

# Appendix 1: Survey and Workshop Report – Prioritising evidence needs for river woodlands

**Julie Rostan, Keith Marshall, Kerry A. Waylen, Flurina Wartmann,  
Susan Cooksley, Kerr Adams, Josie Geris, Mark Wilkinson, Marc Stutter**





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# Introduction

The RivyEvi project ([Creating healthy and resilient river systems across Scotland: prioritising research and development gap opportunities for river woodlands](#)) aims to update and prioritise the research and development (R&D) needs identified in the prior 2022 Riverwoods Evidence Review (Ogilvy *et al.*, 2022). This project is based on a phase of evidence review and extensive stakeholder engagement. The RivyEvi project phases are described in Figure 1.

This report summarises the results of the first two stakeholder engagement activities: the survey and the workshop. This report does not present the full results of the stakeholder engagement carried out through the RivyEvi project. Complementary engagement results are available in Appendices 2, 3, 4 and 5. The summary of all the results is available in the main project report. Summarised data from the survey and the workshop are available in the project database (Appendix 6).

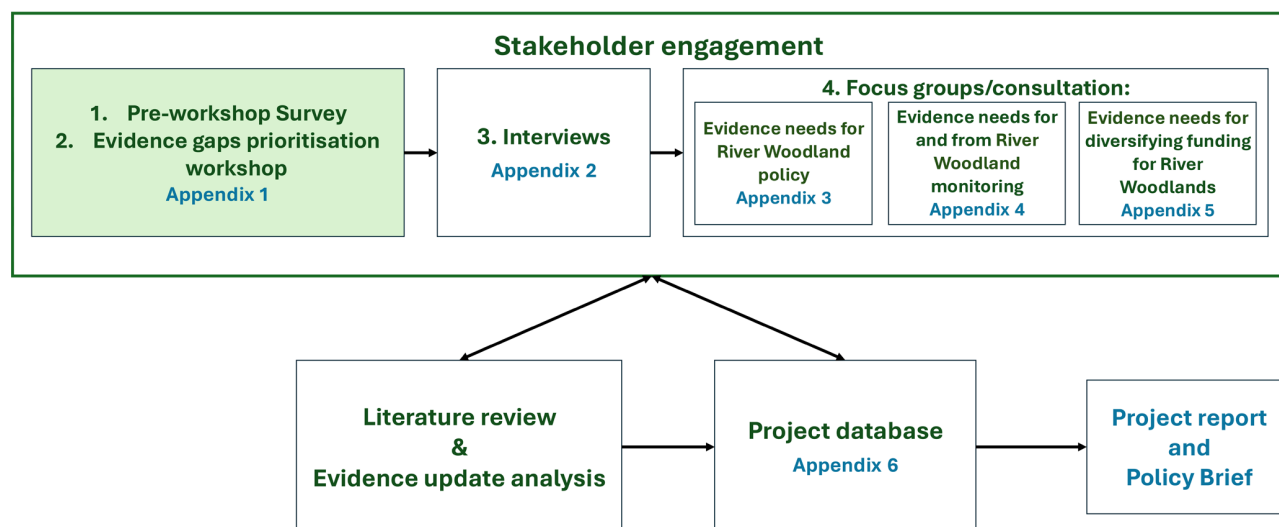


Figure 1: RivyEvi project steps and linked outputs. All the project outputs can be found on the CREW website.

## 1 Survey and workshop methods

To achieve the RivyEvi's overarching aim to update and prioritise the research and development (R&D) needs identified in the prior 2022 Riverwoods Evidence Review, we conducted a stakeholder survey followed by a 1-day stakeholder workshop.

### 1.1 Survey

The survey was designed using the online SnapSurveys platform that securely hosts the online questionnaire and stores all data on the University of Aberdeen servers. The survey used a mixed method approach including open-ended qualitative questions and quantitative questions focusing on precise gaps. To ensure clarity and accessibility for a broader audience beyond academic researchers, the gaps identified from the Riverwoods evidence review were carefully rephrased to align with the survey's design requirements. For example, certain terms were rephrased or defined. Some statements were combined when they related to similar topics to reduce the number of gaps. As a

results, 37 gap statements were incorporated into the survey (Table 1). The survey also collected some background information about respondents so that we could appraise the range of stakeholders engaged and explore if attributes such as profession relate to their answers. Answer formats were a mix of closed ended and Likert type scale (e.g. Not important; Slightly important; Important; Extremely important; Don't know) options focussed on pre-identified gaps, together with open-ended answers where participants could leave comments or suggest other issues to prioritise. Comprehensive details of the questions and their justifications can be found in Table 2.

The survey complied with GDPR and institutional data protection and ethics policies and received formal ethics approval by the James Hutton Institute. The intended audience for this survey included a broad spectrum of individuals with experience and expertise in river woodland (RW) restoration and creation.

Table 1: List of reworded gaps from the 2022 Riverwoods Evidence Review reworded for the survey or the workshop.		
Themes	gap#	Gaps
Clean water	1	The understanding of the ecological and chemical status of headwaters nationally to support river woodland planning.
	2	The way river woodland types and placement (scale, positions across differing soils and slopes) contribute to stabilising river banks and mitigating other sediment sources to streams.
	3	The effect of river woodland types and designs on catchment nutrient pollution, including as part of wider catchment diffuse pollution measures.
	4	The role of river woodland shading in mitigating excess algal growth in streams (especially to counter climate change effects).
	5	The effect of river woodlands characteristics (e.g. creation, age and composition) on mitigating pesticide pollution.
	6	The effect of establishing river woodlands on general aspects of pollution swapping. Pollution swapping is: "the increase in one pollutant as a result of a measure introduced to reduce a different pollutant."
	7	The effect of river woodlands on the transport of coarse sediment to and within waterways.
	8	The influence of river corridor tree rooting on water infiltration and physical particle trapping to mitigate pathogens (microbial contaminations).
Drought adaptation	9	River woodlands' contribution to maintaining river flows, especially during dry periods.
	10	The effect of different river woodland tree species on moisture content in different soils.
	11	Understanding which river woodland tree species can best adapt to drought periods in Scotland.
Alleviating flood risk	12	The effect of river woodland type, age, placement and scale on mitigating downstream flood risk.
	13	The effect of human made leaky barriers and large woody materials on watercourse sediment loads. Leaky barriers are part of the measures and techniques used for flood management.
	14	The effect of different leaky barriers and large woody materials (including design and construction aspects) in mitigating flood peaks at the catchment scale.
Carbon storage	15	The comparison between carbon storage in wooded versus non-wooded zones along different Scottish rivers.
	16	The effect of river woodland restoration and creation on greenhouse gas emissions.
Clean air	17	The effect of different river woodland designs on pollution swapping resulting specifically in air pollution (e.g. dissolved nitrate to airborne nitrogen oxides).
Sustaining soils	18	The effect of river woodlands on soil health and structure, biodiversity, fungi and microbes, soil carbon storage and nutrient cycling.
	19	The physical and economic effects of soil loss in wooded versus non-wooded river corridors.
Biodiversity and ecosystems	20	The effect of the expansion of river woodlands on biodiversity.
	21	The understanding of the genetic diversity of river woodland native tree species in Scotland, and the implications for sourcing trees and tree nurseries.
	22	The characterisation of native river woodlands' tree structures and species composition across Scottish regions to inform restoration practices benefitting ecological condition.
	23	The interactions of large herbivores (such as deer or beavers) with river woodland restoration and creation.
	24	The characterisation of habitat benefits of river woodlands for specific key species e.g. birds, bats, freshwater pearl mussels, aquatic invertebrates and lichens.
	25	The understanding of the type of vegetation and space required for achieving specific river morphological outcomes.
	26	The effect of the presence of different species (trees, wider vegetation, terrestrial and aquatic animals) on catchment-scale nutrient recycling through ecosystems and trophic levels.
Good health	27	The mental and physical health outcomes of river woodlands.
	28	How river woodlands can be integrated to urban settings to optimise cooling for human health benefits.
	29	The economic effects of river woodlands on the NHS as an organisation.
	30	The role of river woodland in changing dissolved organic carbon concentrations and forms that impact drinking water treatment (harmful disinfection by-products).
Wild fish and angling	31	The effects of river woodlands on the availability of invertebrate food sources for salmonids.
	32	The cooling, warming and insulating effect for fish under different river woodland canopies, with or without the influence of groundwaters.



Table 1 continued: List of reworded gaps from the 2022 Riverwoods Evidence Review reworded for the survey or the workshop.		
Themes	gap#	Gaps
Sustainable food production	33	The relationship between river woodland and livestock management in different landscape settings (e.g. different soils, upland vs lowland).
	34	The nutritional and medicinal effects of tree fodder for livestock productivity.
	35	The understanding of how to design heterogenous landscapes (to include river woodlands) in order to optimise crop pollination.
Clean energy and biomass	36	The effect of short rotation coppice (fast growing trees planted for fuel e.g. willow, poplar) river woodland on water and soil quality.
	37	The viability of local to regional biomass markets for river woodland products, including economic benefits to small producers such as farms, specific to Scotland.

From the outset of the project, the RivyEvi team built a stakeholder list through a sign-up form describing the project objectives, activities and requesting formal consent for contact in a GDPR compliant way. The sign-up form was sent out to initial contacts and networks from the RivyEvi team and Riverwoods colleagues. Distribution of the survey was carried out via email, targeting in the first instance the 135 stakeholders included on the RivyEvi list. Members of the RivyEvi team as well as members for the Project Steering Group also shared the survey individually with appropriate contacts. Reminders were sent two to three weeks after the initial distribution emails. Additionally, the survey was shared via relevant networks on social media and through mailing lists accessible to team members and their contacts. It was also advertised via professional research, policy and practice networks (e.g. Scottish Freshwater Group, Scotland's Soils, Treescapes programme). The last section of the survey contained an additional sign-up question for respondents that were not on the initial stakeholder list. This aimed to record interest for further engagement and contacts to share project outputs such as this report.

The first question on the gaps aimed to assess the level of consensus with the gaps raised by the evidence review. This question takes into account that respondents might be aware of other relevant evidence or consider that the level of existing evidence is sufficient on this topic. Although individuals vary in their understanding and training in evidence collection and collation, we aimed to assess their perspectives and perception of the current evidence base as expert providing a broad analysis of the various opinions on the topic relevant to Scotland and the UK conditions of practice. The second question on the gaps aimed to understand how important they considered the need to know more on this topic.

The survey was open from 25/04/2024 to 31/07/2024. Data was exported and analysed in Excel for the qualitative responses. The team carried out thematic analysis of open text answers on MS Excel, checking for patterns in the data. Responses to the quantitative questions were curated and represented in RStudio.

## 1.2 Workshop

The workshop took place at the Perth Concert Hall on the 26/06/2024. Participants were selected from the RivyEvi list of stakeholders and from respondents to the pre-workshop survey and according to their organisation and expertise. Participants were recruited from seven sectors: natural science; policy and public sector seeking to enable restoration; businesses; land use (farmers, estate managers); restoration practitioners (site managers, contractors); finance (funders and nature finance); NGOs, advocacy groups for riparian and river restoration. As numbers were limited, we aimed to maximise the number of organisations represented at the event (so in general only one person from an organisation was invited to represent that organisation or department in the case of larger organisations). It is recognised that many stakeholders could fit into several of those categories. Sixty potential participants were invited; 18 accepted the invitation and 15 joined. There were many other stakeholders interested but unable to join the chosen date, who were noted as priority stakeholders to engage with at a later stage.

The workshop agenda was divided in four main stages:

- Welcome and introduction
- Prioritisation exercise: Activity 1
- Prioritisation exercise: Activity 2
- Plenary discussion

Table 2: Survey questions and justifications			
	Question	Type of question	Justification
<b>Section 0: Information and consent</b>	Information statement, further information, data processing, consent		Hourglass approach to the survey starting with a general question and moving toward more precise questions on our gaps, finishing with open question on any missing gap.
<b>Section 1: About you</b>	Name	Open ended Text box	
	Organisation	Open ended Text box	
	Job role	Open ended Text box	
	If and how are river woodlands relevant to you or your organisation?	Open ended Text box	
	Are you currently involved in supporting river woodland restoration or creation?	Yes/no	
	Area of interest or expertise	Multiple choice: Clean water Biodiversity & Ecosystems Water stress & drought adaptation Flood risk alleviation Carbon Soils Human health Wild fish and angling Food production Energy and biomass None of the above Other [Text]	Aims to understand the various rang of expertise of respondents (respondents are able to pick several choices and add more if relevant)
	Geographical locations of relevance to your organisation:	Scotland Wales Northern Ireland England Europe Other	
	1. What, do you think currently holds your organisation back from doing more to support RW?	Open ended Text box	General open-ended question to capture barriers (beyond evidence) for stakeholders before introducing our list of evidence gaps.
<b>Section 2: Views on the evidence gaps identified by pre-existing work</b>	1. Do you agree that there is currently a lack of evidence relating to...Or We have enough evidence on...	Agree; Disagree; Don't know	Do they agree or not that each statement is a gap. If they agree or are unsure question 2 will appear
	2. How important is it to know more about this topic?	Scale of importance: Not important; Slightly important; Important; Extremely important; Don't know	Assessing the level of perceived importance of each gap
	3. Are there any other major gaps beyond those listed above	No / Yes	
	3a follow-up: If yes, please explain	Open ended Text box	If "no" don't show the question Recording any additional/missing gaps

Table 2 continued: Survey questions and justifications			
	Question	Type of question	Justification
<b>Section 3: Beyond evidence</b>	Beyond evidence needs, what else would need to be addressed to help your organisation or sector to support river woodlands?	Open ended Text box	Expand the focus on barriers (contextualise)
<b>Closing page</b>	Do you have any other comments on the subject, or this project more broadly?	Open ended Text box	Capture additional thoughts
	Further consent to be contacted by the team.	Yes/No + email address box	

**Welcome and introduction:** As participants arrived, they were encouraged to post a note on a flipchart answering the following open questions, "What is your interest in river woodlands?" and "What is your number one evidence need?" (prior to seeing the list of gaps). This exercise helped everyone get acquainted with each other's interests and reasons for attending. The team provided materials such as the agenda, a list of gaps, and participant feedback forms.

The workshop formally started with a welcome address introducing the team, facilitators, and project leaders, followed by an overview of the day's program as well as a short ice breaker. The team presented the overall RivyEvi project and objectives, the workshop plan, the update to the 2022 Riverwoods Evidence Review, and the results of the pre-workshop survey to set a context for the workshop. During this session, the terms used in the workshop were precisely defined:

*"Barriers" refer to any challenge or obstacle that prevents progress in river woodland restoration.*

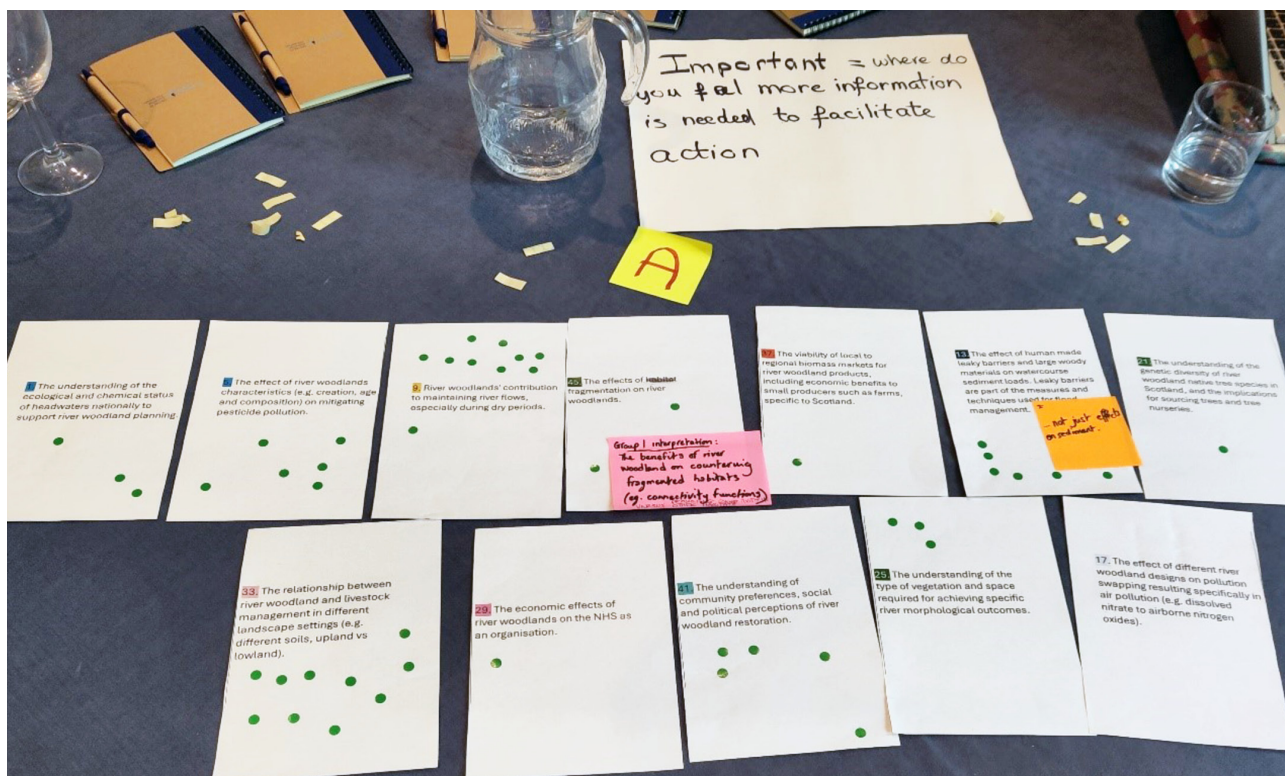
*"Gaps" or "research and development evidence gap" refers to a lack of sufficient data, studies, documented results, or methodologies and techniques necessary to fully understand or validate a particular area of river woodland restoration.*

These definitions were put on the wall alongside dedicated "parking spaces" for participants to post additional notes and ideas throughout the day. One specific parking place was dedicated to barriers that did not correspond to evidence gaps.

**Activity 1:** The first workshop main activity comprised an initial prioritisation carousel exercise aiming for participants to vote for gaps that's they deemed the most "important". "Important" was defined as "where do you feel more information is needed to facilitate action" and was reminded on each of the four carousel tables (Photo 1). Participants were divided into four mixed groups, each assigned to a table with a set of gap cards (11 or 12 gaps randomly distributed on each table). Each participant received three sticky dots to vote for their most important gaps after discussing within their group (voting rules: 3 dots max per person, limit of one dot per person per card). The groups then rotated to the next table, repeating the process to ensure they'd each reviewed and been given a chance to discuss and vote on all gaps. Facilitators and scribes stayed at their assigned tables to guide the discussion and consistently recorded arguments for finding gaps important or not as well as key points of consensus and disagreement. Facilitators roles were to guide and reframe the conversation if needed and to provide clarifications on the gaps. This carousel format was chosen as prioritisation of all the gaps (47 at this stage due to additional emerging from the survey) was not feasible for all gaps to be considered together. The team acknowledged the influence of voting on sets of gaps rather than all of the gaps (participants were discussing and voting on 12 gaps at a time). The gaps on one table were not compared and voted alongside the gaps on other tables). A second round of prioritisation was organised to mitigate this aspect.

During lunch, the project team reorganised the gaps according to the number of sticky dots (number of votes) they were allocated. Cards with sticky dots were placed on the wall for participant to look at the result of the first round of prioritisation (Photo 2). Blank gaps cards were then placed on the tables in the same order (Table A had the cards with the least votes, Table D had the card with the most votes, 25% of the cards on each table).





Photograph 1: Table A at the end of the four rounds of carousel. Following a 15-minute discussion, each participant group had voted and placed their sticky dots on the gaps of their choice.



Photograph 2: Gaps reorganised by number of sticky dots after the first round of prioritisation. This gaps order was used for a second round of prioritisation.



**Activity 2:** After lunch, the workshop continued with the second part of the prioritisation carousel exercise. Participants were re-grouped and assigned to different tables, where they discussed and refined the placement of gaps along a predefined importance axis on flipchart sheets (Photo 3). The groups were rotated so that they could reconsider priorities within each new grouping of gaps. As in the earlier session, a main output was the recorded conversation.

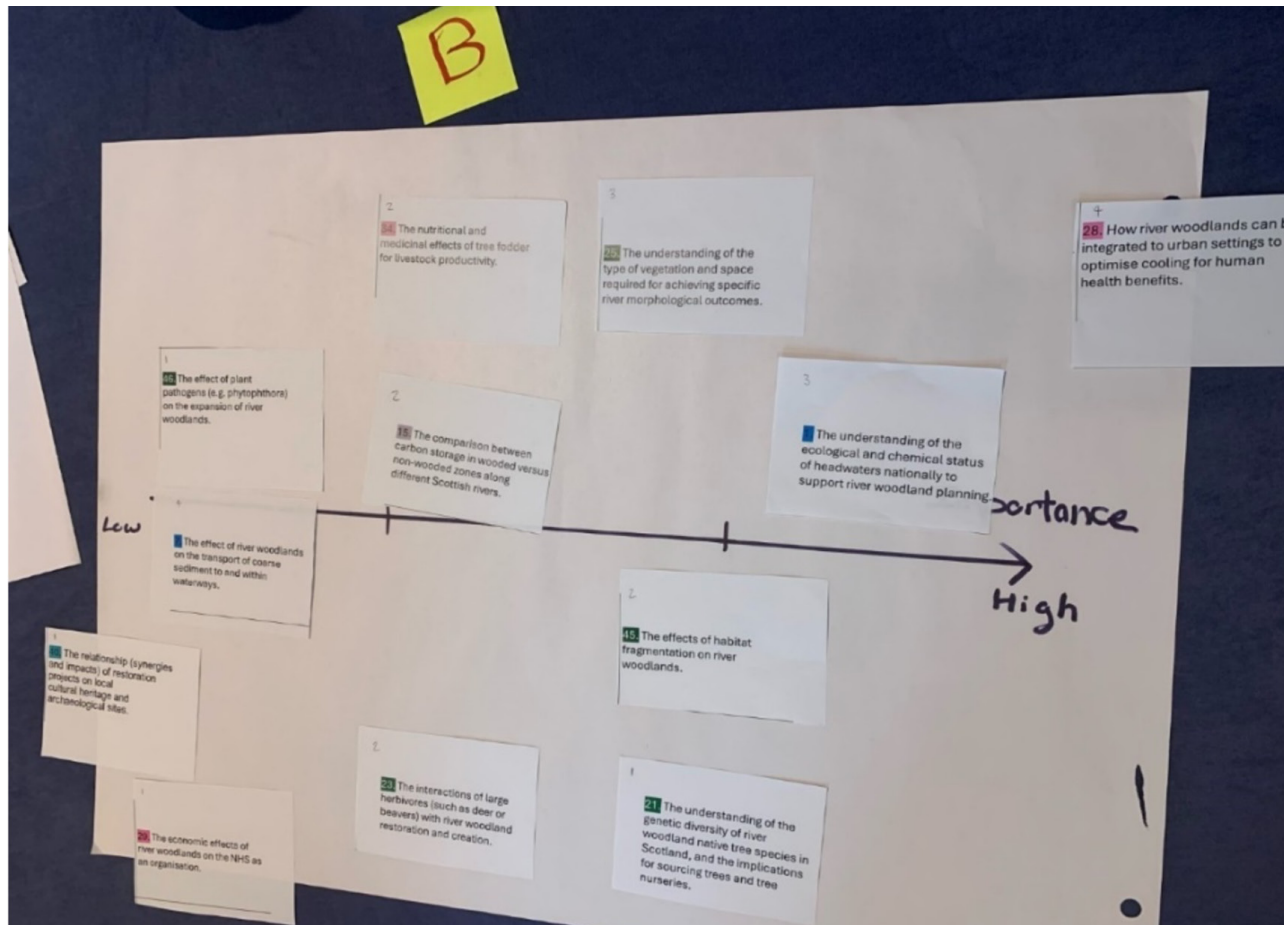
**Plenary discussion:** The plenary discussion summarised the main changes suggested at each table and the resultant order of gaps. The session unpacked and refined these suggestions, addressing any significant disagreements. To conclude the workshop, a summary of key insights and next steps was provided. Participants were thanked for their contributions and encouraged to fill in feedback forms.

Data from the workshop (notes and photos) were gathered on one MS Word document and analysed in excel following these steps:

- a. Workshop notes were put together in one document associated to photo (instruction were initially given to align facilitation and scribing)

- b. Quantitative output: dots counted for each gap as well as their positions on the scale (18 quarters)
- c. Notes were gathered in a MS Word document and reorganised per gap, per group and per activity to allow first familiarisation with the data to note emerging topics
- d. Thematic coding in MS Excel focusing on agreement or disagreement that this is a gap and why, reason for importance, reasons for not important, level of consensus, link to specific sector, link to other gaps, link to other topic.

An initial ranking was established according to the final positioning of gaps during the workshop. A thematic analysis of the discussion provided a refinement of the ranking based on the level of consensus among respondents, the reasons behind the stated level of importance, links to sectors, and questions as to whether each gap is really considered as an evidence need.



Photograph 3: Table B, prioritisation level along this axis of importance after the second carousel round.

## 2 Results

### 2.1 Survey results

In this section, we first report on the characteristics of our survey respondents, before describing the barriers for river woodland restoration they identified, and their opinions on the identified gaps.

#### 2.1.1 Sample descriptions

Sixty-six responses were received for the survey. Respondents to this survey belong in majority to the academic sector (n=19; with a strong focus on natural science), public sector (n=20), third sector (n=18) and businesses (n=9) mostly represented by environmental consultancies (n=7).

#### 2.1.2 Current barriers and needs for river woodland restoration

The responses to the first open-text question “*What, do you think currently holds your organisation back from doing more to support river woodlands?*” and the last open-text question “*Beyond evidence needs, what else would need to be addressed to help your organisation or sector to support river woodlands?*” revealed several key themes of barriers (emerging from thematic coding) to river woodland restoration:

- Funding, incentives and other resources (such as staff and skills)
- Collaboration and knowledge sharing across sectors and some areas of knowledge gap
- Landowners’ involvement
- Grazing impacts and ecological considerations
- Climate change vulnerability
- Social acceptance, communication and engagement with public and communities
- Legal and policy support for conservation

The most mentioned barrier highlighted by respondents is a need for improved and sustainable funding. Respondents emphasised the necessity for better grants and long-term funding sources to facilitate the establishment and maintenance of RW. This includes clear funding pathways and simplified application processes to ensure that projects can be effectively implemented. Collaboration and knowledge sharing were also highlighted barriers. The necessity for effective partnerships between stakeholders (policymakers, land managers,

researchers, and community groups...) were mentioned on multiple occasions. Support from landowners and managers was one of the most recurring barriers stated in the responses.

#### **PARTICIPANT 48 (RESTORATION PRACTITIONER)**

*“Limited funding restricts the scale and scope of our initiatives, preventing us from undertaking larger or more comprehensive projects. Resistance or lack of interest from landowners can impede progress. Establishing and maintaining a productive partnership with the fisheries board is crucial, but it involves ensuring all stakeholders are on the same page.”*

Among the barriers, communication, engaging the public and understanding community perspectives emerged as important for gaining broader support and to gain access to funding. This also included education on the benefits of river woodlands and showcasing successful initiative, taking into account local experience and heritage can enhance community involvement and acceptance. Legal and policy support is essential for conservation efforts but remains a barrier according to the respondents. Stronger policies should be in place to support the rapid and widespread establishment and monitoring of river woodlands in Scotland.

**PARTICIPANT 46 (PUBLIC SECTOR)** *“Policy development involving incentives to support land-owners with this change. Development in legislation/regulation/policy drivers/voluntary schemes to support works and surveillance monitoring in the headwaters in Scotland tackling the source of pressures and targeting restoration efforts where it counts the most.”*

The importance of context-specific management was highlighted, recognising that different catchment areas require tailored approaches. Managing grazing pressure, specifically from deer, was considered a crucial barrier to address for the success of these projects. While research needs were also noted among barriers, some respondents underlined that real-world experience and growing knowledge alongside practice were more persuasive than theoretical research.



**PARTICIPANT 13 (ACADEMIA)** *“The need is for proven examples, rather than more questionnaires – land managers react best to seeing what others have done, not research papers, graphs, GIS, plans, forecasts, long-term promises and predictions.”*

### 2.1.3 Participants opinions on identified gaps

For each gap (Table 1), respondents were asked whether they agreed it represents an evidence gap (agree; disagree; unsure, see Table 2). Responses showed higher levels of agreement with gaps on the following themes: drought adaptation, flood risk alleviation, biodiversity and soils. Responses showed lower levels of agreement and higher levels of uncertainty on the following themes: human health, fishing and angling, food production, clean

energy and biomass, clean air (Figure 2). For each gap there were always a few respondents who considered that it did not constitute a gap.

If respondents agreed or were unsure that the statement constituted a gap, they were asked a follow-up question asking how important they considered it is to know more on the topic. Responses presented in Figure 3 show a high level of perceived importance for gaps on drought adaptation, flood risk alleviation, biodiversity and soils. Although more than half of participants were unsure or disagreed that these statements were gaps, the gaps on fishing and angling were ranked higher in importance. Gaps that were ranked lower in importance were on the following themes: human health, food production, clean energy and biomass, clean air.

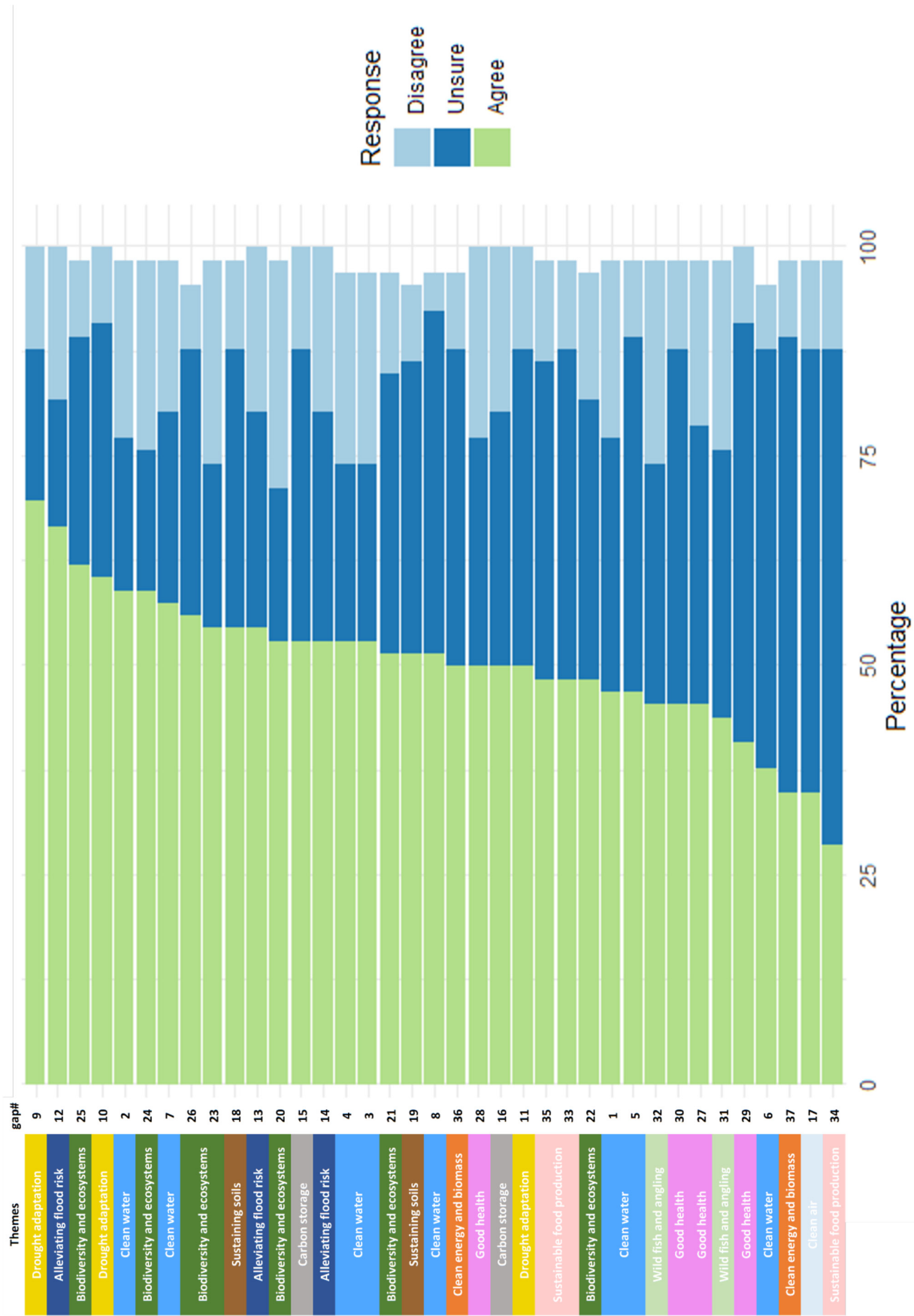


Figure 2: Agreement or disagreement with each gap statement in percentage of responses. Gap themes are visible on the left. Full gap list with ranking available in Table 4.

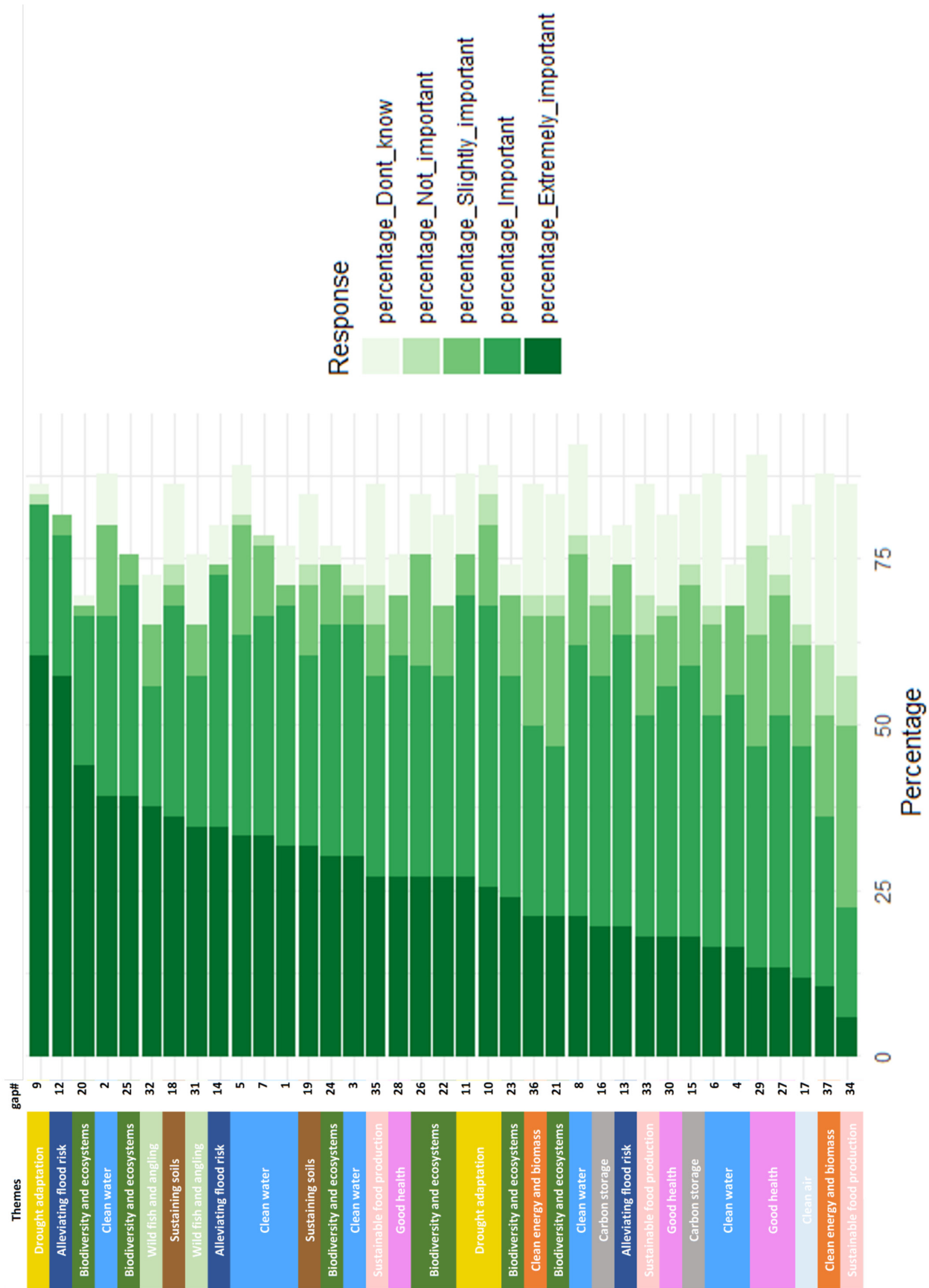


Figure 3: Level of perceived importance to know more on each gap in percentage of responses. Gap themes are visible on the left. Full gap list with ranking available in Table 4 The bar lengths from 100% relate to the % of respondents who answered in first question part that stated gap wasn't a gap.

### 2.1.4 Additional gaps

Forty percent of the respondents identified additional gaps. After analysis, the majority of these were considered to be aligned with the themes and gaps already identified although they were focusing on more nuanced and detailed aspects of the pre-existing gap statements. Ten new gaps, resulting in a total of 47 gaps, were added to the list (Table 3) within three new themes: Techniques, tools and monitoring; Social, cultural and heritage; Finance. Three gaps were added to the biodiversity and ecosystem theme.

These additional knowledge gaps were worded following the process of thematic coding. We estimated that some of the additional gaps noted by the participants were already included in some of the existing gap statements. For the new emerging themes, new gaps were worded by the research team. Although these statements were added to the list of additional gaps for the workshop, it has to be noted that they emerged from the knowledge and perceptions from respondent to the survey. Particular attention to these additional gaps is paid in the literature review phase to assess the strength of existing evidence from an academic perspective.

## 2.2 Workshop results

This result section presents a summary of the main findings emerging from the stakeholder workshop aiming to collaboratively prioritise river

woodland evidence gaps and to complement the survey results. These results do not constitute a comprehensive account of all the discussions on each gap that occurred throughout the workshop due to the large amount and complexity of the data gathered. Further detail and emerging themes relevant for each gap will be presented in the project research database alongside the findings of the literature review. The final prioritisation of the gaps and associated level of consensus are presented in Figure 4.

Fifteen participants from academia, public sector, third sector and private sector joined the workshop (Table 4).

### 2.2.1 High rank gaps

The five highest ranked gaps emerging from the workshop prioritisation exercises are 12, 9, 2, 20 (which are identical to the survey results) and 18. It was notable that conversations around these gaps revealed a high level of consensus.

*Gap 12: the effect of river woodland type, age, placement, and scale on mitigating downstream flood risk.*

**Table 3: List of additional gaps and themes included following the survey results.**

Themes	gap#	Gaps
Techniques, tools and monitoring	38	The integration of the technical and environmental challenges involved in river woodlands restoration (Grazing reduction, restoration vs natural regeneration, effect on water temperature).
	39	The development of necessary tools and methodologies for effective restoration and management of river woodlands.
	40	The development of robust monitoring systems at relevant scales.
Social, cultural and heritage	41	The relationship (synergies and impacts) of restoration projects on local cultural heritage and archaeological sites.
	42	The understanding of community preferences, social and political perceptions of river woodland restoration.
	43	The mechanisms for developing restoration projects are socially acceptable, just and beneficial to local communities.
Finance	44	Developing evidence-based financial incentives and mechanisms.
Biodiversity and ecosystems	45	The interactions between invasive non-native species and river woodlands.
	46	The effects of habitat fragmentation on river woodlands
	47	The effect of pathogens such as phytophthora on the expansion of river woodlands.

**Table 4: Workshop participants sectors.**

	Academia	Private	Public	Third sector	Total
Workshop participants	3	3	8	1	15

Gap 12 sparked significant interest and consensus and was ranked the highest from the first round of prioritisation. Some participants were concerned about the potential negative effects of woody debris causing blockages, while others highlighted the benefits of giving rivers more space to move. The group agreed that understanding these dynamics is crucial for justifying funding and promoting restoration projects. Existing evidence from other regions (e.g., England) was mentioned, but its applicability to Scotland was questioned.

***Gap 9: river woodlands' contribution to maintaining river flows during dry periods.***

There was some uncertainty about the extent of existing evidence related to Gap 9. Participants highlighted the importance of linking this gap to related ones, such as the role of woody barriers in managing water retention. Participants agreed on the significance of this gap for drought adaptation strategies, and some mentioned the importance of other gaps on the theme of droughts. The conversation touched on the need for comprehensive studies to assess the benefits and disbenefits of RW in different contexts, emphasising their potential to support drought resilience.

***Gap 2: the role of river woodland types and placement in stabilising river banks and mitigating sediment sources.***

Participants emphasised the importance of placing the right trees in the right place to avoid potential negative impacts. It was noted that while there is already significant knowledge about Gap 2, the challenge lies in applying this knowledge effectively to specific site conditions. According to some participants, this gap was central to address other gaps on the themes of finance and monitoring (39 and 43). The consensus level was high, with most participants agreeing on the importance of understanding the precise contributions of different tree types and placements.

***Gap 18: the effect of river woodlands on soil health and structure, biodiversity, fungi and microbes, soil carbon storage, and nutrient cycling.***

Participants recognised Gap 18 as broad and multifaceted, addressing multiple benefits. It was noted that while there is evidence for general woodlands, specific data on restoration sites are lacking. The discussion highlighted the importance of taking a holistic view to understand

the interactions between different factors. There was also a recognition that addressing this gap could help fill other related gaps. There was high level of consensus, with participants agreeing on its significance for practical applications in river woodland restoration.

***Gap 20: The effect of river woodland expansion on biodiversity.***

Due to its broad wording, Gap 20 was viewed as encapsulating several other gaps on the theme of biodiversity. Participants acknowledged the importance of biodiversity but noted that landowners might prioritise other factors, such as flood management. The discussion revealed a need for more knowledge exchange and literature reviews to disseminate existing evidence rather than conducting new studies. There was some debate over the specific focus of this gap, but ultimately, it achieved a high level of consensus. Participants agreed that understanding the biodiversity benefits of RW is crucial for encouraging restoration efforts and informing policy.

The next two gaps in ranking order were:

***Gap 39 Strategies for developing robust monitoring of outcomes considering scales and Gap 43 Developing evidence-based financial incentives and mechanisms.***

Gap's 39 and 43 sparked conversations as to whether they are evidence gaps or not, and stakeholders tended to disagree on this aspect. However, stakeholders recognised the central importance of the two themes for river woodland restoration.

The discussion on Gap 39 highlighted the vital role of robust monitoring strategies across various scales. Participants emphasised that effective monitoring is fundamental for validating outcomes and guiding future restoration actions. The conversation revealed a consensus on the need for strategic planning and financial support to implement comprehensive monitoring. However, the discussion also raised questions about whether the emphasis should be on more monitoring or better strategies for existing monitoring efforts. The conversation around Gap 43 focused on the necessity of financial incentives and mechanisms to support river woodland restoration, strongly linking with the main barrier emerging from the survey. Those two gaps were considered as closely

linked and underpinning other gaps, especially the 5 top ones which justified their high rank. The group reached a moderate level of consensus on the importance of these gaps, recognising them as fundamental challenges requiring more strategic and regulatory focus rather than purely single evidence gaps.

### 2.2.2 Lower ranking gaps

Seven of the eight lowest ranking gaps appeared to have high level of consensus among respondents.

*Gap 23: The interactions of large herbivores with river woodland restoration and creation and gap 31 the effects of river woodlands on the availability of invertebrate food sources for salmonids.*

Participants acknowledged that considerable existing knowledge from other countries is already available in relation to Gap 23. While knowledge toward practice from these topics are essential, participants agreed that the primary need is better use and communication of existing knowledge rather than further research.

*Gap 34: The nutritional and medicinal effects of tree fodder for livestock productivity*

The discussion on Gap 34 revealed that this topic generally related more to farmer and agricultural knowledge of farm animals' health rather than being specific to RW. Participants agreed that this gap overlaps significantly with broader agricultural research and is therefore not a priority within the specific scope of river woodland restoration.

*Gap 35: The understanding of how to design heterogeneous landscapes to optimise crop pollination.*

Participants considered there is already extensive knowledge about pollinators. Gap 35 was deemed too niche and more relevant to broader landscape design rather than specifically to RW.

*Gap 36: the effect of short rotation coppice on water and soil quality and gap 37: the viability of local to regional biomass markets for river woodland products.*

The concept of short rotation coppice for fuel, was not well-received by participants. Concerns were raised about the practical aspects and the consensus was that short rotation coppicing does not offer significant benefits for water and soil quality. Participants concluded that the idea of local to regional biomass markets for river woodland products is not viable and that the scale required for such markets is impractical.

*Gap 24: The characterisation of habitat benefits of river woodlands for specific key species (e.g., birds, bats, freshwater pearl mussels, aquatic invertebrates, and lichens); Gap 26: The effect of the presence of different species on catchment-scale nutrient recycling through ecosystems and trophic levels; Gap 32: the cooling, warming, and insulating effect for fish under different river woodland canopies*

Gap's 24, 26 and 32 were also ranked as lower overall because sufficient evidence was deemed already existing on those topics. It is worth noting that participants considered those topics relating to biodiversity and ecosystems already covered by gap 20, which had a high rank.



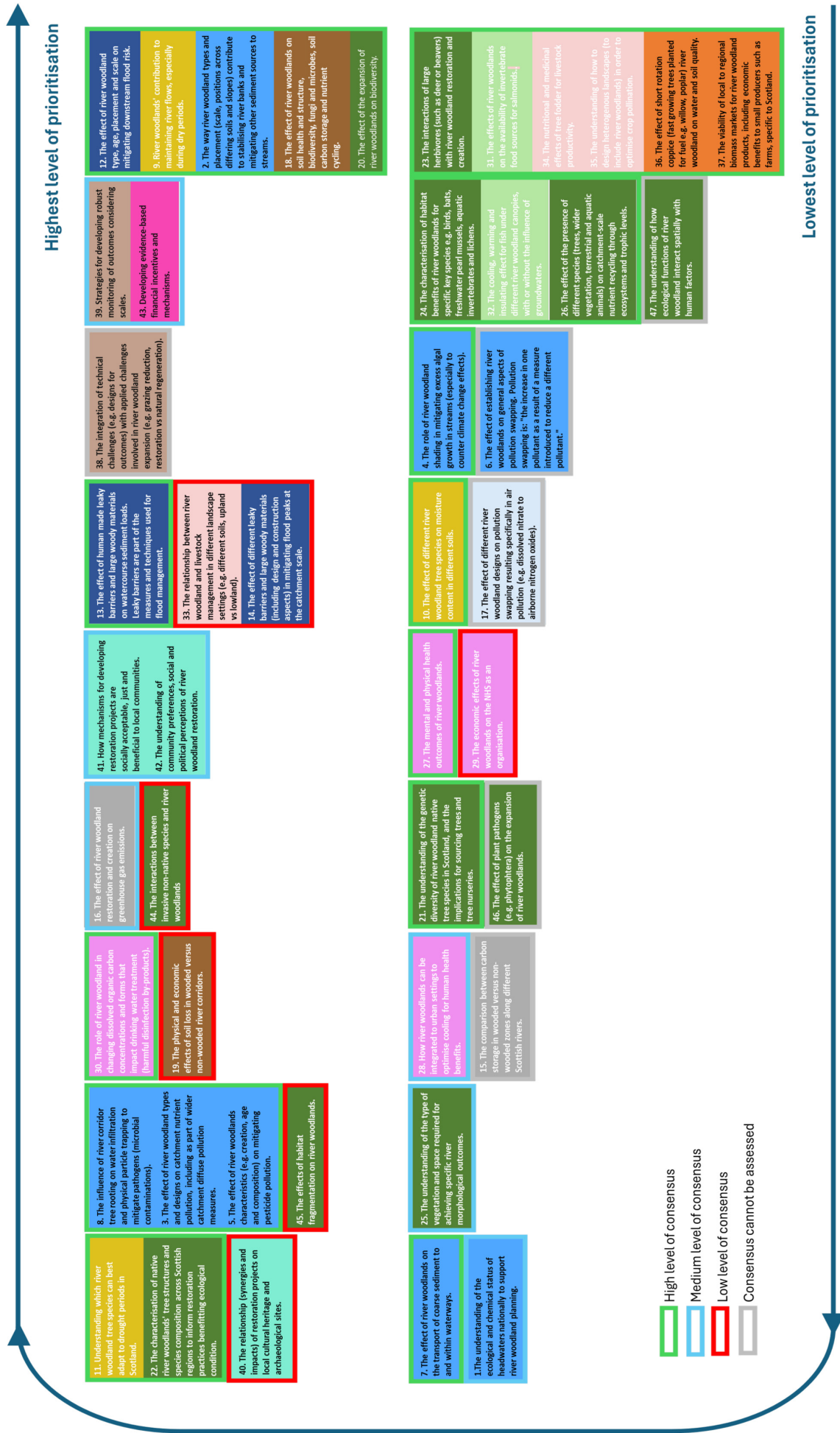


Figure 4: Results from the final prioritisation, weighed by consensus levels emerging from stakeholder conversations. This figure results from the two rounds of prioritisation realised during the workshop (first round with sticky dots and second round of readjusting the position of the gaps relative to each other along the importance axis). By analysing the content of the stakeholder conversations, the researcher then adjusted the position of the gaps for which there were less agreement on their position and attributed a consensus level. See See Table 4 for ranking.

**Table 5: Full gap list (survey and workshop) with ranking resulting from each activity (1 is the highest). The 5 highest ranked gaps are in yellow in each column - Column A, level of agreement from the survey (agree that this is a gap) - Column B, level of importance from the survey (number of “extremely important”) – Column C, level of importance emerging from the workshop (ranking from figure 4).**

gap#	Gaps	Themes	Survey levels of agreements – number of agree responses (top 5 in yellow)	Survey levels of importance – Number of "extremely important" responses (top 5 in yellow)	Final workshop ranking divided in 18 clusters (1=highest importance - 18 = lowest importance) (accounting for discussions and consensus) - (top 5 in yellow)
1	The understanding of the ecological and chemical status of headwaters nationally to support river woodland planning.	Clean water	31	21	10
2	The way river woodland types and placement (scale, positions across differing soils and slopes) contribute to stabilising river banks and mitigating other sediment sources to streams.		39	26	1
3	The effect of river woodland types and designs on catchment nutrient pollution, including as part of wider catchment diffuse pollution measures.		35	20	8
4	The role of river woodland shading in mitigating excess algal growth in streams (especially to counter climate change effects).		35	11	16
5	The effect of river woodlands characteristics (e.g. creation, age and composition) on mitigating pesticide pollution.		31	22	8
6	The effect of establishing river woodlands on general aspects of pollution swapping. Pollution swapping is: "the increase in one pollutant as a result of a measure introduced to reduce a different pollutant."		25	11	16
7	The effect of river woodlands on the transport of coarse sediment to and within waterways.		38	22	10
8	The influence of river corridor tree rooting on water infiltration and physical particle trapping to mitigate pathogens (microbial contaminations).		34	14	8
9	River woodlands' contribution to maintaining river flows, especially during dry periods.	Drought adaptation	46	40	1
10	The effect of different river woodland tree species on moisture content in different soils.		40	17	15
11	Understanding which river woodland tree species can best adapt to drought periods in Scotland.		33	18	9

**Table 5 continued: Full gap list (survey and workshop) with ranking resulting from each activity (1 is the highest). The 5 highest ranked gaps are in yellow in each column – Column A, level of agreement from the survey (agree that this is a gap) – Column B, level of importance from the survey (number of “extremely important”) – Column C, level of importance emerging from the workshop (ranking from figure 4).**

gap#	Gaps	Themes	Survey levels of agreements – number of agree responses (top 5 in yellow)	Survey levels of importance – Number of "extremely important" responses (top 5 in yellow)	Final workshop ranking divided in 18 clusters (1=highest importance - 18 = lowest importance) (accounting for discussions and consensus) - (top 5 in yellow)
12	The effect of river woodland type, age, placement and scale on mitigating downstream flood risk.	Alleviating flood risk	44	38	1
13	The effect of human made leaky barriers and large woody materials on watercourse sediment loads. Leaky barriers are part of the measures and techniques used for flood management.		36	13	4
14	The effect of different leaky barriers and large woody materials (including design and construction aspects) in mitigating flood peaks at the catchment scale.		35	23	4
15	The comparison between carbon storage in wooded versus non-wooded zones along different Scottish rivers.	Carbon storage	35	12	12
16	The effect of river woodland restoration and creation on greenhouse gas emissions.		33	13	6
17	The effect of different river woodland designs on pollution swapping resulting specifically in air pollution (e.g. dissolved nitrate to airborne nitrogen oxides).	Clean air	23	8	15
18	The effect of river woodlands on soil health and structure, biodiversity, fungi and microbes, soil carbon storage and nutrient cycling.	Sustaining soils	36	24	1
19	The physical and economic effects of soil loss in wooded versus non-wooded river corridors.		34	21	7
20	The effect of the expansion of river woodlands on biodiversity.	Biodiversity and ecosystems	35	29	1
21	The characterisation of native river woodlands' tree structures and species composition across Scottish regions to inform restoration practices benefitting ecological condition.		34	14	13
22	The interactions of large herbivores (such as deer or beavers) with river woodland restoration and creation.		32	18	9
23	The characterisation of habitat benefits of river woodlands for specific key species e.g. birds, bats, freshwater pearl mussels, aquatic invertebrates and lichens.		36	16	18

**Table 5 continued: Full gap list (survey and workshop) with ranking resulting from each activity (1 is the highest). The 5 highest ranked gaps are in yellow in each column - Column A, level of agreement from the survey (agree that this is a gap) - Column B, level of importance from the survey (number of "extremely important") – Column C, level of importance emerging from the workshop (ranking from figure 4).**

gap#	Gaps	Themes	Survey levels of agreements – number of agree responses (top 5 in yellow)	Survey levels of importance – Number of "extremely important" responses (top 5 in yellow)	Final workshop ranking divided in 18 clusters (1=highest importance - 18 = lowest importance) (accounting for discussions and consensus) - (top 5 in yellow)
24	The understanding of the type of vegetation and space required for achieving specific river morphological outcomes.	Biodiversity and ecosystems	39	20	17
25	The effect of the presence of different species (trees, wider vegetation, terrestrial and aquatic animals) on catchment-scale nutrient recycling through ecosystems and trophic levels.		41	26	11
26	The mental and physical health outcomes of river woodlands.		37	18	17
27	The mental and physical health outcomes of river woodlands.	Good health	30	9	14
28	How river woodlands can be integrated to urban settings to optimise cooling for human health benefits.		33	18	12
29	The economic effects of river woodlands on the NHS as an organisation.		27	9	14
30	The role of river woodland in changing dissolved organic carbon concentrations and forms that impact drinking water treatment (harmful disinfection by-products).		30	12	7
31	The effects of river woodlands on the availability of invertebrate food sources for salmonids.	Wild fish and angling	29	23	18
32	The cooling, warming and insulating effect for fish under different river woodland canopies, with or without the influence of groundwaters.		30	25	17
33	The relationship between river woodland and livestock management in different landscape settings (e.g. different soils, upland vs lowland).	Sustainable food production	32	12	4
34	The nutritional and medicinal effects of tree fodder for livestock productivity.		19	4	18
35	The understanding of how to design heterogenous landscapes (to include river woodlands) in order to optimise crop pollination.		32	18	18

**Table 5 continued: Full gap list (survey and workshop) with ranking resulting from each activity (1 is the highest). The 5 highest ranked gaps are in yellow in each column - Column A, level of agreement from the survey (agree that this is a gap) - Column B, level of importance from the survey (number of "extremely important") – Column C, level of importance emerging from the workshop (ranking from figure 4).**

gap#	Gaps	Themes	Survey levels of agreements – number of agree responses (top 5 in yellow)	Survey levels of importance – Number of "extremely important" responses (top 5 in yellow)	Final workshop ranking divided in 18 clusters (1=highest importance - 18 = lowest importance) (accounting for discussions and consensus) - (top 5 in yellow)
36	The effect of short rotation coppice (fast growing trees planted for fuel e.g. willow, poplar) river woodland on water and soil quality.	Clean energy and biomass	33	14	18
37	The viability of local to regional biomass markets for river woodland products, including economic benefits to small producers such as farms, specific to Scotland.		23	7	18
38	The integration of technical challenges (e.g. designs for outcomes) with applied challenges involved in river woodland expansion (e.g. grazing reduction, restoration vs natural regeneration).	Techniques, tools and monitoring	Included after the survey		3
39	Strategies for developing robust monitoring of outcomes considering scales.				2
40	The relationship (synergies and impacts) of restoration projects on local cultural heritage and archaeological sites.	Social, cultural and heritage			9
41	The understanding of community preferences, social and political perceptions of river woodland restoration.				5
42	How mechanisms for developing restoration projects are socially acceptable, just and beneficial to local communities.				5
43	Developing evidence-based financial incentives and mechanisms.	Finance			2
44	The interactions between invasive non-native species and river woodlands.	Biodiversity and ecosystems			6
45	The effects of habitat fragmentation on river woodlands.				8
46	The effect of plant pathogens (e.g. phytophthora) on the expansion of river woodlands.				13
47	The understanding of how ecological functions of river woodland interact spatially with human factors.				17

### 2.2.3 Important or not? Overall stakeholder justification rationale

Throughout the conversations, participants were able to justify why they considered some gaps important and some gaps less important and shared it with the group. For each gap, there were topic specific justifications that we are not able to discuss in this report due to complexity. However, some important focus areas emerged from the conversations as well as patterns for justification. This is discussed in this section. It is important to emphasise that it was not unusual that some participants thought one gap was important while others considered it unimportant. The degree of consensus is represented in Figure 4.

Firstly, it was notable that gaps were considered important when they were able to address questions of optimal tree placement (“the right tree in the right place”) by considering soil types, slopes, and other environmental factors, thereby maximising benefits such as riverbank stabilisation, reducing sedimentation, improving soil quality, or reducing pollution (Gap 2, 8, 10). Secondly, participants tended to identify specific stakeholder interests, such as those of SEPA, landowners, farmers, funders, and planning authorities to make their choice on the importance of specific gaps. For example, focusing on the potential to inform landowners and provide strong incentives through evidence on water quality benefits (Gap 30). Thirdly, social acceptance is another major consideration for the justification of importance, where gaps were directly linked to community engagement and ensuring that restoration projects are just and beneficial to local communities (Gaps 41, 42) or perceived as indirectly promoting social acceptance (Gap 16). Lastly, national or strategic implementation necessities underscore the need for scalable, evidence-based approaches that align with broader environmental and governmental goals, such as climate change adaptation and enhancing biodiversity (Gaps 20, 12).

Conversely, conversations occurred justifying why gaps are considered unimportant by some respondents. Some gaps were considered too complex to address, which reduce their perceived importance, such as Gap 30 (on dissolved organic carbon in drinking water). Overlaps with broader woodland issues, made certain gaps less relevant when focusing specifically on RW (Gaps 34 and 36 focusing on medicinal effects of tree fodder for livestock productivity and the effect of short rotation

coppice on water and soil quality). The practical and economic feasibility of achieving certain intended benefits, such as the positive effect leaky barriers for flood management (Gaps 13) or the use of river woodland tree as biomass (Gap 37) also challenged the importance of certain gaps. Finally, many gaps are considered already addressed or adequately covered by existing research. Even though they were considered important topics (e.g. Gap 32 on the availability of invertebrate food sources for salmonids), participants were happy to deprioritise many gaps for this reason.

### 2.2.4 Stakeholders’ perceptions of evidence: gaps or no gaps

As discussed in the previous section, for many of the gaps, respondents questioned whether there was a lack of evidence, noting the following reasoning:

- 1. Existing information and experience:** Some responses suggest that there is already a significant amount of information available, regardless of the type of evidence considered (scientific or grey literature). Practice and experience were sometimes considered as evidence.
- 2. Knowledge exchange (KE) and communication:** Several responses indicate that evidence exists on the gaps in question, but the issue might originate from a lack of knowledge exchange and communication among stakeholders.
- 3. Resource limitations:** There is a recognition that for some of the gaps there is a good understanding and existing approaches, but insufficient resources to implement the outcome of this knowledge.
- 4. Transferability of evidence:** For many gaps, respondents acknowledged the existence of evidence from other countries. In certain cases, and for some participants, the evidence from other locations was considered as sufficient. For others, there was some debate over the applicability to Scotland.
- 5. Specific vs. generalisable gaps:** Some responses highlight that while there is a lot of general evidence, specific gaps might exist that need to be addressed on a case-by-case or site basis. In those cases, some respondents did not consider this as an evidence need but this was challenged by other participants.



### 2.2.5 Plenary conversation

The plenary conversation session of the workshop concluded the work on prioritisation and focused on key topics of interest for the stakeholders present. Here are the main points of conversation.

#### **Monitoring approach:**

- Emphasis on improving understanding of effective monitoring for restoration projects.
- Significant interest from private investors in effective monitoring.
- Clarity needed on monitoring processes and their role in addressing gaps.
- Effective monitoring can both inform and be informed by addressing knowledge gaps.
- Funding Mechanisms:
- Current funding mechanisms are seen as overly bureaucratic.
- Need for more flexible and accessible funding options.
- Private finance requires solid evidence of returns, necessitating clarity on financial metrics and investor risk perspectives.

#### **Data availability and sharing:**

- Need for improved communication, knowledge exchange, and stakeholder cooperation.
- Existing knowledge requires more efficient dissemination.
- Identifying and addressing gaps in data availability and sharing.
- The discussion also highlighted contentious issues, such as the presence and placement of large wood in rivers. There were disagreements in this area showing that specific attention should be paid to gaps with less consensus in terms of research focus.

#### **Interventions and skills:**

- Need for interventions targeting both knowledge and action, particularly technical knowledge.
- The need to focus on local and regional planning considerations.
- Emphasis on increasing skills for river woodland restoration.
- Attention was raised to the differences between natural regeneration and planting. Exploring the benefits and challenges associated with each approach is crucial for informed decision-making.

#### **Communication and advocacy:**

- Improving narrative and communication around river woodland restoration is crucial.
- Importance of exemplars and experience in informing and the use of sector champions to facilitate peer-to-peer learning and promote restoration efforts.
- The absence of common understanding of the term and concept of “resilience” from the discussion.

#### **Which stakeholders to engage next:**

- Health sector, businesses, landowners, infrastructure (gas, electricity, transport), and local authorities.

## 3 Discussion

### 3.1 Workshop and survey approaches and limitations

In applied research fields such as river woodland restoration there is a need to conduct research that will be useful to practitioners and policymakers, thereby contributing to evidence-based decision-making (Dey *et al.*, 2020). The survey and workshop activities were the first two steps of stakeholder engagement in the RivyEvi project. They represent two complementary steps for prioritising evidence gaps. The survey provides an individual assessment of the importance of each gap, while the workshop is a collaborative exercise aimed at exploring the relative importance of each gap for different stakeholders. The collaborative aspect of the workshop and the rich discussion were welcomed by participants, who recognised the value of sharing and understanding the needs and perspectives of other sectors. Despite the differences in the design of the two activities, it is important to underline that four of the five highest-ranked gaps were consistent across both activities and presented high levels of consensus through the workshop findings. This reinforces the importance of these gaps and their overall themes (flood risk alleviation, drought adaptation, clean water, and biodiversity) for future research efforts. These areas of research and specific research questions have been underlined by the scientific literature (Feld *et al.*, 2018; Harper *et al.*, 2021) and findings from the stakeholder engagement activities were compared to the updated literature review work conducted in parallel by the RivyEvi team. However, it is important to underline the methodological complexity of prioritising 37 to 47 gaps. For both activities, the ranking obtained strongly depends on the methods and approach to data representation. For the survey, the choice was made to rank the gaps according to the number of “extremely important” responses. Another ranking approach could have been chosen (e.g., cumulating “extremely important” and “important”) and could have influenced the relative position of the gaps. Consequently, we suggest looking at this prioritisation by clusters/groups of gaps rather than their one-by-one positions and to nuance the positions of the gaps with conversation content and levels of consensus.

Some of the gaps that were ranked lower in importance with high level of consensus in both the survey and the workshop were on: human health, food production, clean energy and biomass, clean

air. However, it was notable that despite the team’s effort to engage with a wide range of stakeholders, experts in those areas remained absent from both activities. To confirm, inform or bring nuance to this pattern of responses, the RivyEvi team engaged specifically with experts on these topics via interviews and focus groups (Appendix 2,3,4,5). Considering time constraint for the project, this underlines the importance to adopt a flexible approach and more targeted engagement (e.g. through site visits and interviews) to reach out to different types of stakeholders (Carmen *et al.*, 2023; Dey *et al.*, 2020).

### 3.2 Key points of conversations

A primary area of interest was the approach to monitoring. Monitoring in general requires reliable and standardised methodologies and is an efficient way of growing evidence from practice. Developing effective monitoring techniques – such as sensors, data querying methods like concentration-discharge analysis, scale studies, techniques for emerging contaminants – constitutes R&D needs that aimed at advancing monitoring methodologies and addressing evidence-development (England *et al.*, 2021). Participants emphasised the need to enhance understanding of how effective monitoring can inform restoration projects, noting significant interest from private investors. Clarity is needed on the necessary monitoring processes and participants recognised that many of the gaps discussed, if addressed correctly, could inform effective monitoring and vice versa. This topic of conversation appeared central for the stakeholders present at the workshop and constituted the foundation of a future focus group discussion (Appendix 4).

Whether or not it was considered as a real evidence gap, the topic of fundings emerged as a key focus point for stakeholders. The conversation also revealed that current funding mechanisms are perceived as overly bureaucratic, highlighting the necessity for more flexible and accessible funding. Private finance was also mentioned as requiring solid evidence of returns, making it essential to further clarify evidence gaps relating to financial metrics and investor perspectives on risk.

Additionally, there was a call to reconsider the balance between incentives and regulations, with exemplars/experience playing a key role informing this. Participants underscored the need

for interventions targeting both knowledge and action, particularly technical knowledge and the need to increase skills. Improving the narrative and communication around RW restoration is essential. Employing sector champions to facilitate peer-to-peer learning could promote RW restoration.

Finally, beyond addressing evidence gaps, stakeholders raised the need for improving data availability and sharing. They underlined that for a lot of the gaps discussed, knowledge exists but would require more efficient communication, knowledge exchange and stakeholder cooperation.

### 3.3 Different perceptions and understanding of “gaps”

There were diverse ways in which stakeholders related to the term “evidence.” Despite our common definition of evidence gaps as referring to a *“lack of sufficient data, studies, documented results, or methodologies necessary for fully understanding or validating aspects of river woodland restoration”*, it became evident that stakeholders’ interpretations and relationships with this concept varied significantly. Some stakeholders challenged the precise wording of some gaps, insisting they could identify them as such if formulated as explicit research questions. Others perceived broader research gaps emerging from thematic statements, viewing issues such as monitoring and finance either as integral components or as barriers. Precision in the wording of these gaps also sparked issues; for instance, specific gaps focusing on soils and sediment were considered too niche and highlighted as missing an important ecological consideration. On the contrary, some gaps such as Gap 20 (“The effect of the expansion of river woodlands on biodiversity”) were sometimes considered as too broad encompassing multiple other gaps. Gap 20 received a high ranking due to its link to multiple other gaps on biodiversity. The systemic nature and interconnections of evidence gaps was noted multiple times by participants, reflecting a general inclination to link and categorise gaps within broader categories and themes. This underscores inherent trade-offs with the wording of evidence gaps that needs to be considered in prioritisation processes.

The discussion also revealed a distinction between specific and generalisable gaps; while some participants emphasised the need for broader transferable evidence, others argued for the value of site specific, case-by-case evidence. For instance, archaeological gaps were initially dismissed by

some as not fitting the evidence gap criteria due to their localised and project-based nature. However, the argument of a specialist underscored the nuanced understanding required, affirming these as legitimate evidence gaps deserving attention. This highlights the necessity for expertise within our discussions to foster mutual understanding among stakeholders.

Survey and workshop respondents, varied widely with respect to levels of formal training in evidence collection and on the whole many practitioners were answering from knowledge of practice and not from an understanding of the breadth and depth of global scientific literature on the topic. In this respect understanding that different types of evidence exist, relative benefits and constraints, where they originate from and who has access to them is an important part of the overall project. To enable this, final reporting of the RivyEvi project brought together aspects of the formal literature evidence and the stakeholder knowledge base.

### 3.4 Contextualising evidence gaps

As part of the workshop discussions and the survey comments, nuanced stakeholder responses emphasised the need for balance between research and actionable work. Participants refocused the attention on the value of evidence. While it was agreed many gaps lacked evidence, the value of bringing more evidence, or the amount of evidence necessary, was questioned. This is in part why the survey design carefully distinguished questions on *“Is this a gap?”* and *“Is this important?”*. There was a recognition of the need to select appropriate research topics, design studies effectively, and ensure the right amount of research is conducted to provide valuable information for projects. This involves highlighting the relevance of the research to practitioners and carefully considering the broader context. In the survey, contextualisation was captured by focusing on barriers to RW restoration. Barriers such as funding, monitoring, collaboration, and knowledge exchanges were recurring and emerged as particularly important for respondents. Understanding the current hurdles for restoration projects can help define research priorities that can help address some of these barriers, acknowledging that not all barriers can be resolved by new evidence (Dey *et al.*, 2020). During the workshop, we further contextualised priorities by bringing together and sharing the perspectives of different stakeholders.

## 4 Conclusion and next steps

The survey and workshop activities of the RivyEvi project are complementary. The survey provided an individual assessment of each gap's importance, while the workshop collaboratively explored their relative importance. Stakeholders' assessments of evidence gaps were strongly influenced by their backgrounds, and creating a collaborative space during the workshop enabled various perspectives to be shared. This suggests that a mixed-method approach, including discussion and collaboration, is a useful way to carry out evidence gaps prioritisation.

In response to our aims, we reviewed the gaps from the 2022 Riverwoods Evidence Review and evaluated their priorities with key stakeholders. We identified additional gaps that might have been previously overlooked and included them in our initial list. We gained insights into stakeholders' perceptions and understanding of current evidence through comments in the survey and workshop conversations. Despite a broad range of understandings and perceptions of what evidence is and what level of evidence is necessary, some gaps clearly emerged as highly important, while others emerged as relatively less important or already addressed.

Four out of the five highest-ranked gaps were consistent across both the survey and the workshop, underscoring their significance:

***Gap 12: The effect of river woodland type, age, placement, and scale on mitigating downstream flood risk.***

***Gap 9: River woodlands' contribution to maintaining river flows during dry periods.***

***Gap 2: The role of river woodland types and placement in stabilising river banks and mitigating sediment sources.***

***Gap 20: The effect of river woodland expansion on biodiversity.***

At this stage of the project it appeared that these gaps, which relate to the broader benefits themes of flood risk alleviation, drought adaptation, clean water, and biodiversity, will be crucial for future research efforts. Clarifying and contextualising these gaps in relation to various levels of intervention and data needs is essential. Both from the survey and the workshop, monitoring and funding emerged as two particularly central areas with the potential of raising specific gaps questions and bringing more evidence relevant to practice.

### Next steps:

The survey and workshop reported here were the initial steps of engagement in the RivyEvi project. Other activities (interviews and focused engagement) aimed to expand the range of stakeholders involved and to deepen consideration of priority topics. The survey results and workshop discussions highlighted the need to engage additional stakeholders who were not able to join the initial group. These included representatives from health, businesses, landowners, infrastructure (gas, electricity, transport), and local authorities. Engaging these stakeholders and focusing on their critical topics of interest were part of the next research steps, which were conducted via interviews (Appendix 2). Planned focus engagement presented in Appendix 3, 4, 5 cover key topics such as monitoring, evidence for diversifying funding for RW as well as needs, ensuring a comprehensive approach to advancing RW restoration.

The survey and workshop showed important aspects of stakeholder perspectives on evidence and highlighted a wide range of perceptions of what is evidence and what is needed. In parallel to the stakeholder engagement, the RivyEvi team also conducted a literature review work aiming to update and complete the evaluation of evidence strength on those different topic areas. The priorities emerging from both literature work and stakeholder engagement are reported in the main project report and summarised data are available in the project database Appendix 6.

## Acknowledgements

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