



UK Centre for  
Ecology & Hydrology

# BioFIND: Biomass Innovation and Information Platform Final Report

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# 1 BioFIND: Demonstrator Design Study

## 1.1 BioFIND Project overview

### 1.1.1 Aims and rationale

Land based greenhouse-gas removal is a key part of achieving net zero by 2050 for the UK. Bioenergy combined with carbon capture and storage technology is identified as an essential component of delivering this target and will require a large and rapid scale up in domestic biomass production.<sup>1</sup> The BioFIND platform design and the team behind it are uniquely positioned to make this possible.

The principle aim of the BioFIND Lot 2 Project is to create a demonstration and knowledge sharing platform to showcase best practice and innovations in land-based biomass production. Our vision is for this platform to support the growth of a thriving land-based biomass sector which contributes to achieving the UKs net zero targets while supporting regional and rural economies.

Our specific aims are:

1. To provide land-owners and land managers with robust, independent information on biomass feedstock performance, agronomy, economics and environmental benefits.
2. To de-risk new crop adoption for prospective growers, developers, supply chain intermediaries and end users by ensuring that geographic variations in the efficacy of biomass feedstocks and relevant innovations are fully evaluated and demonstrated to a broad range of stakeholders across the UK.
3. To facilitate discussion and learning within the biomass sector by enabling the sharing of knowledge, experiences and case studies.
4. To contribute to agricultural, environmental and bioenergy policy development by contributing robust evidence and facilitating interactions between policy, academia and industry.

BioFIND will focus primarily on land-based biomass feedstocks which could deliver a rapid scale up in production, building on 30+ years of academic and industrial research and development from organisations spanning the four nations of the UK. The focus will be on perennial energy crops (short rotation coppice (SRC) and miscanthus) identified by the Climate Change Committee as having significant potential to increase from the current ~10,000 hectares to between 0.2-1.4 million hectares. Other biomass feedstocks, which have had less R&D focus, are lower TRL and have either no or limited planting at commercial scale will also be demonstrated and supported by BioFIND. These include a range of short-rotation forestry (SRF) species, novel perennial crops and annual crops including switchgrass, reed canary grass, hemp etc.

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<sup>1</sup> Element Energy and UKCEH (2021) [Greenhouse Gas removal methods and their potential UK deployment](#), BEIS report

### 1.1.2 BioFIND Objectives

To achieve the aims described above the BioFIND Platform has three objectives:

- **Innovation Evaluation** - supporting the development of Lot 1 innovations through multi-site, independent evaluation and verification of Lot 1 project outcomes.
- **Biomass and Innovation Demonstration** - demonstrating and showcasing best-practice and innovation in biomass feedstock cultivation across the UK.
- **Biomass Information Hub** - Creating and delivering a programme of physical and online dissemination and knowledge sharing events to improve knowledge and awareness of biomass cultivation best practice and innovations.

### 1.1.3 BioFIND Phase 1 Project outline

During Phase 1 the BioFIND consortium delivered five work-packages to better understand industry needs and to scope and design the platform to address those needs and the goals of the BFI programme. The Demonstrator Design Study described in section 1 is based on the outcomes of these work packages which are briefly summarised below.

In **WP1 Stakeholder consultation**, we consulted with ~90 stakeholders including Lot 1 project leads, biomass industry stakeholders from UK and international platforms and networks using questionnaires and semi structured-interviews.

In **WP2 Hub Site Selection**, from an initial long-list we identified 15 potential Hub sites for screening through our site selection process and selected eight for inclusion within the BioFIND platform.

In **WP3 Hub Site Design** we consulted with industry, relevant Lot 1 project teams and Hub Site hosts to develop a Hub site design which could be implemented relatively consistently across the Hubs including 12 types of biomass feedstocks.

In **WP4 Spoke Network Design** we defined the requirements for Spoke sites, produced a long list of ~140 sites and narrowed this down to 40 covering 6 types of biomass feedstocks across all regions of the UK.

In **WP5 Knowledge exchange and engagement strategy**, based on stakeholder questionnaires, semi-structured interviews and consortium expertise we identified target audiences, priority topics and appropriate mechanisms for knowledge sharing and dissemination. This fed into a knowledge exchange strategy with 10 recommendations to take forward in Phase 2 for knowledge sharing, dissemination and showcasing the BFI programme.

### 1.1.4 How BioFIND will support the aims of the BFI Programme

The overarching objective of the BFI Programme is “to address barriers to feedstock production helping to scale up the supply of sustainable domestic biomass in the coming years”. Our stakeholder consultation in Phase 1 (Annex 1-Table A1) confirmed published evidence that the biggest barriers to the rapid scale up of biomass feedstocks in the UK are: production economics; the lack of markets; unsupportive policy; and a lack of robust,

independent, accessible information on biomass agronomy, performance and economics.<sup>2,3</sup>

The BioFIND platform will directly assist Lot 1 projects involved in improving efficiency, cost effectiveness and financial returns from biomass feedstock production, directly addressing the barriers identified drawing on the wealth of experience of the BioFIND consortium. We will also work alongside Lot 1 projects developing innovative decision support tools and exploit synergies between these projects and the platform. As a result, the innovations we help demonstrate and the information we disseminate will promote and de-risk new crop adoption for future growers.

BioFIND will operate a Hub and Spoke model with a broad range of distributed and diverse sites across the UK. These physical sites for “Innovation evaluation” and “Biomass and Innovation demonstration” will be supported by the “Biomass Information Hub” which will co-ordinate knowledge sharing and dissemination activities across the Platform. Hub sites will act as focal points for biomass and innovation demonstration and knowledge dissemination with new biomass feedstock planting and infrastructure to support stakeholder engagement. The Hubs will be complemented by Spoke sites that geographically extend the opportunities for multi-site innovation evaluation and demonstration. This combination of new demonstration planting at Hubs and existing plantations and trial plots at Spoke sites has been devised to enable demonstration and innovation evaluation of biomass feedstocks with long life-cycles of up to 20 years.

### **1.1.5 BioFIND platform structure**

**BioFIND Hubs:** Eight Hub sites will be located across the UK, 4 in England, 2 in Scotland, 1 in Wales and 1 in Northern Ireland (Table 1). At each hub we will plant a diverse range of perennial crops, annual crops and SRF in demonstration plots, alongside new variety trials and existing biomass plantings which are present at many of the Hub sites. This side-by-side comparison of feedstock performance across the UK was highlighted as desirable in our stakeholder consultation.

**BioFIND Spokes:** The Spoke sites will complement the Hubs forming a network of biomass plantations varying in maturity, soil type and environmental context. These will be used for local demonstration days and for gathering data on feedstock performance to inform future growers. The Spoke network will be used for Lot 1 innovation evaluations which cannot be accommodated at Hub sites. Here we will work closely with the successful Lot 1 teams to identify appropriate sites which match their requirements and add value to the testing being conducted within their own projects.

**Biomass Information Hub:** The delivery of regionally appropriate data and information to support decision-making was also identified as desirable by current and potential growers. This includes the provision of information on biomass feedstock agronomy, and the environmental and economic outcomes of its cultivation. The BioFIND platform will disseminate to relevant stakeholders via a hybrid of physical face-to-face and online dissemination events and the creation of a biomass information portal.

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<sup>2</sup> Adams PWR & Lindegaard K (2016) [A critical appraisal of the effectiveness of UK perennial energy crops policy since 1990](#). Renewable and Sustainable Energy Reviews 55: 188-202

<sup>3</sup> Ricardo et al (2020) Sustainable Bioenergy Feedstocks Feasibility Study. BEIS Final Report.

## 1.2 Innovation Integration

### 1.2.1 Principles for inclusion of innovations

The innovations we will support in the BioFIND Platform are focused on improving productivity, economic returns and environmental benefits from land-based biomass feedstocks, directly addressing the barriers identified and drawing on the wealth of experience of the BioFIND consortium. During Phase 1, the BioFIND consortium has identified the Lot 1 projects which it can support with demonstration or innovation evaluation in Phase 2 (Annex 1-Table A2). These innovations sit within the categories of mechanical, geospatial, biological and agronomic innovations as defined in the BFI call. The innovations we will support are focused on land-based biomass, predominantly cultivated feedstocks (annual and perennial crops and forestry), with some support for semi-wild feedstock projects. However, we will also support all Lot 1 projects through our online Biomass Information Hub and via the final year BFI Programme Showcase Event. The innovations included in the BioFIND platform match the following criteria:

- Innovations where multi-site trialling is critical to assess efficacy/performance in different environments across the UK.
- Innovations which could have synergistic or antagonistic interactions with other innovations.
- Innovations suitable for physical and/or virtual demonstration.
- Innovations focused on cultivated and semi-wild land-based biomass.

### 1.2.2 Managing uncertainties around Lot 1 projects

There is inherent uncertainty around the number, scope and precise requirements that successful Lot 1 projects will have for the Lot 2 Demonstrator. Through consultation we have a reasonable description of each Lot 1s expectations and requirements but there is no doubt this will evolve as projects get underway (Annex 1-Table A2). All land-based Lot 1 projects have shown interest in collaborating with BioFIND to demonstrate their innovations through physical and/or virtual events or forums, and to disseminate knowledge on best practice agronomy, varietal choice and innovation. The Innovation Integration Plan (WP3) will be finalised once Phase 2 awards are announced and will describe which Lot 1 projects require demonstration, evaluation and/or promotion, their provisional timings and locations and the form they will take.

Our Hub and Spoke model has built in flexibility to match Lot 1 project requirements to appropriate sites for evaluation and demonstration. It encompasses diverse sites which can accommodate new planting for projects on plant breeding, propagation and cultivation, and Spoke sites with mature biomass plantations across a range of soil types and topographies to accommodate projects developing planting and harvesting machinery or requiring feedstocks growing in specific environmental contexts.

### 1.2.3 Integration of Lot 1 innovations

SRUC will act as the main point of contact for Lot 1 teams as they are not involved in any Lot 1 bids. From Phase 1 consultation Lot 1 project requirements include:



- Multi-site trials and evaluation
- Independent verification of Lot 1 project outcomes
- Innovation demonstration
- Showcasing and promotion
- General support, e.g. assistance with additional field sites external to the platform

Of 22 Phase 1 projects, all are interested in general support from BioFIND and opportunities to disseminate knowledge and promote their innovations through our Biomass Information Hub. In addition, all projects will be included in the final year showcase event. Eleven projects are interested in demonstrating their innovations at our Hub and Spoke sites (Annex 1-Table A2). These are projects developing planting and harvesting machinery, trialling new or imported varieties, plant propagation innovations biomass processing and other land-based biomass innovations. The number of projects interested in multi-site evaluation through the platform was small. Only 5 projects require multi-site trials which involve planting material at Hub sites or demonstrating and monitoring machinery at Spoke sites. This limited uptake may be in part due to significant confusion over the role of the platform and where requirements for trials and costs lay between Lot 1 and Lot 2 projects. For this reason, we will consult again with all projects once awards have been made.

In Q1-Q2 a Lot 1 Innovation Integration plan will be developed (WP3) in consultation with Lot 1 teams clarifying details of their requirements under these specific headings. This will build on the information collated in Phase 1. The integration plan will include timetables of activities and will identify appropriate locations from Hub and Spoke options. Following this, evaluation protocols will be drawn up in collaboration with Lot 1s to objectively measure innovation impact and success. Reporting and confidentiality protocols and procedures will be agreed with each Lot 1 project and with BEIS, prior to evaluation commencing. Review and feedback meetings will be conducted at appropriate intervals to identify issues.

### **1.2.4 Innovation evaluation**

Based on current understanding the key elements and timelines for Lot 1 evaluation are:

- Planning and land preparation of field trials (Q3 2022 – Q2 2023)
- Planting and monitoring of establishment (Q1-3 2023)
- Routine visits to understand progress in design and factory testing (Q3-4 2022)
- Monitoring of machinery testing and demonstration activities
  - Multiplication machines (Q1 2023, 2024 & 2025)
  - Planting machines (Q 1-2 2023, 2024; Q1 2025)
  - Harvesting machines (Q1 2023, 2024 & 2025)

Monitoring metrics will be agreed with Lot 1 projects when evaluation protocols are designed and agreed. However, they are likely to include the following with innovations compared with baseline data collated in WP2 (See “Monitoring Hub Sites” above).

- Breeding: yield, establishment, form, disease and pest incidence

- Multiplication: amount of planting material units per hectare produced from a multiplication bed; production costs of planting material, establishment rate
- Planting machinery: Establishment rate (planting/stocking rate); efficacy / efficiency; fuel usage and life-cycle greenhouse gas (GHG) emissions; establishment costs
- Harvesting: height of stem cut; stool condition; efficacy / efficiency; fuel usage and life-cycle GHG emissions; harvesting costs

### **1.2.5 Innovation demonstration and showcasing**

In liaison with WP1 and 2, demonstration events will be organised at the Hub sites and on an *ad hoc* basis at Spoke sites. Two demonstration events per year per Hub are planned for year-2 and year-3. Annex 1-Table A2 describes the intention of Lot 1 projects to engage with these demonstration days. In addition, we will promote and showcase all innovations through the Online Biomass Information Hub and the BFI Programme Showcase Event (see section 1.6).

## **1.3 Co-ordination plan**

### **1.3.1 BioFIND partner organisations**

BioFIND Phase 1 built a strong consortium and consulted widely, and this approach will continue in Phase 2 with new sub-contractors and stakeholder engagement mechanisms to ensure the platform delivers to industry needs. The core consortium will manage the establishment of Hub sites and the creation of the online platform, working closely with Hub site hosts to leverage added value. Hub Sites will be based at higher education institutions (HEI's) /research institutes, agricultural colleges and a biomass company with eight sites agreed across the UK (Fig. 1, Table 1). These working relationships between the core team and Hub hosts are already established through Phase 1 activity and site visits. The Spoke site network consisting of a large number of potential Spoke sites will be managed by the core consortium with access to specific sites arranged as required dependent on the specific need of funded Lot 1 projects. In addition, four industry sub-contractors will deliver the commercial scale planting of miscanthus and willow across the Hubs.

The Project Co-ordinator (UKCEH) has a track record of successfully managing large research and knowledge exchange projects, while the consortium has a proven track record in managing long-term experimental sites, on commercial and institutional land. All consortium members have been working in bioenergy research, policy or industry for many years and as a result have extensive stakeholder networks and trusted relationships which we will build on in BioFIND.

### **1.3.2 External consultation**

We seek to build a regionally based community around the platform who will contribute to the development, establishment and operation of Hub sites. External stakeholder input and feedback on platform plans and activities will be achieved through 3 mechanisms:

- Advisory Board: We have retained advisory members and added 2 additional members to provide enhanced strategic and policy input for forestry and biomass end-use (Annex 1-Table A3).
- Biomass Industry Consultation Panel: twice yearly meetings of 20 industry stakeholders to gain feedback on platform plans and operation.
- Feedstock-specific panels: to discuss and recommend crop varieties and species for Hub site variety trials, including Lot 1 projects, industry and academic stakeholders.

## 1.4 BioFIND Locations

### 1.4.1 Hub sites

Hub sites were selected in Phase 1 using a robust selection process with sites scored against a range of criteria (Annex 1-Table A4). In addition, information was collated on the environmental context of the sites. Scoring was conducted by the consortium and reviewed by the advisory board with a final decision on the number and distribution of sites considering the geographic spread across the UK as a key factor. Criteria covered:

1. Biomass cultivation capacity – do sites have existing trials or demonstrations; how much land do they have available for new planting?
2. Monitoring capacity and infrastructure – do sites have a met station or data on soils; do sites own or have access to relevant equipment/machinery for biomass cultivation; do sites have biomass cultivation expertise?
3. Engagement and outreach – do sites have educational engagement/outreach; do sites have links to relevant stakeholder communities; do sites have facilities for hosting engagement/dissemination events?

Eight Hub sites were selected through this site selection process (Fig. 1, Table 1). These sites encompass a wide range of climates, soil types, geographies, marginality and environmental contexts. The Hub sites will support multi-site trials of planting materials from Lot 1 projects spanning these conditions, extending the northern boundaries of miscanthus and other energy grass cultivation. These sites represent 30+ years' experience in developing the biomass feedstock sector and are located at academic institutions with strengths in agriculture and bioenergy and existing farm platforms which BioFIND will be aligned with. One exception is the Hub site at Bio Global Industries, a company with existing trials of biomass feedstocks and a broad supply-chain network which BioFIND will benefit from.



## 1.4.2 Spoke Network

The Spoke site network will provide potential sites for innovation evaluation and *ad hoc* demonstration events. Criteria for selection included:

- Existing commercial plantations of perennial energy crops, annual biomass crops or short rotation forestry
- Sites which exhibit best practice or elite examples of specific varieties, genotypes or species selections
- Sites with difficult terrain, soil types or in harsh environments sites e.g., sloping, wet, stony etc.
- Sites with reasonable access for demonstration events
- Sites where BioFIND team members have existing relationships to facilitate access

The distribution of Spoke sites across the UK will enhance the Hub site network and increase stakeholder reach. Initially we identified 47 SRC willow sites, 48 SRC/SRF poplar sites, 29 miscanthus sites and 14 sites for other crops (including SRF eucalyptus, reed canary grass and sida) and narrowed this down to a shortlist of 40 optimal sites (Fig. 1). The final selection of Spoke sites will depend on the projects that receive Phase 2 funding. We envisage that there will be around 30 Spoke sites in all. One key consideration is making sure that a Hub or Spoke site is located reasonably close to the 22 agricultural colleges located in the UK as we see agricultural students and lecturers as being a key target audience for BioFIND demonstration activities.

## 1.5 BioFIND Hub Site Design

### 1.5.1 Hub site planting

Demonstrating perennial biomass crops and short-rotation forestry (SRF) feedstocks within a 3-year project is a challenge. We have addressed this by selecting Hub sites (6 of 8) which have existing planting alongside our planned demonstration plots and variety trials. Hubs also have additional land which could be used for innovation evaluation and planting demonstrations, and we will use mature Spoke sites for innovation evaluation where that is appropriate. In addition, the BioFIND website will be launched early in year-1 to begin building awareness of the platform plans, activities and resources.

In Q2-Q3 2022 WP1 will work with Hub sites to draw-up planting designs for the biomass demonstration plots and variety trials. Best practice for establishment will be determined (an opportunity to work with any Lot 1 decision support / knowledge provision projects) and implementation plans agreed for putting into action by early autumn with Feedstock-specific consultation panels drawn from industry feeding into this process. A preliminary design for the demonstration site at Newcastle University is in Annex 1-Fig. A1. In Q1-Q2 2023 Hub sites will be planted with some or all the following and will be managed and used as a resource for demonstration over the subsequent 2 years:

- Demonstration blocks and plots of miscanthus, SRC willow and poplar, SRF Eucalyptus, SRF poplar and hemp (0.1 to 0.5 ha)
- Small demonstration plots of more niche crops e.g. reed canary grass, switchgrass, hemp, SRF alder, Paulownia, Sida and Arundo (0.25 ha total).

- Replicated varietal trials of miscanthus and SRC willow at 5 Hub sites.

### **1.5.2 Monitoring framework for demonstration plots and varietal trials**

Multi-site, UK-wide comparison of biomass feedstock performance is a key component of BioFIND and requires consistent agronomy and management across the Hub sites. Day-to-day management of the demonstration plots and trials will be conducted by Hub site managers, with quality checks and regular oversight visits by a full-time agronomist (WP1). Hub site monitoring of feedstock performance, environmental and economic outcomes will deliver regionally specific data from across the UK feeding into WP4 knowledge sharing (WP2). In Q3-Q4 2022, instrumentation including a weather station and soil sensors will be set up at each Hub site so that baseline soil and climate data can be collected. In 2023, impacts of crop establishment (e.g. fuel use for planting, soil compaction) will be assessed, with monitoring of crop success (establishment, pest and diseases, yields) running from Q2 2023 to the end of the project. Comparisons of crop impacts on soil compaction, water infiltration, and earthworm populations, will also take place during this timeframe with all data reported in the “UK wide comparison of biomass feedstock performance”. BioFIND data management plans will be developed in year-1, including analytical pipelines and data synthesis plans to feed into knowledge sharing and dissemination materials (WP4). Data ingestion from all Hub sites will begin from year-1, stored on UKCEH facilities, and published on the Environmental Information Data Centre (EIDC) where appropriate.

### **1.5.3 Data collation**

Data management and quality procedures are described in the Phase 2 project plan (section 2.3.5). Regionally-specific data collected within the BioFIND Platform will include:

- WP2 environmental data (e.g. soils) collated from Hub site demonstration plots and variety trials.
- WP2 crop performance data (e.g. health, yields) collated from Hub site demonstration plots and variety trials.
- WP2 economic and life cycle GHG emissions data collation for dissemination including data on costs, subsidies and markets.
- WP3 data collated as part of Innovation Evaluation activities.
- WP4 data collated on stakeholders for engagement activities.
- Social value KPIs at each site

These data will be used in virtual and physical dissemination activities described below and drawn together in a UK wide comparison of biomass feedstock performance. In addition, standard protocols for assessment of soils, crops and operations will be assembled in a Monitoring and Protocols Handbook. This will support consistent monitoring approaches across Hub sites, comparable assessment at Spoke sites, and provide structure toward data collation activities and statistical analyses.

### 1.5.4 Direct environmental benefits and trade-offs at Hub sites

BioFIND Hub sites will be planted with a range of biomass feedstocks over 5-hectare sites in each location. This change in land use to biomass feedstock cultivation has the potential to deliver a range of environmental benefits but there are also risks and trade-offs. Hub sites will be established on existing agricultural land with well-known history and non-limiting conservation designations, to avoid significant risks to the environment and biodiversity. A desk-based assessment of each Hub site was conducted during Phase 1, collating existing field-based data and using online tools (e.g. Defra Magic Map, National Biodiversity Network) to identify risks and ensure that environmental and biodiversity impacts are minimised (Annex 1-Table A5). In Phase 2, we will conduct a more detailed desk-based assessment of potential GHG emissions, environmental and biodiversity impacts at each Hub site, and of activities related to Lot 1 projects at BioFIND sites.

**Greenhouse gas (GHG) emissions:** The GHG emissions from running the demonstration sites through land preparation, planting and harvesting are not predicted to be significantly greater than ongoing agricultural use. However, emissions will be estimated at the start of Phase 2, and then verified throughout the project using data captured at Hub sites as management activities take place (e.g. fuel use); additional energy use linked to the running the demonstration sites will also be captured.

**Environmental impacts:** Where a Hub site is close to water courses which may be sensitive to nutrient run-off, it is predicted that biomass feedstock planting will reduce the risk of degrading water quality. Loss of soil carbon may be expected under some biomass crops on grassland sites. In Phase 2, baseline sampling prior to any land use change at all Hub sites will ensure that longer-term changes in soil carbon stocks, available nutrients and hydrological status, as a result of biomass cultivation can be assessed where greatest impacts are expected.

**Biodiversity:** The mainly arable or rotational grassland which will be planted on at Hub sites, and the scale and nature of the proposed planting (diverse mosaic of crops compared to large scale monoculture planting) suggests an overall positive outcome for biodiversity is likely. In addition, the relatively small scale of the plots will result in a high crop to edge ratio, a factor known to maximise positive outcomes for a range of species.<sup>4</sup> In Phase 2, incidental species records will be collated, and basic breeding bird surveys will be undertaken at Hub sites.

## 1.6 Demonstration, dissemination and engagement

### 1.6.1 BioFIND: Showcasing the BFI programme

Reaching new biomass growers is the core purpose of BioFIND. The platform will promote the BFI programme through a focussed knowledge dissemination and engagement strategy. We will focus our efforts on land-based biomass but will also support all Lot 1 projects in our online Biomass platform and final Showcase Event for the BFI Programme. From research undertaken in Phase 1, key actions and activities have been identified as essential for engaging stakeholders relevant to the BFI programme

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<sup>4</sup> Rowe RL, Street NR, Taylor G (2009) [Identifying potential environmental impacts of large-scale deployment of dedicated bioenergy crops in the UK](#), *Renewable and Sustainable Energy Reviews* 13, 271-290

(Annex 1-Table A6). These include face to face and online dissemination and engagement tools, which have been included in BioFIND project actions (WP4):

- Demonstration activities/events (e.g. Industry demonstration and engagement days)
- Peer-to-peer learning opportunities through demonstration
- Comprehensive 'one-stop shop' website, including high-level knowledge resource and library and broad array of virtual knowledge transfer materials
- Suite of engagement materials available across range of media (both online and offline) to offer maximum accessibility/inclusivity
- Presence and engagement at agricultural shows
- Showcase event for all BFI programme projects (including algae projects)
- Online and new media engagement (e.g. video/online demonstrations, podcasts, webinars, eLearning materials)
- Presence on Farming Forum and other land manager communication networks

The BioFIND consortium have a long track-record in this sector and extensive networks of biomass industry and land management professionals. We will use this influence to build wider engagement across agriculture, biomass and energy sectors utilising existing contacts in national and local media to increase BFI programme exposure. Consortium leadership in other knowledge exchange programmes, such as Farming Connect, will be leveraged to increase awareness of the BFI programme across broad-reach land management communication networks, communicating the advantages of utilising biomass feedstocks as part of the Government's Net Zero strategy.

### **1.6.2 Sharing learnings with the biomass sector and value chain**

In Phase 1, stakeholder feedback was clear that delivering regionally appropriate information to support decision-making is essential with the importance of online deliverability for knowledge sharing highlighted. Consequently, we will create and deliver an online engagement platform, spanning dedicated website and social media campaigns, to effectively drive interest in BioFIND and the wider BFI programme. Relevant stakeholder groups were identified through consortium knowledge, Lot 1 interviews and stakeholder consultation. Key groups identified were:

- Existing biomass feedstock growers
- Potential future biomass feedstock growers
- Industry representative bodies (agriculture / renewable energy / bioenergy)
- Farm business advisers / land agents / crop consultants
- Institute / University farms
- Bioenergy companies
- Biomass end-users
- UK / international farm networks or demonstration platforms
- Policymakers

Opportunities to see biomass crops, talk to growers and hear first-hand experience is also an essential component of our engagement strategy. Hub and Spoke sites will create these opportunities for farmers / landowners / students and other sectoral



operators to benefit from peer-to-peer learning and will facilitate engagement between biomass supply chain actors including growers, consultants, land agents, agronomists, agri-advisors and agricultural colleges, end market users and policymakers.

BioFIND Hubs will act as regional centres and host demonstration events and develop training and educational materials using the Hub site biomass plantings as a physical resource engaging with professional training, industry open days and educational programmes. BioFIND Spokes will engage stakeholders who might not travel to one of the regional centres maximising the accessibility for growers from across the UK.

**The Biomass Information Hub** will co-ordinate all demonstration, dissemination and engagement activities. To complement the site-based programme, a broad array of knowledge-sharing and dissemination materials will be created to support growers transitioning to biomass crops. This will be accessible primarily through the BioFIND website but also via other media, to ensure accessibility regardless of grower learning medium preference and wider inclusivity. This will include:

- Literature, both technical and newsletter-style
- YouTube videos and grower podcasts
- Webinars
- Social media content

The Biomass Information Hub will also develop high-level learning material from the existing canon of scientific literature to ensure growers have access to a comprehensive information resource, covering relevant factors from beyond the planned project activities. It is anticipated that BioFIND will engage closely with any successful Lot 1 projects which focus on knowledge provision / Biomass Crop Decision support / Best Practice Guidance.

### ***1.6.3 Scale and scope of the BioFIND Platform approach***

Our aim is to maximise exposure of the BioFIND Platform and Lot 1 projects. The target audience for BioFIND encompasses over a half a million people who are involved in UK agriculture and biomass supply chains<sup>5, 6</sup>. During the three years of the BioFIND project we aim to engage with at least 5% of this audience – 25,000 people. This will be achieved through:

- BioFIND website
- Stakeholders signing up to newsletters
- Social media follows
- Views of online videos
- Attendance at open days, online training and webinars
- Exposure through TV and radio programmes e.g. Countryfile, Farming Today
- Individual local engagement by Hub sites (local Govt, policy, energy, regulation, industry, NGO, academics...)

In the third year of the project we will organise and host international trade missions. This will provide Lot 1 projects with a global audience for their products and could lead to greater export potential, additional job creation and increased foreign investment, further bolstering the UK's reputation as a pioneer in green technologies

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<sup>5</sup> [https://en.wikipedia.org/wiki/Agriculture\\_in\\_the\\_United\\_Kingdom](https://en.wikipedia.org/wiki/Agriculture_in_the_United_Kingdom)

<sup>6</sup> <https://www.biomassheatworks.co.uk/resources>

## 2 BioFIND Phase 2 Project Plan

### 2.1 Project delivery team

#### 2.1.1 Project team overview

The BioFIND Platform will be led by UKCEH in collaboration with subcontractors at Aberystwyth University (IBERS), Rothamsted Research (RothR), Scotland's Rural College (SRUC), Agri-Food Biosciences Institute (AFBI) and Crops for Energy (C4E). These major research organisations have collaborated over the last 20+ years to deliver biomass research and knowledge dissemination, providing underpinning evidence for industry and policy on biomass feedstock cultivation and sustainability. The consortium will sub-contract leading bioenergy industry organisations to deliver specific components of the project including additional sub-contractors to host 3 Hub sites and sub-contractors for planting and harvesting biomass feedstocks. This breadth of knowledge and expertise is essential and ensures we have the capacity to successfully deliver this ambitious project (Annex 1-Table A7, A8).

#### 2.1.2 Key team members and roles

UKCEH: Dr Jeanette Whitaker will continue her role from Phase 1 as Project Co-ordinator overseeing the delivery of the project. She will act as Science Lead for the Platform, WP5 lead on Platform Management and Co-ordination and chair the project management and advisory boards. Jeanette is a biogeochemist with 23 years' research experience in impacts of climate change, land-use change and land management on biogeochemical cycling, and bioenergy sustainability.

UKCEH: Chris Bell is an experienced Senior Project & Programme Manager at UKCEH who will provide project management and support for the Project Co-ordinator and the Project Management Board. His responsibilities will include reporting and invoicing, managing dependencies, risks, sub-contracts and supplier management; meetings and project communication; and work with the Knowledge Exchange lead at IBERS in coordinating Hub and Spoke activities.

UKCEH: Dr Aidan Keith will lead WP2 Field monitoring and data synthesis contributing expertise in soil science and bioenergy, supported by technical staff. Dr Rebecca Rowe who has 15 years' research and stakeholder experience in perennial bioenergy crop sustainability will deliver the environmental impact assessment.

RothR: Dr Ian Shield and William Macalpine have 18 years' experience in this field and specialisms in willow breeding and agronomy. William Macalpine will lead WP1 co-ordinating the Hub Site planting and manage an agronomist who will support the BioFIND Hubs. Shield will sit on the Project Management Board and contribute to work within WP1 Hub Biomass Demonstration.

IBERS: Professor Iain Donnison, Dr Chris Ashman and Dr William Stiles, have extensive experience in plant breeding, soil-science, project design, trial management, and the development of European multi-site platforms. Chris Ashman will manage the Hub site at IBERS, supported by field technical staff. Will Stiles will lead the WP4 Biomass Information Hub. Iain Donnison is Professor of plant science and will sit on the Project Management Board.

AFBI: Christopher Johnston will manage the Hub site at AFBI Hillsborough supported by a scientific officer for wider platform integration and a field agronomist. Chris will also sit on the Project Management Board and contribute to the integrating of Lot 1 innovations within the hub and demo site activities. Chris's role will also develop localised communication and dissemination activities.

SRUC: David Lawson will lead WP3 Innovation Integration building on his expertise with trials for biomass crop growth in Scotland. He will provide coordination between Lot 1 projects and the relevant Spoke and Hub sites. Pierre Bouffandeau, an experienced trials manager, will co-ordinate the management of the two Hub sites. Bob Rees, Professor of agriculture and climate change will sit on the Project Management Board.

C4E: Kevin Lindegaard will act as Biomass Industry Consultant for the project, facilitating interactions with stakeholders and access to Spoke sites and input specifically on WP4. C4E will sub-contract Bryan Elliott of Eucalyptus Renewables / Devon Forestry Consultants to provide additional expertise in Short-rotation and long-rotation forestry. Both consultants will provide advice across the WPs.

### **2.1.3 Hub site management and delivery**

A full-time Agronomist based at Rothamsted Research will oversee all agronomic activity at the eight Hub sites, ensuring consistency and quality assurance and providing support for all Hub site managers.

At each Hub site a field site manager/agronomist will work with the WP1 team to establish and manage the demonstration plots and variety trials; with knowledge exchange staff working with WP4 to deliver physical demonstration and dissemination events. Hub site personnel will also support local Spoke sites with innovation evaluation and demonstration (Annex 1-Table A8).

Newcastle University, led by Kirsty McInnes, will host a Hub site at Cockle Park University Farm where there is an established Innovation and Demonstration Platform. This platform connects industry, NGO and academic stakeholders.

Bishop Burton College University Centre will host a Hub site. As Hub site lead, Jonathan Dearlove, will manage the site and has significant experience in crop agronomy and as a technical manager for one of the largest UK nurseries, in addition to his academic role.

Bio-Global Industries (BGI) will host a Hub site at their company in Buckinghamshire. They have a 10-year track record of growing perennial energy crops and installing biomass systems. They will use their wider supply-chain networks to promote BioFIND activities and ensure high levels of engagement across the industry.

## **2.2 Project delivery plan**

The BioFIND platform has a Hub and Spoke model with diverse sites distributed across UK. These physical sites for "Innovation evaluation" and "Biomass and Innovation demonstration" will be supported by the Biomass Information Hub which will co-ordinate knowledge sharing and dissemination activities across the Platform.

To deliver this vision, the BioFIND project delivery plan is structured as five work packages with WP leadership distributed across the consortium (Annex 1-Fig. A2). The

Project Co-ordinator is responsible for ensuring milestones and deliverables are achieved with WP leads responsible for deliverables produced in their WPs and with shared responsibility where deliverables are produced from multiple WPs.

### **2.2.1 WP Structure**

The project will be managed as 5 interlinked work packages as follows:

WP1: Hub Biomass Demonstration

Lead: RothR (Macalpine); contributors: IBERS, C4E, ERDFC, Hub sites.

WP2: Hub Monitoring and Data Synthesis

Lead: UKCEH (Keith); contributors: RothR, IBERS, C4E, Hub sites.

WP3: Lot 1 Innovation Integration

Lead: SRUC (Lawson); contributors: AFBI, C4E, ERDFC, Hub sites.

WP4: Biomass Information Hub

Lead: IBERS (Stiles); contributors: C4E, ERDFC, Hub sites.

WP 5: Platform Management and Co-ordination

Lead: UKCEH Project Co-ordinator (Whitaker), UKCEH Project Manager (Bell) & UKCEH Data Manager.

### **2.2.2 Project milestones and deliverables**

1. Milestone 1 (01 October 2022), with deliverables:
  - a. Biomass planting design and protocols for all Hubs (WP1)
  - b. Hub monitoring plan and protocol handbook (WP2)
  - c. Lot 1 innovation integration plan (WP3)
  - d. Knowledge dissemination and engagement plan (WP4)
  - e. Website and online communication platform launch (WP4)
2. Milestone 2 (01 April 2023) with deliverables:
  - a. Biomass planting implementation plan for all hubs (WP1)
  - b. Hub data synthesis and management plan (WP2)
  - c. Environmental impact assessment of BioFIND Hub sites (WP2; interim report)
  - d. Innovation evaluation plans and protocols (WP3)
  - e. 8 Demonstration events completed – year-1 (WP1+WP4)
3. Milestone 3 (01 October 2023) with deliverables:
  - a. Establishment of variety/species trials at 5 Hub sites (WP1)
  - b. Establishment of biomass demonstration plots at 8 Hub sites (WP1)
  - c. Baseline soil and environmental properties at Hub sites (year-1) (WP2)
  - d. Economics of biomass feedstock cultivation: website and dissemination materials (WP2+WP4)
  - e. Biomass cultivation case studies (WP2+WP4)
4. Milestone 4 (01 April 2024) with deliverables:
  - a. Establishment year monitoring data: feedstocks and environment (year-2) (WP1+2)
  - b. 12 Demonstration events completed – year-2 (WP1+WP3+WP4)
  - c. Interim report on Lot 1 innovation evaluation (WP3)

- d. Legacy funding for BioFIND (WP5)
5. Milestone 5 (01 October 2024) with deliverables
  - a. Draft final report (WP5) including:
    - Environmental impact assessment of BioFIND Hub sites (WP2)
    - Innovation Evaluation results and analysis (WP3+WP4)
    - Impacts of BioFIND on the UK bioeconomy (WP4)
    - The social value and success of BioFIND (WP5)
6. Milestone 6 ( 28 February 2025) with deliverables
  - a. Final report including sections below
    - i. A final report taking into account feedback from BEIS on the draft (commercially sensitive version)
    - ii. Final report (non-commercially sensitive version)
      - UK wide comparison of biomass feedstock performance (WP1+WP2)
      - 12 Demonstration events completed - year 3 (WP1+WP3+WP4)
      - Showcase for BEIS Biomass Feedstock Programme (WP4)

### 2.2.3 Reporting plans

In addition to the milestones above, UKCEH will:

- Meet with their Monitoring Officer at least once per month to discuss project progress and highlight successes and exceptions, issues and risks. Immediate communication will occur if specific risks or issues are identified.
- Submit a project progress report every quarter covering:
  - Progress against the project delivery plan and project milestones, upcoming work over the next quarter.
  - Financial information (including budget spend and budget forecast).
  - Updated risk and issue registers (including where risk ratings have changed, or new risks/issue have been identified).
  - Any key lessons learnt during delivery.
  - Progress against relevant programme KPIs.
- Attend all stage gate reviews, held every six months after project commencement to assess the project's deliverables, progress, costs, risks, and spend against the project plan.
- Facilitate annual site visits at different Hub sites each year.
- Participate in three BEIS Phase-2 dissemination events.

## 2.3 Project oversight and governance

### 2.3.1 Project governance

The Project Co-ordinator will lead and have overall responsibility for project delivery supported by an experienced UKCEH Project Manager who will manage the project using

the UKCEH Project Management Framework. This follows the principles of PRINCE2 and operates in line with ISO9001:2015 standards.

The external advisory board (Annex 1-Table A3) will provide independent project oversight and review all key decisions and deliverables. A Project Management Board will be established, chaired by the Project Co-ordinator with the Project Manager and representatives of each of the main project partners (RothR, IBERS, SRUC, AFBI). The Management Board will have responsibility for project governance including risk and issue management, quality assurance, tracking progress against deliverables. They will convene the external advisory board, biomass industry panel and the feedstock-specific panels. Timelines, protocols and risk registers will be completed for each WP activity with roles and responsibilities being identified.

The Project Co-ordinator and sub-contractors will complete a Consortium Agreement containing: the governance structure, roles and responsibilities; distribution of project resources; arrangements for adding or removing parties to the consortium; a GDPR compliant data management process; agreements on handling intellectual properties; terms for termination of the consortium; and dispute resolution process.

UKCEH recognise that in many instances, the greatest risk exists from the use of sub-contractors. We ensure that our partners have the capability and capacity to deliver their relevant tasks, including contingency should critical staff become unavailable. This is achieved by our due diligence and risk assessment and mitigation process. UKCEH maintains contractor information for each partner and supplier; contracts are issued through the UKCEH Research Contracts and Data Licensing Team, and invoices and payments issued by the UKCEH Finance Team.

As lead contractor, UKCEH defines the roles and responsibilities and oversees delivery of all tasks. In designing a project, we identify all critical pathways to delivery and, where these are dependent upon a sub-contractor, particular focus will be given to understanding the risk and building in redundancy and safeguards. We will also ensure that specifications and contracts with sub-contractors recognise and address the risk identified, and minimise risks to the project, UKCEH and BEIS. UKCEH will design contracts to ensure that at least an element of payment is provided to sub-contractors only on delivery of satisfactory outputs, thus creating appropriate incentives and responsible governance.

Project progress will be reviewed and communicated on a regular basis by the Project Manager and Management Board. This will include the performance of any subcontractors and allows for any problems to be identified at an early stage and remedial action taken. Additionally, as part of our ISO9001 certified QA processes, projects are audited by the UKCEH QA Team on a regular basis both during the project and towards closure. This ensures management, procedures and actions are appropriate, timely and effective.

### ***2.3.2 Management of Lot 1 – Lot 2 interactions***

Establishing strong, trusted relationships between Lot 1 projects and the BioFIND team is critical to the success of the platform and the BFI programme. A strength of our consortium is our long track-record working in this sector, but this also creates challenges in a small sector, with many of our sub-contractors also involved in Lot 1 bids.

In Phase-1, we made great efforts to recognise and manage any concerns Lot 1 projects might have about bias and conflicts of interest within our team. We did this by focusing communication initially through UKCEH (not a Lot 1 competitor), by offering NDAs and by asking specifically about any concerns so we could incorporate feedback into our Phase-2 plans. We also laid out for Lot 1 participants and other biomass stakeholders our desire to create an inclusive platform which represents the whole industry. We have reconfigured the industry input to the core platform with reduced and specific roles, SRUC will lead WP3 Lot 1 Integration as they are not involved in a Lot 1 project and will establish a consultation panel which will be inclusive and allow the platform to be responsive to the industry.

The External Advisory Board will be particularly important in the evaluation of Lot 1 innovations as a number of the project partners are bidding for Lot 1 Phase 2 projects. Advisory group members have appropriate expertise but are not involved in any aspect of the BEIS BFI Programme

### **2.3.3 Risks and risk management**

Dr Whitaker, and the Project Manager, will manage exposure to risk using UKCEH's risk and issue tracking system. On project initiation, the Project Management Board will evaluate the risk management plan and agree actions to appropriately reduce the impacts of risks identified. Each risk identified will incorporate an actual or planned response and be designated an appropriate owner to monitor the threat. Issues that have affected the delivery of the project will be identified, assessed and managed at the appropriate level by the management group, the Project Board or escalated further.

### **2.3.4 Approach to project design and quality assurance**

The BioFIND Platform has been designed in Phase-1 through a collaborative, inclusive process. In Phase-1 the consortium comprised a diverse range of organisations and company structures (SMEs, research institutes and HEIs). In addition, we conducted extensive stakeholder consultation with bioenergy and agricultural stakeholders from the UK and internationally, through a questionnaire and a series of semi-structured interviews. The breadth of the consortium bridging academic and industry perspectives and expertise is critical in realising the goals of the BFI programme.

UKCEH operates an ISO 9001:2015 Quality Management System (certificate no FS 596893). Dr Whitaker will seek compliance with Quality standards in the execution of the project and will delegate authority over certain quality control tasks where appropriate. Criteria to achieve the expected level of quality will be incorporated into the deliverable descriptions. Dr Whitaker will approve all project reports, and these will also be subject to UKCEH internal review process. As described under project oversight and governance, sub-contractors will also be expected to comply with quality standards.

### **2.3.5 Data management**

UKCEH has a robust policy for information and data management with mandatory project Data Management Plans (DMP), and a track record of managing similar large and complex datasets. UKCEH will assign an experienced Data Manager and that person, the Project Manager and the Project Co-ordinator will complete a DMP at the project outset incorporating FAIR (Findability, Accessibility, Interoperability, and Reusability) principles of data sharing. The DMP will be reviewed independently by the UKCEH Quality Manager and a member of the UKCEH Data Team. Dr Whitaker will familiarise the project team

with the DMP to ensure correct implementation, review the DMP and datasets produced during the project, and provide overall QA/QC. Quality will be maintained through clear communication of work plans, deliverables and deadlines; file management with appropriate data security and back up regime; and data recording, access and sharing protocols.

The WP2 Hub data synthesis and management plan will document a database schema and QC procedures for use by all Hub site managers and project staff (this will also cover data from Spoke sites), to ensure consistent data capture, processing & ingestion processes and delivery of robust, high-quality and well-documented datasets. Processed data from Hub and Spoke sites will be received by the BioFIND Data Manager (UKCEH), undergo initial checks and stored in dedicated project space on UKCEH drives (with daily backups). Datasets proposed for publication on EIDC will be reviewed by the project management board to address potential issues (e.g. IP, anonymity, commercial concerns).

**Data protection:** Sensitive personal data including landowner contact information, consents and site information will be handled according to the requirements of GDPR, under the Project Manager's supervision. The UKCEH Quality and Compliance Manager (Quentin Tucker) will be consulted and provide formal sign-off that GDPR requirements have been complied with. As part of the project delivery plan, we will develop confidentiality protocols for interactions with innovation teams, such that the IP and commercial sensitivity of innovations and their development is not compromised.

## 2.4 List of Annexes

Annex 1 BioFIND Final report Tables and Figures



# Annex 1 – BioFIND: Biomass Innovation and Information Platform. Final report tables and figures

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**Figure A1. Example of Hub biomass planting design at Cockle Park Farm, Newcastle University**

Newly planted areas to include:

*Demonstration blocks*

- Miscanthus giganteus 70m x 70 m (0.5 ha)
- Miscanthus Terravesta Athena 70m x 70 m (0.5 ha)
- SRC willow (a 6 way mixture) 70m x 70 m (0.5 ha)
- SRC poplar 30 m x 30 m (0.09ha)
- SRF Eucalyptus 50 m x 50 m (0.25 ha)
- SRF Poplar 50 m x 50 m (0.25 ha)
- Hemp rotation (0.25 ha)

*Demonstration plots* including Reed Canary Grass, Switch Grass (upland and lowland ecotypes), SRF Alder, Paulownia, Sida and Arundo. 0.25 ha. Plots 18 m x 18 m.

*Variety trials*

2023- Miscanthus, 8 varieties, 0.44 ha.

2-23- SRC willow, 30 varieties 0.6 ha  
(These areas may grow depending which Lot 1s are successful)

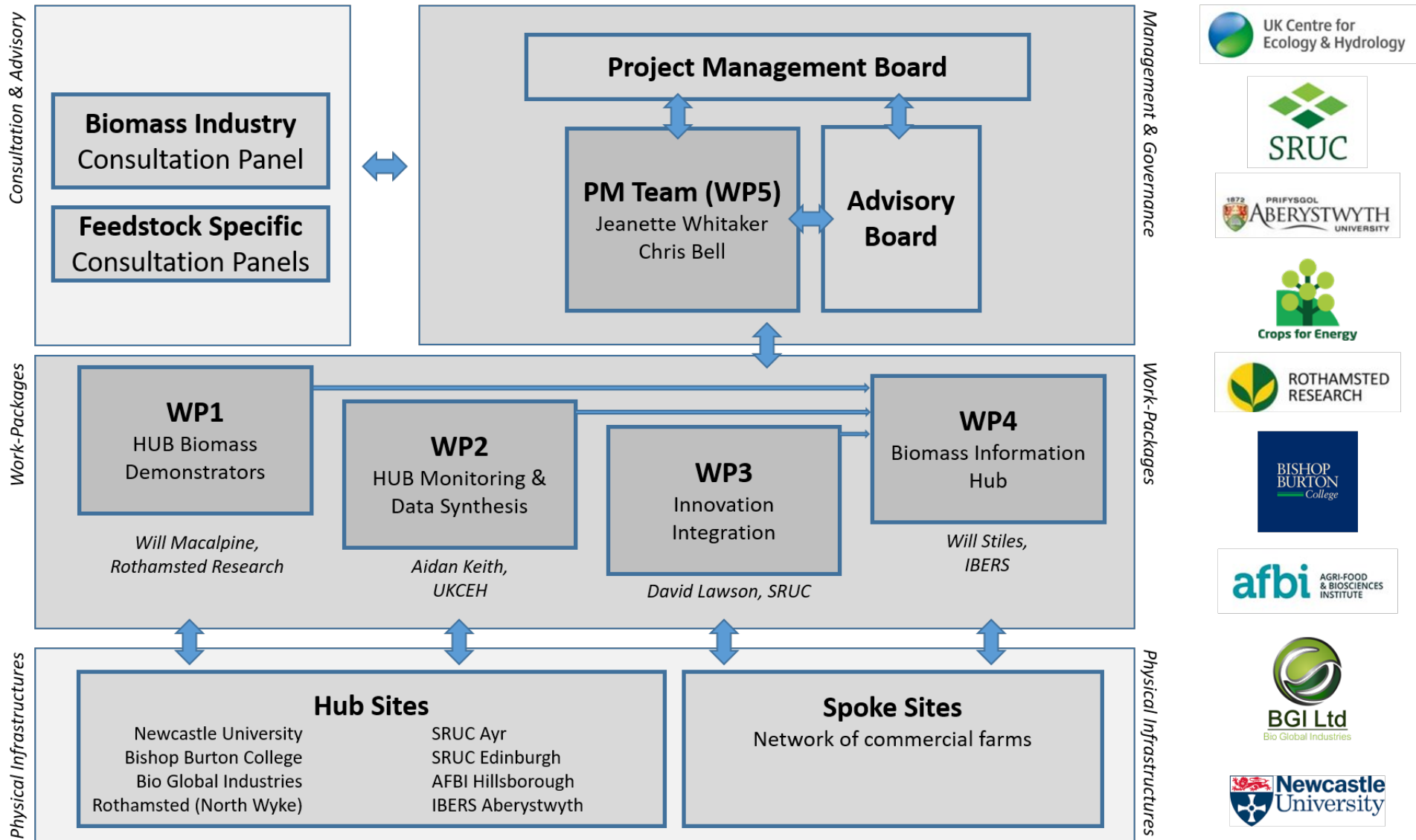
Remaining field available for other Lot 1 use ~1.5 ha

Pre-existing biomass plantings:

- >8ha of established SRC willow
- Agroforestry experiment



Figure A2. BioFIND Project organisation, Work package structure, leadership and information flows



**Table A1. List of stakeholders consulted in Phase 1**

Key: *E* = *Eucalyptus*, *M* = *Miscanthus*, *P* = *Poplar*, *W* = *Willow*

Stakeholder type	Crop
Academic	E
Academic	
Agri college	W
Consultant	W, P
Consultant	
Consultant	
Consultant	
Consultant	
Consultant/Advisor	M,W
Consultant/Advisor	W,M
Energy Company	
Energy Company	
Energy Company	
Energy Company	
Energy consultancy	
Farm contractor	W
Farmer	
Farmer	
Farmer	M
Farmer/User	M
Grower	M
Grower	W
Grower	W
Grower	W
Grower	M
Grower	M
Grower	H
Grower	W
Grower	W
Grower	M
Grower	M
Grower	W
Grower	W
Grower	M
Grower	M
Grower	W, P, E
Grower	W
Grower	E
Grower	W
Grower	M
Grower	M
Grower	M
Grower	M

Grower	M
Grower	M
Grower	M
Grower	M
Grower	M
Grower	M
Grower	M
Grower/Consultant	M
Local authority	W, E
Local authority/ Grower	W
Member association	
Member association	
Member association	
Paperboard manufacturer	
Plant material supplier	M
Plant material supplier	W
Plant material supplier	E
Plant material supplier	E
Plant material supplier	P
Plant material supplier	W
Potential grower	W
Potential grower	W
Potential grower	W
Waste management company	W, E

**Table A2. Lot 1 requirements for Innovation evaluation and demonstration**

All projects will be offered the opportunity to share knowledge of their innovation through the Biomass Information Hub Online portal and Showcase events, including projects which do not have specific trials or demonstration requirements from BioFIND.

Lead Organisation	Project title	Category of support & synergy with BioFind	Demonstration	Number of Demo events	Trials and evaluation
Aberystwyth University	Miscanspeed	No planting required at Hub or spoke sites but will provide planting materials for demo sites to be implemented in Hub variety trials	During Hub site Demo Days and visits, the new developed planting materials will be demonstrated	(1) All BioFIND Demo days – upto 32	None required
Agri-Food and Biosciences Institute	Perennial Energy Crops Decision Support System (PEC-DSS)	This project is planned to integrate well with BioFind given its aim of knowledge, provision, outreach and data and information delivery. BioFind will explore data synergies (e.g. harvesting, planting, new yield data)	At Hub site Demo days the Decision Support Tool will be demonstrated and promoted	(1) As many Demo days as possible - up to 32 (2) At relevant hub trial events	None required
ECCL 2020 Limited	Proving low ground pressure harvesting equipment in the field to extend Short Rotation Coppice (SRC) Willow and Poplar wood crops harvesting season	Proving low ground pressure harvesting equipment in the field to extend SRC willow and poplar harvesting season. Planting & harvesting equipment (low pressure)	Demonstration at Spoke Sites required at 5 sites.	(1) 3 Demo events at spokes in 2023 (2) 2 Demo Events at spokes in 2024	Provision of site impact data from innovation demonstration e.g. soil compaction.
Forest Creation Partners Limited	Using geospatial data science to identify optimal planting sites for forestry-based biomass production	BioFIND will facilitate access to appropriate Hub and Spoke sites for measurements; additionally they would access support for promotion and showcasing.	No Specific Demonstration required.	Mainly promotion. Information will be disseminated at hub site demo days - up to 32 over years 2 & 3	None Required

Green Fuels Research Ltd	MISTY: Microalgae Biomass Sustainability	None required	None required	None required	None required
Hennock International Ltd	Marginal land biomass harvesting and extraction using drone assisted technology	No commitment from this Lot 1 however BioFind has offered demo along with promotion of the innovation.	No Specific Demonstration required,	None required	None required
Impact Laboratories Limited	MIDAs	None required	None required.	None required	None required
J George Limited t/a Hej Harvester	Harvesting Agricultural Hedges for Biomass Production	No commitment from this Lot 1 however BioFind has offered demo along with promotion of the innovation.	Possibly could be integrated in some hub site Demo days. TBC.	None required	None required
Mostex Global Solutions Ltd	Integrated whole tree extraction and on site pre-processing of under-yielding forest resources	Funding to support development of a mobile demo unit (20 foot container with opening sides to co-house reactor). Biomass feedstocks include core forestry raw material, SRC and Miscanthus + new energy crops.	Demonstrate the mobile unit across Hub sites Demo Days.	(1) 15 demo days over 3 years at Hub sites – years 2 & 3	None required
New Energy Farms	Enhanced vegetative propagation combined with new variety introductions to expand energy crop production.	Enhanced vegetative propagation combined with new variety introductions to expand energy crop production	No Specific Demonstration required	Intending to attend Demo days and events. Promotion, data for website. Up to 32 demo days.	(1) 1 to 2 plots trials in yr 2023 (depending on Lot 1 progress) (2) 5 to 10 trial plots in yr 2024
NMC2	Development of a biodegradable, bio-based tree shelter that improves planting efficiency	Development of a biodegradable, bio-based tree shelter that improves planting efficiency. BioFind has offered demo at Hub	Hub site events and Open Days will provide opportunity to demonstrate sample tree guards to stakeholders	Mainly promotion. Any information from this Lot 1 will be disseminated at hub site demo days - up to	None required

		demo days and promotion through online portal.		32 planned for years 2 & 3	
Phycofoods Ltd	Gold to Green to Gold (3Gs)	None required	None required	None required	None required
Rickerby Estates Ltd	Upscaling UK SRC willow planting and Harvesting Capacity	General support by Hub sites regarding new technology development. BioFind will arrange demo along with promotion of the innovation.	Likely to be Spoke Site Trials & demonstration 3 planting or harvesting comparison trials in year 2 and year 3	(1) 3 demo events at spokes in 2023 (2) 3 demo events at spokes in 2024	Provision of site impact data from innovation demonstration e.g. soil compaction.
Rothamsted Research	Accelerating Willow Breeding and Deployment (AWBD)	Yield Trials will be conducted at some Hub sites under Lot 1 funding. General support by Hub sites regarding new Breeding and development innovations for planting material.	No Specific Demonstration required	No requirement for demonstration or promotion but intended hub day attendance.	Trials will be conducted at some of the Hub sites under Lot 1 funding
SEaB Power Ltd	Integrated microalgae biomass production via carbon dioxide sequestration	None required	None required	None required	None required
SeaGrown Limited	Transforming UK offshore marine algae biomass production	None required	None required	None required	None required
Teesdale Environmental Consulting Ltd	Teesdale Moorland Biomass	General support to identify field sites and facilitate communication with landowners.	No Specific Demonstration required	0	None required
Terravesta Farms Limited	OMENZ – Optimising Miscanthus Establishment through improved mechanisation and	General support by Hub sites regarding new establishment technology. Will attend demo days and require promotion of the innovation.	Demonstration to be incorporated at Hub site open days where the small plots exist as part of variety trials. Small plots, 4-8 varieties,	(1) 4 Hub site demonstrations in year 2023 / 2024	None required



	data capture to meet net zero targets		some Hub sites but especially Scot/NI		
University of Glasgow	Automated planting, weeding and harvesting of Miscanthus in harsh environments, exploiting complimentary micro algae production for increased revenue options	Support to demonstrate and collect data from our sites in Yr1 in preparation for demo or trials at hub sites in year 3. Comparison of good and harsh sites, site comparison 2022 drone assessment 2023 planter, weeder testing/demo 2024 harvester test	Demonstration of planting & harvesting using a small area. Proposed these are therefore at Hub sites	(1) 4 Hub site demonstrations of planter, weeder testing in 2023 (2) 4 Hub site demonstrations of harvester in 2024	Provision of site impact data from innovation demonstration for planting, weeding and harvesting machinery e.g. soil compaction.
University of Surrey	Soilless cultivation for rapid bioenergy feedstock production	Trialling of cultivated material produced from their soilless cultivation process' and technologies	Planting of plots at selected Hub sites for growth trials. Available for any hub site demonstration events	(1) available at hub site demo days - up to 32 (2) 4 hub site Demo days in 2023 (3) 4 hub site Demo days during 2024	Willow material will be trialled at 5 Hub sites, aligning with the Hub variety trials. Consist of 5x5m plots with 15 treatments and 4 replicates
University of York	HEMP-30 - Catalysing a step change in the production and utilisation of industrial hemp as a biorefinery crop in the UK	Hemp will form part of the Hub site demonstration crop plantings	Hemp demo plots as Hub sites will form part of the resource for Hub site demo days	Mainly Promotion. Any information will be disseminated at hub site demo days - up to 32 over the 3 years	Multi-site comparison with in-field monitoring will be conducted as part of the Hub site demonstration planting.
White Horse Energy Ltd	Technological Innovations in Mobile Pelletisation	None required	None required	None required	None required

**Table A3. Phase 2 Advisory Board**

Name	Position	Organisation	Track record
<b>Jonathan Scurlock</b>	Chief Adviser, Renewable Energy and Climate Change	National Farmers Union	Provides analysis and advice on energy, climate change and net zero to senior management, office holders and the NFU's farmer membership. Background in university and government research in the UK and USA, covering energy and climate policy, plant physiology, all kinds of biomass fuels, bio-based products and other renewables.
<b>Richard Harris</b>	Senior Fuels Developer Lead	Drax	Leads the development of sustainable supply chains for a portfolio of agri-biomass fuel feedstocks, including UK energy crops. Experienced in the development and financing of new agro-industrial supply chain and renewable energy projects. Experience in international carbon markets in the UK and abroad.
<b>Gill Alker</b>	Head of consultancy	AMP Clean Energy	22 year track record in biomass and bioenergy with expertise in wood fuel and energy crop supply, wood fuel energy supply contracts. Business creation experience with TV Bioenergy and formation of an SRC producer group (TV Bioenergy Coppice). Since 2014 Gill has worked for Forest Fuels Ltd, now AMP Clean Energy. Role to provide consultancy advice to our 2000+ fuel clients on many different aspects of biomass heating. This includes advice about RHI applications, regulations and guidance.
<b>Seán Finan</b>	Chief Executive Officer	IrBEA Irish Bioenergy Association	A Chartered Engineer, Bachelor of Civil Engineering (Hons) and 35th National President of Macra na Feirme – the young farmers' organisation. Vice-President of the European Council of Young Farmers (CEJA). Committed to strategically positioning bioenergy to play a key role in Ireland's Sustainability Renewable Energy Roadmap into the future.
<b>Caroline Ayre</b>	National Manager (England)	CONFOR - Confederation of Forest Industries	A Chartered Forester with a 22 year career in sustainable forestry, and wood-based supply chain support, development and innovation. Represents Confor's membership from seed to saw, influencing and developing policy, guidance and regulation to support productive woodland creation, woodland management and the supply of timber and wood-fibre to markets.

**Table A4. Hub site scoring and evaluation criteria (Phase 1 WP2 report, D2.5)**

Each potential Hub site was scored against objective criteria for 'Trials', 'Monitoring Capacity and Infrastructure', and 'Engagement and Outreach'; the evaluation panel agreed by consensus on scores for each site. Scores were used, along with considerations of the potential number of Hub sites, the need for regional presence, environmental similarities and links to potential Spoke sites, to select the BioFIND Hub sites (Fig. 1, Table 3).

Criteria / Scoring description	Score
Biomass cultivation capacity I	
Site has no existing biomass feedstock trials/demonstrations	0
Site has established biomass feedstock trial/demonstration of single crop type	1
Site has established biomass feedstock trial/demonstration of multiple crop types	2
Biomass cultivation capacity II	
Site has no land available for new demonstration plots / trials	0
Site has limited land available for new demonstration plots / trials	1
Site has extensive land available for new demonstration plots / trials	2
Monitoring capacity and Infrastructure I	
Site has no access to a weather station	0
Site has nearby weather station	1
Site has weather station on site	2
Monitoring capacity and Infrastructure II	
Site has no soils data	0
Site has existing soils data	1
Monitoring capacity and Infrastructure III	
Site has no relevant machinery or equipment	0
Relevant machinery or equipment through contractors	1
Site has own machinery and equipment	2
Monitoring capacity and Infrastructure IV	
No staff with relevant experience/expertise for biomass feedstock trials	0
Staff within organisation with relevant experience/expertise	1
Staff on site with relevant experience/expertise	2
Engagement and Outreach I	
Site has no engagement/outreach via education	0
Site has limited engagement/outreach via education	1
Site has extensive engagement/outreach via education	2
Engagement and Outreach II	
Site has no links to communities of practice	0
Site has limited links to communities of practice	1
Site has extensive links to communities of practice	2
Engagement and Outreach III	
Site has no appropriate facilities for engagement events	0
Site has limited appropriate facilities for engagement events	1
Site has extensive facilities for engagement events	2

**Table A5. Summary from Phase 1 desk-based environmental impact assessment for Hub sites. CS=Countryside Stewardship.**

Hub site	Designations	Considerations [Risk mitigation]
Rothamsted Research, North Wyke, Devon	None	Currently grassland [Potential for carbon stock losses; baseline sampling will allow quantification]  Adjacent to river [Boundary wooded so risk of nutrient run-off and erosion limited]  CS target species: Brown hair streak, Grey Partridge [Planting would be beneficial via cover and complexity]
AFBI Hillsborough, County Down	None	Currently grassland [Potential for carbon stock losses; baseline will allow quantification]
Bishop Burton College, East Riding of Yorkshire	Nitrate Vulnerable Zone	Currently arable [Likely to increase carbon stocks]  Nitrate Vulnerable Zone [Planting likely to lower excess nutrients and run-off]  CS target species: Lapwing, Curlew [No existing records within 500m]
Newcastle University Cockle Park Farm, Northumberland	Priority species buffer zone - Willow tit; Sediment issues priority	Currently arable [Likely to increase carbon stocks]  Sediment issues priority [Planting likely to reduce erosion]  CS target species: Lapwing, Curlew [No existing records within 500m]  Priority species buffer zone - Willow tit [Planting would be beneficial via cover and complexity]
IBERS Trawsgoed, Ceredigion	None	Currently grassland [Potential for carbon stock losses; baseline will allow quantification]
Auchincruive, South Ayrshire	None	Adjacent to river [Field has grass margin and boundary has trees so risk of nutrient run-off and erosion limited]
SRUC Edinburgh, Penicuik, Midlothian	None	Currently arable [Likely to increase carbon stocks]
Bio Global Industries, Buckinghamshire	Area of Outstanding Natural Beauty (AONB)	AONB [Existing perennial bioenergy crops so no extensive change in landscape character]  Currently grassland [Potential for carbon losses; sampling will allow quantification]

**Table A6. Knowledge sharing, dissemination, and engagement strategy actions**

WP4 action	Output	Purpose	Audience
<b>Demonstration events</b>	In-person demonstration and talks, peer to peer engagement. Supporting KE materials	Peer to peer learning, networking, grower feedback and knowledge exchange, grower engagement	Growers, industry professionals
<b>Website/online portal</b>	Technical article library	Translation of scientific literature/evidence from BFI programme and beyond. Dissemination of wider Biomass science	Growers, all biomass industry
	Hub/spoke site interface	Interactive map to showcase BioFIND project sites, with information and updates from each location	Growers, all biomass industry
	News & updates	Dissemination of project information. Industry and project-based news, embedded social media feeds	Growers, all biomass industry, policy makers
	New media materials	Library of new media engagement materials, including webinars, podcasts, videos, case studies, eLearning materials	Growers, all biomass industry
	Events	Calendar of BioFIND events to publicise outreach and engagement	Growers, all biomass industry
<b>Online communication</b>	Social media (1-way channel)	Network enhancement to reach new growers and allow real-time direct communication, dissemination of project information	Growers, industry professionals
	Farming forum (2-way channel)	Network enhancement to reach new growers, and opportunity for feedback and knowledge exchange from land manager community. Dissemination of project information	Growers, industry professionals
<b>Other knowledge dissemination</b>	Newsletter	Bi-annual publication of project activities. Engagement with grower network and industry, dissemination of project outcomes	Growers, all biomass industry, policy makers

	Articles in agricultural and land management trade press	Production of articles for relevant publications (on and offline) to increase exposure of BioFIND/BFI, and increase scope of dissemination of biomass advances	Agriculture and land management industries
<b>Face to face engagement</b>	Agri shows	Project outreach and direct engagement, timed to advertise demonstration events in nearby geography to show location	All land management and agricultural industries
	Other demonstration networks	Collaboration with other knowledge transfer initiatives to publicise BioFIND	Biomass and land management professionals
	Showcase event	Focussed event for the dissemination and showcase of BioFIND and Lot 1 BFI programme projects	BFI programme partners, biomass industry professionals, policy makers
<b>International engagement</b>	Trade missions	Engagement with international biomass industry bodies and professionals for dissemination and engagement of BFI programme outcomes. Enhance potential for UK biomass export	International biomass industry
	International conferences/expos	Engagement with international biomass industry bodies and professionals to increase exposure of UK marketplace. Opportunity for gaining insight into best practice approaches/ management in international biomass industry	International biomass industry, UK biomass industry for derived insight

**Table A7. BioFIND core project team roles and responsibilities**

Organisation	Person or position	Project roles + responsibilities
UKCEH	Jeanette Whitaker	Project Co-ordinator, Management Board, WP5 lead
UKCEH	Chris Bell	Project Manager, Management Board - WP5
UKCEH	Aidan Keith	WP2 lead
UKCEH	Rebecca Rowe	WP2 Environmental Impact Assessment
UKCEH	Data manager	WP2 delivery
UKCEH	Environmental sampling and analyses	WP2 delivery
Rothamsted Research	William Macalpine	WP1 lead
Rothamsted Research	Ian Shield	Management board, WP5 + WP1 delivery
Rothamsted Research	Agronomist, To be recruited	WP1 delivery, Hub biomass management
AFBI	Chris Johnston	Management Board, WP5, Hub engagement
AFBI	To be recruited	Hub site management, agronomy, monitoring trial activities
IBERS	Will Stiles	WP4 lead and delivery
IBERS	KE fellow 1	WP4 delivery
IBERS	KE fellow 2	WP4 delivery
IBERS	Digital content manager	WP4 delivery
IBERS	Iain Donnison	Management Board, WP5
IBERS	Chris Ashman	WP1 delivery and Hub site agronomy
SRUC	Bob Rees	Management Board, WP5
SRUC	David Lawson	WP3 lead
SRUC	Pierre Bouffandeau	WP1 delivery – Hub Management
SRUC	Fiona Burnett	WP4 delivery
C4E	Kevin Lindegaard	Biomass consultant to all WPs WP2 and WP4 specific tasks
ERDFC	Bryan Elliott	Biomass consultant to all WPs

**Table A8 Hub agronomy and engagement teams**

Hub sites	Project role	Person or position
Bio Global Industries, Buckinghamshire	Hub site agronomy	Steve Hunt
	Hub site agronomy	Matt Hunt
	Hub site engagement	Helen West
Newcastle University, Cockle Park Farm, Northumberland	Hub site agronomy	Kirsty McInnes
	Hub site agronomy	James Standen
	Hub site agronomy	Julia Cooper
	Hub site agronomy	Rachel Chapman
	Hub site engagement	Alison Lawson
Bishop Burton College, East Riding of Yorkshire	Hub site agronomy	Jonathan Dearlove
	Hub site agronomy	tbc
	Hub site engagement	tbc
Rothamsted Research, North Wyke, Devon	Hub site agronomy	Ian Shield
	Hub site agronomy	tbc
	Hub site engagement	tbc
SRUC Ayr, Auchincruive, South Ayrshire	Hub site agronomy	Pierre-Alain Bouffandeau
	Hub site agronomy	Bob Rees
	Hub site engagement	Fiona Burnett
	Hub site agronomy	New appointment (Grade 4)
	Hub site agronomy	Donald Kiltie
	Hub site agronomy	Claire Kennedy
	Hub site engagement	Fiona Burnett
SRUC Edinburgh, Penicuik, Midlothian	Hub site agronomy	Team as above, SRUC Ayr
	Hub site engagement	
IBERS, Trawsgoed, Ceredigion	Hub site agronomy	Chris Ashman
	Hub site agronomy	Plant breeder (tba)
	Hub site agronomy	Chris Glover
	Hub site agronomy	Field Technician (tba)
	Hub site engagement	Will Stiles
AFBI Hillsborough, County Down	Hub site agronomy	Chris Johnston
	Hub site engagement	tba





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