Centre for Ecology & Hydrology
NATURAL ENVIRONMENT RESEARCH COUNCIL

Steps to scaling up UK sustainable bioenergy supply

A stakeholder workshop convened by the Centre for Ecology & Hydrology and the Committee on Climate Change

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EXECUTIVE SUMMARY

This technical annex was produced in support of the CCC's 2018 report *Biomass in a low carbon economy*. The objective is to identify steps to scaling up UK sustainable bioenergy supply, focussing on short to medium term measures that can increase UK production of bioenergy feedstocks whilst delivering social, economic and environmental benefits. This assessment was based on stakeholder workshops held in July 2018 and informs Chapter 4 of the CCC's report.

Sustainable biomass is identified as having a key role in the UK government's Clean Growth Strategy and in the devolved administrations' energy and decarbonisation plans. The UK's 25 Year Environment Plan and planned exit from the European Union and Common Agricultural Policy (CAP) provide a new context within which policies and strategies to scale up UK bioenergy supply can be considered. However, scaling up UK production of perennial energy crops and forestry for bioenergy feedstock supply represents a significant challenge. Domestic production of perennial energy crops has been relatively static over the last 10 years with ~10,000 hectares cultivated. In addition, planting of new woodland and forestry is not happening at a sufficient rate to achieve current government targets. This is despite increasing demand from a new generation of biomass power stations and other biomass users. Policies and strategies to achieve this up-scaling must therefore consider farmers' decision making, market risks, establishment costs and logistics along with the wider social, economic and environmental benefits and trade-offs of sustainable bioenergy production.

On the 16th July 2018, the CCC and the Centre for Ecology & Hydrology (CEH) held a stakeholder workshop to discuss these issues bringing together leading researchers, policymakers, commercial stakeholders and NGOs from agriculture, forestry, energy and environmental sectors (Appendix 1). The workshop was convened by Dr Jeanette Whitaker (CEH) in her role as Knowledge Exchange Fellow (Natural Environment Research Council). The aims of the workshop were: (a) to explore which options for scaling up UK sustainable bioenergy supply will deliver the best environmental and socio-economic outcomes; (b) to identify the key barriers and evidence gaps currently limiting expansion of the sector; and (c) to prioritise the actions needed by government, industry and academia to deliver significant increases in sustainable bioenergy production in the UK. This report is intended as a record of the views of the workshop participants and does not necessarily reflect the views of the CCC. The workshop attendees represented a range of backgrounds, values and perspectives and yet there was strong consensus on many issues and a wealth of positive ideas and proposals which could help to achieve the expansion of sustainable bioenergy production in the UK. The key conclusions of the workshop are summarised below.

There is ***strong evidence of the diverse environmental and socio-economic benefits*** of growing perennial energy crops and forestry, in addition to their climate mitigation potential as bioenergy feedstocks. Benefits accrued will vary dependent on the location, site characteristics, feedstock choice and land management, but there is a robust evidence base from which to develop advice and guidance to maximise environmental benefits and avoid unintended consequences. This includes

identifying land which should be prioritised for planting and land which should be avoided. This evidence base should be used in developing any post-CAP support framework for sustainable bioenergy supply.

The UK's exit from the European Union and the CAP provides an opportunity to develop ***a more strategic approach to managing the conflicting demands on our land***. A new Agriculture Bill is currently going through UK Parliament which aims to incentivize and support farmers and land managers to deliver public goods, such as better air, soil and water quality, through a new Environmental Land Management Scheme (ELMS). Integrating bioenergy support within this ***'public goods' framework*** was viewed as broadly positive for forestry and energy crops, with a recognition that this would recognise and reward the multi-functional environmental and socio-economic benefits of sustainable bioenergy production. It was recognised that bioenergy feedstocks will not always provide the greatest economic return to land-owners on a productivity basis, but valuation of co-benefits to the environment and local communities could support efforts to scale-up sustainable bioenergy production.

The development of an ***Integrated Land Use Strategy*** for England was also strongly supported by attendees, bringing together relevant policy areas which influence the delivery of public goods for example, forestry creation, sustainable farming practices, priority habitat management and climate change mitigation. It was believed that this would help to ensure land is being managed effectively to deliver environmental, social and economic benefits and enable trade-offs to be assessed more comprehensively, avoiding unintended consequences.

Building a self-sustaining industry in the UK should be the long-term goal, but in the short-term this requires ***the economic, policy and regulatory barriers to bioenergy expansion*** to be addressed through targeted government and industry action. For example, streamlining the complex and inefficient cross-agency responsibilities for planting approvals; ironing out inconsistencies in regulation which create barriers to sustainable bioenergy expansion; creating a compelling business case for growers by addressing the high establishment costs and delayed income from energy crop and tree-planting; and establishing sources of robust advice for growers and landowners to develop knowledge and skills in planting and managing unfamiliar crops and forestry.

Scaling-up sustainable bioenergy production in the UK is a significant challenge which requires ***government and commercial stakeholders to work together***. Government and industrial users should consistently and specifically support demand for UK grown feedstocks to stimulate a supply response which shares risk between growers and end users. The creation of domestic supply chains and partnerships is critical here to encourage investment which will deliver ambitious rates of planting and the growth and diversification of end markets, giving growers greater confidence that end-markets will expand and not fail. It is clear there are significant socio-economic and environmental benefits to developing a strong sustainable bioenergy production sector in the UK but there is a significant lack of confidence and inertia. Action must be taken by government in the short term if production in the UK is to be scaled-up to make a more substantial contribution to meeting the UK's 2050 climate targets and the ambitions of the Paris agreement.

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BACKGROUND

On the 16th July 2018, the Committee on Climate Change (CCC) and Centre for Ecology & Hydrology (CEH) held a stakeholder workshop in London to discuss "**the steps needed to scale-up UK sustainable bioenergy supply"**. The workshop was convened by Dr Jeanette Whitaker (CEH) in her role as Knowledge Exchange Fellow funded by the Natural Environment Research Council (NERC). Leading researchers, policymakers, commercial stakeholders and NGOs from agriculture, forestry, energy and environmental sectors (Appendix 1) attended the workshop which focused on sustainable bioenergy from perennial energy crops and forestry (including agricultural and forestry residues), but also considered first generation annual crops. The goal of the workshop was to identify the steps needed to scale up production of sustainable bioenergy feedstocks in the UK for use in the energy sector and addressed the following specific questions:

- Which land use options and planting strategies for sustainable bioenergy production will deliver the best environmental and socio-economic outcomes now and in future, at local and UK scale?
- What are the major barriers and enablers for scaling up production of sustainable bioenergy feedstocks in the UK?
- What should government and industry do in the short (0-5) and medium term (5-10 yrs.) to scale up sustainable bioenergy production in the UK?

This document is intended as a record of the views of the participants and does not necessarily reflect the views of the CCC, although it will be used to inform the work of the CCC.

WORKSHOP STRUCTURE AND AIMS

Following a welcome from the workshop facilitator, the meeting was opened by Sam Friggens (CCC Lead Bioenergy Analyst) who introduced the context, scope and format of the workshop and the key questions to be addressed. The workshop was divided into 4 sessions. The first 3 sessions each comprised two presentations and break-out group discussions addressing each of the 3 workshop questions above, with a final plenary session to discuss and scope out a route-map for scaling up UK sustainable bioenergy supply. Attendees were mixed into different discussion groups dependent on the questions being addressed and were encouraged to capture issues and actions on post-it notes and flip chart sheets which were collated throughout the day. The questions addressed and speakers within each session are detailed below.

Session 1: Which land use options and planting strategies for sustainable bioenergy production will deliver the best environmental and socio-economic outcomes now and in future, at local and UK scale?

Speakers: Iain Donnison (Aberystwyth University); James Morison (Forest Research)

1. What positive environmental outcomes can bioenergy feedstock production deliver, and in what situations (e.g. geography/land use/management)?
2. What positive social or economic benefits can bioenergy feedstock production deliver, and in what circumstances?

3. What types of land or habitats should/should not be targeted for new planting or changed management?

Session 2: What are the major barriers and enablers for scaling up production of sustainable bioenergy feedstocks in the UK?

Speakers: Caroline Harrison (CONFOR: Confederation of Forest Industries), Neil Watkins (Iggesund)

1. ENABLERS: What current measures by industry/government are important in supporting energy crops or tree planting?
2. BARRIERS: What is currently stopping farmers or landowners producing more biomass for energy (cultural, technical, economic, policy or environmental barriers)?

Session 3: What should government and industry do in the short (0-5) and medium term (5-10 yrs) to scale up sustainable bioenergy production in the UK?

Speakers: Mark Broadmeadow (Forestry Commission); Hannah Evans (Energy Systems Catapult)

1. If support for bioenergy was part of a broader 'public good' framework, what should this look like?
2. If interventions are targeted, what factors are important? For example: (a) support for at specific crops or land types; (b) Incentives linked to positive environmental and socio-economic benefits.
3. What other approaches could support scaling up of sustainable bioenergy feedstocks?
4. Are there measures industry/business could take that do not rely on Government intervention?

Session 4: Mapping a Route Forward

The necessary, important, and desirable actions looking ahead

WORKSHOP OUTCOMES

This report reflects the general themes of discussions and recommendations from the workshop, and summarises the key points made by speakers and in the discussion groups. The text does not always reflect the views of all attendees and does not necessarily reflect the views of the CCC. 'Energy crops' generally refers to *Miscanthus* and short-rotation coppice (SRC) Willow; 'Forestry' may refer to traditional long-rotation forestry, mixed woodland or short-rotation forestry (SRF).

Session 1. Which land use options and planting strategies for sustainable bioenergy production will deliver the best environmental and socio-economic outcomes now and in future, at local and UK scale?

Speakers: Iain Donnison (Aberystwyth University); James Morison (Forest Research)

1. What positive environmental outcomes can bioenergy feedstock production deliver, and in what situations (e.g. geography, land use, management)?

Energy crops: There was a broad consensus that perennial energy crops have the potential to deliver multi-functional environmental benefits and that expansion of energy crop production is potentially high benefit and low risk. Energy crops are perennial, require low inputs (fertiliser and agrochemicals), can grow on low quality, economically marginal or contaminated land and are more resilient to extreme weather than annual crops. There is good evidence (for *Miscanthus* and SRC willow) that these attributes can lead to a range of environmental benefits, but this will be location specific. Potential benefits include increased biodiversity (through increased landscape heterogeneity and connectivity), climate mitigation (soil carbon sequestration and low nitrous oxide emissions due to low fertiliser inputs), soil quality improvements due to lack of tillage and large root biomass, flood mitigation and livestock shelter. Energy crop expansion was not perceived to be a biodiversity risk, but effects would be subject to location (i.e. not planting on protected habitats) and the total area of land planted. To maximise the environmental benefits while also achieving an economic return from energy crops requires careful location and crop selection, matching the crop species or varieties to the location, soil conditions and climate. For example, the greatest potential for soil carbon sequestration is on low carbon soils, typically arable soils, while land use change from permanent grassland to energy crops can, in some situations, cause a loss of soil carbon, e.g. in high carbon soils. A small to moderate soil carbon loss may be recoverable during the crop lifetime but a positive greenhouse gas (GHG) balance for energy crops is still achievable even without recovery of any soil carbon loss. In the future, less disruptive crop establishment measures reduce impacts on soil carbon stocks e.g. no till or min-till SRC willow planting and seed rather than rhizome establishment of *Miscanthus*. Larger losses e.g. from peatlands and high carbon soils are unlikely to be recovered and planting on these soils should be avoided.

Forestry: Increased bioenergy production from forestry can be achieved either through new planting, altered management of existing resource or bringing unmanaged woodland back into management. These strategies can deliver positive environmental outcomes which are a function of crop type, planting technique, management strategies and location (soil type and climate). There was an assumption that new forestry would not be planted solely to produce bioenergy feedstocks and that timber, residues, thinnings and disease material would go to a range of end uses driven by timber or wood product quality and economic value. Short-rotation forestry is an option for solely producing bioenergy feedstocks, but this has not been demonstrated at commercial scale. Positive

environmental outcomes from forestry include: climate mitigation (fossil fuel displacement and increased carbon stocks); biodiversity (ecosystem connectivity and improved habitat); air quality; improvements to soil quality and soil carbon stocks; improved climate resilience; and improved water quality. Forestry planting can also reduce erosion and flooding (natural flood management (NFM)) by buffering agrochemical and nutrient runoff, though flood mitigation benefits depend on managing harvest time around likely flooding times. New management and planting must be in line with best practice and the UK Forestry Standard with long-term management plans to maximise environmental and socio-economic benefits but there are trade-offs. For example, forest management optimised for biodiversity may impact on productivity, traditional long-rotation forestry may benefit flood mitigation but may not be optimal for bioenergy feedstock production, whilst SRF may be the most economic and appropriate option for bioenergy feedstock production. There is also good evidence that agroforestry (land management combining crops or grassland with trees or perennial energy crops) can deliver a range of environmental benefits (e.g. biodiversity and livestock shelter) and can be economically beneficial without significant policy intervention (low risk/high benefit).

2. What positive social or economic benefits can bioenergy feedstock production deliver, and in what circumstances?

Energy crops: Energy crop expansion can deliver a range of socio-economic benefits, particularly for the rural economy. These include diversification of farm income, as farmers can turn over a proportion of farmed land e.g. 10-20% with relatively secure long-term contracts available in some areas. Diversification also promotes co-operation between growers through farmer networks and there is potential to increase non-farm employment if domestic bioenergy supply chains develop, providing opportunities for new skills and business.

Forestry: Scaling-up bioenergy production from forestry could also deliver socio-economic benefits, as it will generate increased activity in the forestry sector as a whole. Benefits could include increased rural employment in forestry and primary processing, development of a domestic bioenergy supply chain providing opportunities for new skills and business, providing a market for thinnings and residues, generating recreational opportunities with linked income from woodland tourism/recreation. New management and planting must be in line with best practice and the UK Forestry Standard with long-term management plans to maximise environmental and socio-economic benefits.

3. What types of land or habitats should/should not be targeted for new planting or changed management?

For all types of bioenergy feedstocks there are locations/sites where planting should be avoided/prevented and areas of low risk which should be prioritised:

- Planting should be avoided on UK Biodiversity Action Plan (BAP) priority habitats, land with cultural value, peatlands and other high carbon soils >120 t C ha^{-1}.
- Planting should be prioritised on low quality agricultural soils (arable or grassland with <70 t C ha^{-1} (<2%)), marginal/upland areas, Grade 5-4-3b land, public access land, contaminated land and land identified by Forestry Commission as ‘low risk for woodland creation’.
- Grade 1-2-3a agricultural land (Best and Most Versatile land - BMV) is designated for flexibility and not only intended for food production. Planting should not be prioritised on BMV land but should be supported.

- Suitability of uplands or mid-carbon soils is site, crop and climate specific, and subject to slope and machinery access.

Energy Crops: Planting of energy crops should be prioritised on low grade agricultural land (grade 3b-4-5) where conditions are suitable to establish an economically productive crop. This is typically economically marginal arable or grassland, including land which is difficult to access or prone to flooding. Planting on permanent grassland should be approached with caution as there is uncertainty around the risk of soil carbon loss in grassland soils with a high carbon content, which may reduce the climate mitigation benefit of the crop. However, mid-carbon grassland and arable soils can still deliver GHG savings over the crops life-cycle, accounting for fossil-fuel displacement. Research is required into less disruptive crop establishment measures, to determine whether there are benefits for soil carbon and soil quality. For example, min- or no-till establishment of SRC (which will require weed control during establishment), and seed rather than rhizome establishment of *Miscanthus*. There are no government targets for energy crop planting, but rates viewed as achievable in the workshop were in the range 3500-6500 ha yr^{-1} through to 2030.

Forestry: The priority for new forest planting should be to produce feedstock with low GHG emissions on land with the greatest potential for soil carbon sequestration. This requires careful targeting by geography/ soil/location/species. Productive forestry can be achieved on low grade land and could be prioritised on low grade agricultural land near urban centres, to maximise environmental benefits in tandem with amenity benefits. Current government targets and aspirations for new forestry differ between England and the devolved administrations (e.g. 5000 ha yr^{-1} in England, 12,000 ha yr^{-1} in Scotland) with greater ambition stated in the Governments Clean Growth Strategy, however in England current targets are not on track to be achieved. Restoring management of under-managed woodlands, whilst taking measures to mitigate short term carbon stock losses could increase biomass supply more quickly in the short-term compared to planting of new woodlands. This strategy could be economically marginal but have additional environmental benefits e.g. improved biodiversity and ecosystem function/services (see Appendix 2, Rushmore estate and Whittaker et al 2017).

Session 2: What are the major barriers and enablers for scaling up production of sustainable bioenergy feedstocks in the UK?

Speakers: Caroline Harrison (Confederation of Forest Industries), Neil Watkins (Iggesund)

1. ENABLERS: What current measures by industry/government are important in supporting energy crops or tree planting?

Energy crops: Production of perennial energy crops is currently very limited in the UK (~10,000 ha) with little change in the last 10 years. Planting is expanding slowly in some areas of the UK, mainly through companies' direct relationships with farmers i.e. Iggesund (SRC willow) and Terravesta (*Miscanthus*). These companies provide long-term contracts, advice and support to farmers individually and through farmers networks creating long-term financial security and building confidence and trust. Through R&D and practical experience Iggesund and Terravesta have significantly improved the productivity and economic return on these crops but this could be improved further. Policy has enabled some market pull (e.g. Renewable Heat Incentive, Renewables Obligation, Contracts for Difference) and some energy crops (e.g. *Miscanthus* and SRC willow) are compliant with the basic payment scheme under the current CAP. In addition, straw power plants in the UK are now buying *Miscanthus* which is also used for animal bedding, therefore diversifying end markets.

Forestry: In recent years there has been renewed government focus on forestry, including woodland creation, with policy objectives to plant 5000 ha yr^{-1}. There is increased financial support for farmers for tree planting on marginal land, including agroforestry and bioenergy production to support rural diversification. Environmental Impact Assessment (EIA) regulations have been amended and woodland creation in England is currently supported through grant schemes (Countryside Stewardship, the Woodland Carbon Fund and Woodland Creation Planning Grants). However, there was a view expressed in the workshop that these policies are more targeted at supporting woodland for biodiversity or amenity rather than increasing economically productive forestry. This targeted support can hamper the design and resultant productivity of new forests as there are trade-offs between productivity and other ecosystem services. There are also plans to create forestry investment zones where decision making would be streamlined (Clean Growth Strategy). Good examples of new woodland creation include the National Forest and Lowther Estate.

2. BARRIERS: What is currently stopping farmers or landowners producing more biomass for energy?

A range of barriers were identified by stakeholders as disincentivising or preventing the scale-up of bioenergy production in the UK. Some are generic to all bioenergy feedstocks and some are specific to the agriculture or forestry sectors.

Policy/regulatory barriers were strongly cited by stakeholders for both energy crops and forestry. Specifics included a policy focus on end-use (irrespective of feedstock type) rather than feedstock production *per se*; a lack of policy to encourage or support domestic sourcing of biomass; a lack of long-term policy certainty (in particular a chequered history of support for energy crops leading to a lack of trust amongst potential growers); no consistent pull through policies (e.g. carbon market); and a lacked of joined up policy (bioenergy is relevant to Defra, BEIS, DfT, MHCLG across agriculture, forestry, climate change and energy sectors). A lack of incentives for energy crop planting, and the exclusion of energy crops in Defra's implementation of CAP Greening measures were also identified as significant barriers. The approvals processes for planting energy crops and forestry were seen as bureaucratic, complex and time-consuming (in part due to a lack of resources in the relevant agencies and cross-agency responsibilities and processes). This complexity adds to establishment costs and delays planting. A lack of a level playing field between different land uses (forestry, energy crops and food crops) was also cited as confusing and unfair, with additional differences in the approvals for *Miscanthus* and SRC willow.

Economic barriers: Long-term contacts for energy crops (e.g. from Iggesund and Terravesta) have provided financial security and confidence but more contracts need to be available to support future expansion. High establishment costs and delayed revenues from harvestable biomass were perceived as barriers which discourage landowner uptake for both energy crops and forestry. However, other attendees viewed this as a perceived rather than a real barrier stating that banks accounted for these factors in their support to farmers. There were also perceived risks concerning the negative impact of energy crops or forestry on land values due to potential impacts on drainage, and a belief that perennial energy crops are difficult to remove if a landowner chooses to revert the land back to arable of grassland. These facts have not been borne out in practice but are views widely held in the farming community. The status of forestry development as a permanent land use change in EIAs was also identified as a barrier and for tree planting there is also the barrier of farm ownership. Lots of farms are under tenancy (30-40%) and therefore tenant farmers risk not getting the income if they choose woodland planting due to the associated long-term returns. For energy crops, there is a lack of trust in end markets with farmers needing stronger reassurance that new

markets will not fail, this would be helped by diversification of end markets increasing long-term revenue certainty and reducing the risk of lock-in for farmers if markets decline. The wider value of energy crops and forestry including ecosystem services and social benefits is currently not quantified, valued or monetised, limiting the appreciation of the broader contribution bioenergy feedstocks can deliver environmentally and socio-economically.

Technical barriers: Lack of skills and knowledge amongst farmers and landowners were identified as barriers to expansion for energy crops and forestry. In particular, a lack of agronomic advice leading to poor energy crop establishment and loss of revenue, and a lack of advice and guidance for farmers and landowners on tree planting and management. There were also concerns that specialist machinery is required which needs scale to offset establishment cost. To deliver a significant scale up (10,000 - 100,000+ ha) of energy crop planting will require significant increases in production of planting material/seed, planting and harvesting equipment and skills training. This scale of increase, within the timeframe of meeting the 2050 targets, is only possible for those species varieties which are currently planted i.e. *Miscanthus* and SRC willow, due to the time required for developing new varieties.

Cultural barriers: Energy crops and tree planting are unfamiliar crops for farmers who, in some cases, can be slow to adapt to latest ideas/technologies. There is a lack of knowledge around the benefits and management of perennial crops and trees which are viewed as less flexible and a significant long-term commitment, therefore high risk. There is also the cultural issue that farmers perceive themselves as food growers not energy providers. A lack of woodland culture was also identified as a barrier for tree planting which needs to be re-established by bringing together public, farmers, and woodland managers/owners.

Environmental barriers were viewed as an issue for policy and public perception, not for farmers or landowners. For example, negative media on biofuels were not believed to influence farmer decision making. Air quality concerns in urban areas were cited, and the lack of support for energy crops in national parks due to aesthetic landscape concerns was raised.

Session 3. What should government and industry do in the short (0-5 yrs.) and medium term (5-10 yrs.) to scale up sustainable bioenergy production in the UK?

Speakers: Mark Broadmeadow (Forestry Commission); Hannah Evans (Energy Systems Catapult)

1. If support for bioenergy was part of a statutory framework of 'public money for public goods', what should this look like?

The UK Government's 25 Year Environment Plan and planned exit from the European Union and Common Agricultural Policy (CAP) provide a new context within which policies and support to scale up UK bioenergy supply can be considered. In the government's command paper "Health and harmony: the future for food, farming and environment in a Green Brexit", the UK government consulted on an Agriculture Bill under which farmers and land managers will be paid for 'public goods', such as better air and water quality and improved soil health through a new Environmental Land Management System (ELMS), replacing the current subsidy system of Direct Payments under CAP. The concept of integrating bioenergy support within this 'public good' statutory framework was viewed by attendees as broadly positive for forestry and energy crops as the multifunctional environmental and socio-economic benefits they can deliver, in addition to climate mitigation

benefits, could be valued and rewarded. However, there were significant concerns around how this would work in practice (for bioenergy and land management more generally), specifically how the additionality of co-benefits would be captured. Monetising GHG savings and carbon cost effectiveness was seen as critical for bioenergy with farmers and landowners (rather than energy producers) paid for carbon savings. There was a strong view that policy and incentives need to be consistent with achieving an 80% GHG reduction by 2050 and that to achieve this, incentives need to be simple and not changed over time to build trust and confidence. Attendees discussed different options for a post-CAP ELMS, including a Land Management Contract (proposed by the Country Land and Business Association) which would be menu-based with a set of options to choose from (as are current and past agri-environment schemes) rather than plan-based (as proposed by government). Other comments were that government policy should encourage diversification (nudge policy); and that payment for ecosystem services and/or trading platforms for natural capital (joint benefit incentives) need to be developed further as part of the public good approach e.g. water companies or food companies emit grey water which can be used to grow energy crops, or forestry providing benefits for upland water quality.

The need for an ***Integrated Land Use Strategy*** which would better join up elements of policy, was a view strongly expressed throughout the workshop by a range of stakeholders. Land use is influenced by a range of policy areas (agriculture, forestry, food, climate change, energy, environment, land use planning, infrastructure and transport). Land use decisions are consequently made across government departments and agencies (Defra, BEIS, DfT and MHCLG, Environment Agency, Natural England, Forestry Commission) and influenced by charitable and private sector organisations (e.g. Woodland Trust, water companies, National trust, RSPB). The lack of a joined-up approach to policy making for land use can result in a siloed and non-integrated approach to managing the conflicting demands on our land. An Integrated Land Use Strategy, such as those already developed for Scotland and under development in Wales, would enable a strategic long-term approach to land use planning. This could help to ensure that land is being used and managed effectively for the delivery of public goods by linking policy objectives, for example, forestry creation, sustainable farming practices, priority habitat delivery and management as well as renewable energy and climate change mitigation. Bringing together relevant policy areas which influence the delivery of public goods would enable trade-offs to be assessed in a more comprehensive way, avoiding unintended consequences and optimising land use to deliver environmental and socio-economic benefits.

2. If interventions are targeted, what factors are important? For example: (a) support for specific crops or land use types; (b) Incentives linked to positive environmental and socio-economic benefits.

A range of ideas and views on government interventions were raised by attendees. It was widely discussed that policy should be implemented at a land holding level to unlock premium payments for a baseline of integrated environmental delivery e.g. a menu-based scheme such as the “Land Management Contract (CLA)”. Policy should focus on the whole land-holding and the environmental and socio-economic benefits it delivers, leaving the specific actions to land managers to plan, with a menu of options to achieve top up payments for public goods delivery. It was also stated that incentives need to have less conditionality (more flexibility) than current schemes and should not target specific crops or land use types. This type of land-holding approach, rather than being prescriptive at the field level, would deliver better integration of agriculture and forestry. It was also proposed that incentives should recognise the multifunctional benefits of bioenergy, either in a specific scheme or as part of Public Good scheme, so valuing the co-benefits delivered in specific locations e.g. biodiversity, soil carbon, landscape resilience (of food production). Specific short-term

measures (pre-2022) proposed included tweaks to CAP greening measures to incentivise or remove disincentives to plant perennial energy crops.

In the forestry sector, it was highlighted that the productive forest resource is declining as a result of restoration of Ancient Woodland sites and open ground habitats (in line with Ancient Woodland Policy in England (Keepers of Time, 2005), Open Habitats Policy, 2010) or forest restructuring to meet the UK Forestry Standard. Restocking, except for plant health reasons, is also not supported in England. Given that new planting rates of productive woodland need to increase to avoid the productive resource being degraded, primarily through environmental policies, new initiatives to support restocking and compensate for losses of productive woodland should be considered. In addition, currently FC can only stipulate like with like restocking so there is a need to amend grant schemes to enable planting of climate resilient species or varieties. In the short-term, there is also a need to find new ways of generating annual payments for farmers based on existing and new woodland, but with consideration that woodland management can be designed for different outcomes with trade-offs e.g. productivity v biodiversity. This approach would complement the farm business model.

3. What other approaches could support scaling up of sustainable bioenergy feedstocks?

- Clear signals of a **long-term government commitment** to bioenergy are needed to build confidence and trust across bioenergy supply chains. Attendees strongly believed that a lack of government position on bioenergy and repeated changes in policy are continuing to damage the industry. Statements of support should include the scale of bioenergy feedstocks needed to achieve climate change targets and specific support for **UK produced** feedstocks building on statements in the 25 Year Environment Plan and the Clean Growth Strategy. This clarity would create a safer investment environment.
- The development of an **integrated land use strategy** across government (detailed above) was seen as an urgent priority bringing together policy objectives from a multitude of competing demands on land including agriculture and forestry, managed and semi-natural environments, land use planning, infrastructure and transport.
- **Building domestic supply chains and partnerships** through integrated action was viewed as critical, with priorities identified as incentivizing machinery development, end use investment, diversifying and growing non-energy products and end markets from energy crops and timber, and implementing greening policies for landowners.
- **Support for R&D** on agronomy best practice, breeding for future yield and resilience, and scaling up technologies for planting material was also viewed as critical and could be achieved through combined industry/government/academic efforts. Significant scaling up of energy crop planting (10,000-100,000+ ha) will require significant increases in breeding, and production of planting material which needs to be planned and supported.
- **Financial support for scaling-up bioenergy planting** needs to be addressed to provide revenue certainty although there was caution from some stakeholders that building a business on incentives is risky, so the long-term ambition should be for a self-sustaining industry. Ideas proposed include: reducing the impact of crop/woodland establishment costs through incentives or financing schemes (levies, taxation measures, market guarantee, annual (income foregone) payment), creating long-term revenue certainty through “public good” incentives and expansion of long-term grower contracts, loans for land purchase, development of regional carbon offset fund etc.

- **Changes to land use planning and permissions** need to be implemented to streamline processes and join up processes for different government agencies e.g. Natural England, Environment Agency and Forestry Commission. This was identified as an urgent priority currently creating a significant barrier and time delay in getting crops in the ground. Specific suggestions included: further changes to EIA regulations with a presumption to plant in forestry investment zones; review the consideration of forestry as a permanent land use change in EIA, for example only require EIA after 20 years to de-risk planting for landowners if the intention is to retain the crop beyond this time.
- A lack of up to date advice for energy crops and forestry was cited as a major barrier for farmers and landowners. The **creation of an advisory service** for bioenergy planting and management (best practice agronomy and management, variety lists, planning requirements and financial support), across agriculture and forestry sectors (SRC, perennial grasses, SRF, forestry, agroforestry) was identified as a high priority which could contribute to de-risking diversification. This service could build on previous Natural England and Forestry Commission guidelines and Biomass Energy Centre Publications and should be developed through collaboration with relevant agencies (e.g. Natural England, Environment Agency) and industry stakeholders (e.g. Iggesund and Terravesta) to ensure information is up to date.
- **Farmer and landowner engagement** needs to be supported and implemented. Information on land use, environmental and socio-economic benefits needs to be integrated and communicated to landowners/farmers to build awareness, knowledge and confidence, without being too fussy about precise quantification. For example, case studies of whole farm integration of bioenergy crops in the UK, compiled by the Energy Technologies Institute (see Appendix 2) could be used to demonstrate a range of benefits to future growers, while demonstration farms could be established for energy crops, farm woodland and agroforestry. These activities were viewed by attendees as low risk and high benefit and could build on existing demonstration farm networks e.g. LEAF (Linking Environment and Farming).

4. What could industry do? Are there measures commercial stakeholders could take that do not rely on Government intervention?

There was a broad consensus that to deliver significant scale-up of sustainable bioenergy production, government and industrial users need to act together to consistently support demand for UK grown feedstocks, in order to stimulate a supply response which shares risk between growers and end-users. Joint government and industry investment was also viewed as essential to support R&D to scale the production of Miscanthus hybrid seed (with benefits for establishment costs) (e.g. BBSRC 'Stand-alone' LINK or UKRI funding); and to realise investment in planting stock production (breeding and nurseries) for forestry and energy crops. Long-term contracts with growers/landowners to secure crops being grown e.g. Iggesund and Terravesta models, were widely viewed as successful in providing financial security to growers and reducing perceived risks and uncertainty over long-term commitment to perennial crops. These contracts need to be more widely available but require end market demand.

Research and Evidence Needs

A range of research and evidence gaps were identified by attendees during the workshop, which if addressed would better support the expansion of UK bioenergy feedstock production. These evidence gaps were not viewed as barriers to expanding planting rates in the short-term but would inform future strategies to maximise the environmental and socio-economic benefits achieved.

- Collate existing evidence and further research to quantify multifunctional benefits of bioenergy and multifunctional land use, including more research on biodiversity impacts.
- Long-term trials at commercial scale to test improved planting and management strategies, upscaling potential, and climate resilience e.g. no-till or min-till SRC planting to reduce soil impacts; resilience to flooding of varieties; effects of using forest biomass for energy.
- Prioritise locations for woodland creation by linking existing land availability mapping to environmental benefits mapping e.g. natural flood management, water quality enhancement, habitat creation and soil carbon storage potential.
- Synthesise and update existing trials and other information on SRF and improve SRF productivity mapping now there is new data to identify suitable land.
- Research non-financial barriers to tree planting and energy crop planting to support community engagement activities.

Session 4: Mapping a Route Forward

Building on discussions in session 3, the final session of the day was to map a route forward in scaling up UK sustainable bioenergy supply. Attendees were asked to consider the actions that government and industry should/could take and determine the time-scale (short (2018-2021) or medium (2022-2025) term) in which actions need to be taken. The text below reflects the main priorities and recommendations discussed. Items in bold were widely supported and/or urgent.

SHORT TERM 2018-2021: G= UK Government; I = industry; R = researchers.

Stakeholder group	Action
G	**Government signals of long-term commitment to bioenergy including UK production of feedstocks**
G	Reduce long term risk around future policy/incentive framework e.g. ROCS/RHI and investment decisions e.g. CHP, BECCS
G	**Develop Integrated Land Use Strategy**
G	**Develop land management contracts for public good delivery incorporating energy crops and woodland creation**
G	**Incentivise planting and management of bioenergy feedstocks**
G	Implement payment for ecosystem services recognising multifunctional benefits of bioenergy feedstocks
G	Implement carbon-based support for woodland creation and energy crops
G	Financial mechanisms for certainty of markets/contracts for bioenergy feedstocks
G	Carbon markets / pricing: Strengthen carbon markets, apply a carbon floor price to forestry sector; reconsider carbon prices for long term
G/I	**Develop bioenergy advisory service**
G	**Develop strategy to support farmers in forestry/woodland creation**
G/R	Establish independent variety trial to form the basis of a recommended list for SRC willow and Miscanthus varieties giving growers independent advice on yields and pest and disease resistance.
G	Develop strategy and support for restoring management to unmanaged woodlands

G	Adjustments to CAP greening measures for pre- 2022 to include energy crops and SRF.
G	**Streamline and simplify local approvals and permission processes**
G	Review land use change regulations for short rotation coppice and forestry
G	Introduce new initiatives to support restocking and compensate for losses of productive woodland and amend regulations to allow planting of climate resilient varieties
G	Consider whether changes to the tax regime for forestry could incentivise bioenergy production
G	**Community engagement to promote environmental and socio-economic benefits of tree planting and energy crop planting**
G	Establishment of demonstration farms for farm woodland and energy crops
I/R	Scale up seed production x10 over 4 years to reach 1 Mha by 2050. To achieve this a LINK project needs to be funded to scale Miscanthus hybrid seed.
I	**Invest in planting stock breeding and production, for scale-up and future climate resilience.**
I	**Set up more long-term contracts with growers**
R/I/G	Establish R&D to address research and evidence needs (see Session 3)

MEDIUM TERM 2022-2025: G= UK Government; I = industry; R = researchers.

Stakeholder group	Action
R/I/G	Continue addressing research and evidence needs (see Session 3).
G	Ensure tree planting targets are being met
G	Biomass contracts for difference
G	Promote green targets in industry to stimulate markets
G	Further develop monitoring of ecosystem services for Public goods payments
G	Support and diversify end markets (local and national)
G	Establish independent extension/advisory service for planting and agronomy that landowners/farmers can trust
G	Revisit public ownership of forestry (buy, plant and sell-on)
G	Make payment for ecosystem services or trading platform for natural capital a reality
G	Create a level playing field for farming and forestry – align forestry support with other land-based incentives
G	Bring tree planting and energy crops into new post-CAP agricultural /land use policy
G	Propose a strategic carbon stock for the UK as a national asset.

Appendix 1: Workshop Attendees

Committee on Climate Change	Sam Friggens
Committee on Climate Change	Indra Thillainathan
Committee on Climate Change	Jenny Hill
BEIS	Siobhan Sherry
BEIS	Katie Halter
DEFRA	Brenden Hodkinson
Scottish Government- Energy and Climate Change	Jennifer McVey
Environment Agency	Ross Lowrie
Forestry Commission	Ian Tubby
Forestry Commission	Mark Broadmeadow
Natural England	Mike Morecroft
ADAS	Carla Turner
Lowther Estate	David Bliss
Energy Systems Catapult	Hannah Evans
Renewable Energy Association	Frank Aaskov
National Farmers Union	Jonathan Scurlock
CONFOR: Confederation of Forest Industries	Caroline Harrison
ADBA: Anaerobic Digestion and Bioresources Assoc.	Thom Koller
CLA: Country Land and Business Association	Stefan Jimenez Wisler
Iggesund	Neil Watkins
Terravesta	William Cracroft-Eley
Drax Group	Karl Smyth
Estover Energy	Ben Heathcoate Amory
MGT Teesside	Alex Hughes
British Trust for Ornithology	Henrietta Pringle
Forest Research	James Morison
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Centre for Ecology & Hydrology	Rebecca Rowe
Centre for Ecology & Hydrology	Lisa Norton
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Aberystwyth University	John Clifton-Brown
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University of Aberdeen	Astley Hastings

Facilitator: **Matthew Haggis, Creative Exchange**

Workshop support: **Tricia Draycott, Centre for Ecology & Hydrology**

Appendix 2: Sources cited by attendees

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