy and funding can be unlocked by riparian woodland – and vice versa?

7.1 General points

Standardised monitoring resulting in clear evidence for benefits would provide evidence to leverage policy and funding support. There is a need to establish the business and societal benefits, as drivers of future funding for applications. For example, for Scottish Water a key driver is water quality, while distilleries have a greater focus on water temperature and supply.

7.2 Crediting mechanisms

There are several groups working on crediting mechanisms to encourage private investment in trees for the ecosystem services they provide. The Woodland Water Code (equivalent to carbon code, being developed by Forest Research) is a crediting mechanism to encourage private investment in trees for the ecosystem services they provide. This has three key elements to assess for credits: water quality, flood alleviation and shading and metrics are being developed. They aim to explore applications using different Laboratory Catchments in the UK.

7.3 Links with specific plans and policies

Scottish Government has a need for investment to provide resilient ecosystems. The correct evidence can lead to investment in the strategic direction for river woodlands. Monitoring that conveys the contribution of riparian areas to overall stream ecosystem condition/integrity could unlock investment/market opportunities e.g., Biodiversity Net Gain/offsetting. To do this we need to expand beyond an ecosystem services approach and emphasise ecosystem functions. How do you use policy to incentivise expanding natural riparian corridors (e.g. agricultural payments, tax incentives, implementing the mitigation hierarchy, etc)? How can monitoring help to communicate the benefits of wider riparian corridors e.g. providing ecosystem services and contributing to ecosystem integrity?

Notable linked plans and policies are:

- **BSI Flex 702** (framework for operation of nature markets) takes an ecosystem approach, with an emphasis on both biodiversity and ecosystem condition assessments
- **National Planning Framework 4 & Local environmental planning** could include better assessment of blue and green infrastructure
- **Scottish Biodiversity Strategy**
- **Scottish National Adaptation Plan (SNAP3)** sets out Scottish Government actions to prepare for and build Scotland's resilience to the impacts of climate change (2024 – 2029).
- **RBMP** could assess riparian woodland more accurately (currently done via MImAS only)
- **TNFD (Taskforce on Nature-Related Financial Disclosures) State of Nature** metrics on ecosystem extent and condition.
- **Water Environment Fund (WEF)** could implement restoration projects based on riparian woodland as the primary restoration tool to improve morphological condition
- **Wild Salmon Strategy**

8 Ten recommendations for improved riparian woodland monitoring

1. Ensure clarity on the **purpose of monitoring**, particularly whether monitoring is required for accountability or effects. Design the monitoring programme according to the questions to be addressed (PRACTICE, FUNDERS)
2. **Expand evidence** for: a) effects of large wood in rivers, b) shading and water-cooling effects, c) effects on flood peaks, d) conflict potential with other biodiversity objectives, and e) effectiveness of different implementation methods (RESEACH & PRACTICE)
3. **Undertake research** to determine a) best practices for responsive indicators of change, b) timescales for benefits accrual, c) river typing towards understanding reference conditions and anticipated trajectories of change (RESEARCH, FUNDING).
4. **Develop, utilise and promote technical advancements**: a) monitoring of dead wood transported in rivers, b) environmental DNA techniques, c) use of AI data and remote sensing data (satellite, aerial imagery, LiDAR). (RESEARCH, PRACTICE)
5. Establish **catchment observatories** for robustly investigating key questions. Seek to consider **larger physical scales and longer time periods**. As this is complicated by shifting environmental baselines, the needs for consistencies in controls, methods and funding need to be considered (PRACTICE, RESEARCH, FUNDERS, GOVERNMENT)
6. Expand and support well-trained and coordinated **citizen science programs** to generate high quality, evaluated data. (RESEARCH & POLICY)
7. Support development of new funding frameworks (like green financing) by supplying and promoting stronger evidence for benefits (RESEARCH)
8. Avoid woodland creation alone without considering the full package of measures need to achieve a restored riverscape (PRACTICE, FUNDERS, GOVERNMENT)
9. Create and maintain a list of guiding literature plus a range of examples and case studies for developing state of the art river woodland restoration (RESEARCH).
10. Select projects to develop guidance for best practice. Where have we achieved successful projects, where did we not, and what can we do to improve?

9 Acknowledgements

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Annex 1. Interactive comments board notes from monitoring focus group

How can we improve the way we monitor? e.g.

- at different scales
- standardised methods supported by training guides/funds
- sharing data (open access, centralise, availability to stakeholders/ advocators)
- developments in science or technology to make monitoring more effective

Monitoring of the benefits of river woodlands at whole catchment scale seems to be lacking

Open access data platforms are already available but need to be visible and integrateable

Existing standard methods are described by lengthy protocols (eg blue book) which limits use by non-academics. So simpler protocols would help.

Is there specific government support for the establishment of new riparian woodland (targets, funding) and is there a need for evidence to strengthen such support.

Incentive needed for projects to share monitoring data more widely.

Need to understand the barriers to data sharing too (time consuming, data sensitivity, lack of awareness, bias to hide negative trends)

Build an understanding of what is **currently** being **reported**, **where** it is being reported and what is **not being reported** on **centralised** or open source platforms/ datasets e.g. species being reported on NBN Atlas however no centralised reporting for morphology (?)

The same that said above, and consideration on the **objectives** and time-scales of recovery. Interesting this link Pyramid Framework – Stream Mechanics https://stream-mechanics.com/stream-functions-pyramid-framework/

More available functional approaches to monitoring changes in rivers and riparian zones.

NERC with Diego Panici starting Oct 2025 about large wood

Standardistion of monitoring for development with riparian planting as part of BNG/Mitigation, and enforcement of the standard

Rapid and repeatable condition assessments that evaluate a suite of function-based metrics/indicators, either specific to riparian areas or included as part of a broader stream assessment (e.g., RCA/MoRPH, as well as a range of international examples)

Citizen Science MoRPH method could be a useful approach to use more widely as it is low cost but still robust if done in a BACI format. See recent paper for application of in-stream large wood monitoring in an sub-urban river restoration case study: https://doi.org/10.1002/rra.4262

How can citizen scientists contribute useful evidence of benefits through monitoring?

Current aquatic invertebrate monitoring by volunteers has benefited from standard protocols. But this is also needed for other physico=chemcial measurements by citizen scientists

Research and policy needs to find ways of making volunteer monitoring data acceptable for taking action/decisions

Benefits from restoration activities have large lag times. How can we ensure citizen scientists are engaged long term/ build resilience into their networks and capabilities

MoRPH approach a potentially useful citizen science approach to evaluate responses to large wood. e.g.: Citizen Science MoRPH method could be a useful approach to use more widely as it is low cost but still robust if done in a BACI format. See recent paper for application on in-stream large wood monitoring in an sub-urban river restoration case study: https://doi.org/10.1002/rra.4262

Citizen science can provide a useful and affordable approach to monitoring. There needs to be clear and consistent guidance on how to design monitoring so it can inform project or catchment-scale objectives (e.g., site locations, frequency of sampling, which methods to apply, training required, etc.)

How can we achieve synthesis of knowledge of riparian woodland across monitoring sites/datasets?

Riverwoods x SFCC Riverwoods Hub as a vehicle for collating and integrating disparate monitoring efforts and translating them into digestible content for stakeholders and advocators

RRC UK is another resource for synthesis of restoration best practice.

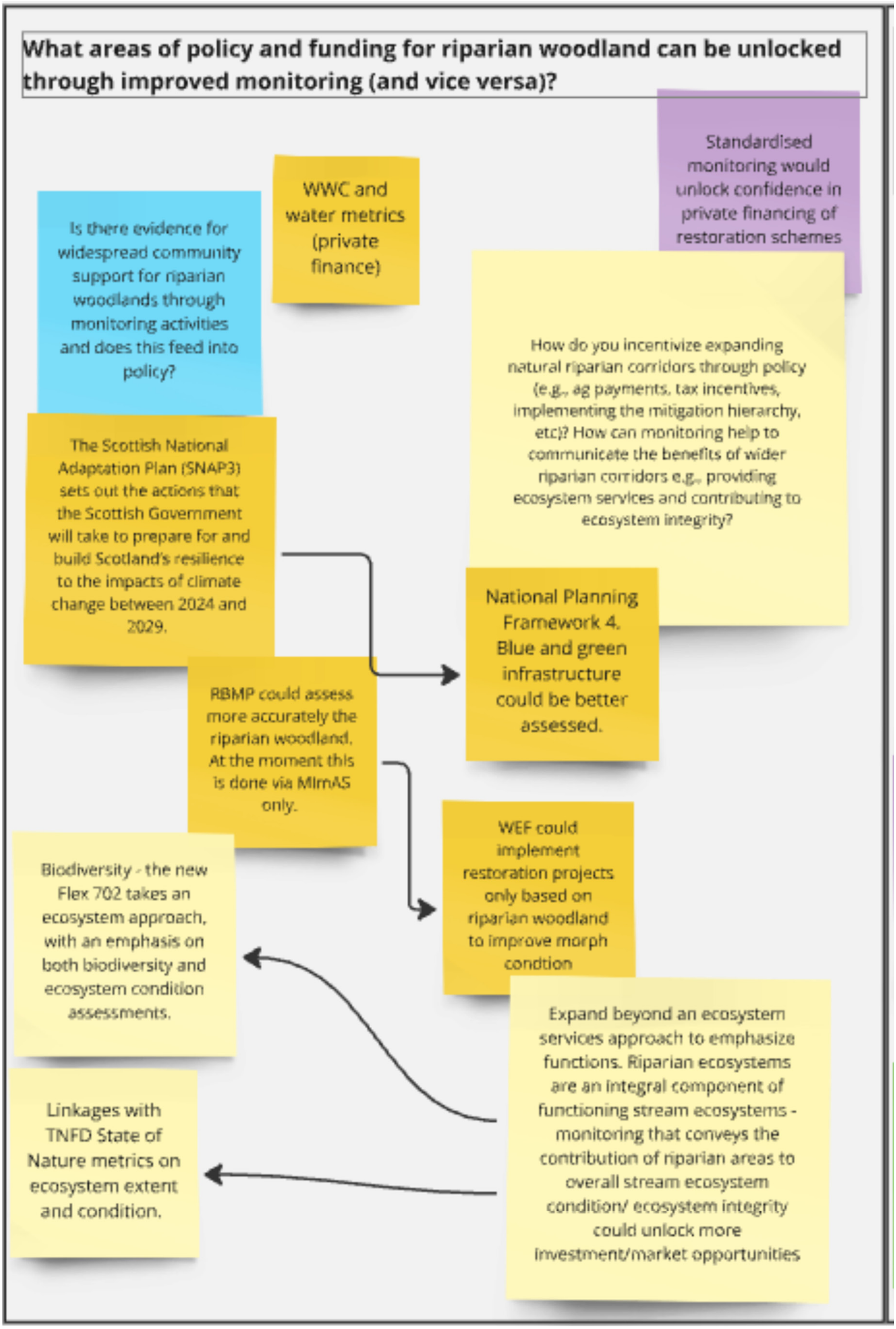
Obligation within planning conditions for individual BNG/mitigation monitoring programmes to be loaded into data hub. Lots of data being collected and not used for wider purpose

There are already established open access citizen science databases (eg. for river invertebrate monitoring includes RiverFly and SmartRivers). Many groups now involved in these. We need to integrate. Scottish Freshwater Group has a website established for this purpose but underused.

And CAR register

Communication plan about the importance of monitoring riparian woodland and sharing knowledge. This should reach restoration communities, river trusts, etc.

The answer will depend, in part, on the purpose of monitoring - e.g., site performance vs. programmatic performance vs. resiliency of restoration actions (See for example Stein et al. https://www.epa.gov/system/files/documents/2022-03/mitigationevaluationframework-2022.pdf)


What areas of policy and funding for riparian woodland can be unlocked through improved monitoring (and vice versa)?
Is there evidence for widespread community support for riparian woodlands through monitoring activities and does this feed into policy?
WWC and water metrics (private finance)
Standardised monitoring would unlock confidence in private financing of restoration schemes
How do you incentivize expanding natural riparian corridors through policy (e.g., ag payments, tax incentives, implementing the mitigation hierarchy, etc)? How can monitoring help to communicate the benefits of wider riparian corridors e.g., providing ecosystem services and contributing to ecosystem integrity?
The Scottish National Adaptation Plan (SNAP3) sets out the actions that the Scottish Government will take to prepare for and build Scotland's resilience to the impacts of climate change between 2024 and 2029.
National Planning Framework 4. Blue and green infrastructure could be better assessed.
RBMP could assess more accurately the riparian woodland. At the moment this is done via MImAS only.
WEF could implement restoration projects only based on riparian woodland to improve morph condtion
Biodiversity - the new Flex 702 takes an ecosystem approach, with an emphasis on both biodiversity and ecosystem condition assessments.
Expand beyond an ecosystem services approach to emphasize functions. Riparian ecosystems are an integral component of functioning stream ecosystems - monitoring that conveys the contribution of riparian areas to overall stream ecosystem condition/ ecosystem integrity could unlock more investment/market opportunities
Linkages with TNFD State of Nature metrics on ecosystem extent and condition.

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