Dr Gemma Delafield – Written Evidence (LUE0036)

1. **About the author**
   Dr Gemma Delafield is a Postdoctoral Research Associate within the Land, Environment, Economics and Policy Institute at the University of Exeter. Her research, funded through the UK Energy Research Centre, focuses on the development of a modelling framework which applies the natural capital approach to determining the optimal spatial distribution of renewable energy technologies within the UK. Gemma has recently provided advice to the Scottish and Welsh governments regarding the expansion of bioenergy crops within the UK.

2. This submission is in a personal capacity therefore comments should not be attributed to any institution to which Gemma is affiliated. Commentary is offered in response to two of the questions posed by this inquiry.

3. **Summary**
   The key points from this submission are as follows:
   - An expansion of domestically grown bioenergy crops could result in considerable land use change within the UK.
   - Bioenergy crops can have adverse or beneficial environmental impacts depending on where they are grown.
   - It is essential that incentives are provided to encourage landowners to grow bioenergy crops in locations which minimise adverse environmental impacts and maximise environmental benefits.
   - Assessments of the availability of land for renewable energy deployment should not just focus on technical feasibility, but economic, environmental, and social implications too.
   - Planning for renewable energy needs to be considered alongside other land use changes such as afforestation and farming.

How will commitments such as the 25-year environment plan and the net zero target require changes to land use in England, and what other impacts might these changes have?

4. The UK government recognises the need to decarbonise the country's energy system to ensure that net zero can be reached by 2050. The UK has considerable potential to scale up renewable energy infrastructure deployment, wind and solar power in particular, to help electrify both the transport and heat sectors. The UK's Net Zero Strategy also highlights the role that bioenergy with carbon capture and storage (BECCS) could play to achieving

negative emissions. The increase in the deployment of wind farms, solar farms and bioenergy power stations, and their bioenergy crops, has the potential to result in considerable land use change.

5. A scale up of bioenergy will result in the largest land use change out of the three technologies. The Committee on Climate Change estimate that up to 1.4 million hectares of land could be converted to bioenergy crops by 2050. Depending on how much bioenergy feedstock is imported to fuel BECCS power stations, this figure could be higher. Incentive mechanisms are needed to ensure bioenergy crops are grown in locations which avoid adverse environmental impacts (i.e. soil organic carbon emissions) and maximise environmental benefits (i.e. soil organic carbon sequestration, improved water quality, increased pollination).[1] Opportunities exist to plant second generation bioenergy crops like *Miscanthus* and short rotation coppice in locations which will help to improve the natural environment.[2]

6. The deployment of onshore wind farms and solar farms may also impact the environment. These impacts are likely to be of a smaller magnitude purely because they result in less land use change as they require less land per unit of electricity. Onshore wind farms are likely to impact the environment in two key ways: through the disturbance of carbon sequestered in peatlands and due to visual disamenity.[3-4] The trade-offs between siting wind farms on peatlands should be assessed on a site-by-site basis. My research shows that there are notable financial and social implications associated with restricting wind farms from being built upon peatlands.[5] Solar farms are more likely to have smaller visual disamenity implications and, if managed effectively, biodiversity benefits.[6] The 25-year environment plan makes it clear that co-benefits should be explored where possible to enhance the natural environment.

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[1] Milner, S., Holland, R.A., Lovett, A., Sunnenberg, G., Hastings, A., Smith, P., Wang, S., Taylor, G., 2016. Potential impacts on ecosystem services of land use transitions to second-generation bioenergy crops in GB. *GCB Bioenergy*, **8**(2), 317-333.

[2] Donnison, C., Holland, R.A., Hastings, A., Armstrong, L.M., Eigenbrod, F., Taylor, G., 2020. Bioenergy with Carbon Capture and Storage (BECCS): Finding the win–wins for energy, negative emissions and ecosystem services—size matters. *GCB Bioenergy*, **12**(8), 586-604.

[3] Nayak, D.R., Miller, D., Nolan, A., Smith, P., Smith, J.U., 2010. Calculating carbon budgets of wind farms on Scottish peatlands. *Mires and Peat*, **4**(9), 1-23.

[4] Rand, J., Hoen, B., 2017. Thirty years of North American wind energy acceptance research: What have we learned? *Energy research & social science*, **29**, 135-148.

[5] Delafield, G., 2022. Spatial optimisation of renewable energy deployment in Great Britain: A Natural Capital Analysis. PhD thesis, University of Exeter.

[6] Randle-Boggis, R.J., White, P.C.L., Cruz, J., Parker, G., Montag, H., Scurlock, J.M.O., Armstrong, A., 2020. Realising co-benefits for natural capital and ecosystem services from solar parks: a co-developed, evidence-based approach. *Renewable and Sustainable Energy Reviews*, **125**, 109775.

7. It is important to note that the distribution of the land use change associated with the decarbonisation of the energy system, and the consequential environmental costs and benefits, may not be spread evenly across the UK. This requires consideration to ensure a just transition to net zero.

8. Many studies have highlighted the technically feasible land area for the deployment of bioenergy, solar and wind power within the UK, however it is important to consider which areas of land are feasible from an economic, environmental and social perspective too. In particular, national land use and energy planning should consider the financial investment in the electricity grid that will be required to increase the deployment of renewable energy infrastructure in the UK.

How should land use pressures around energy and infrastructure be managed?

9. It is essential that the decarbonisation of the UK's energy system is not viewed in isolation. This will require cross departmental decision-making especially between the Department for Environment, Food & Rural Affairs and the Department for Business, Energy & Industrial Strategy.

10. Energy infrastructure will compete for land with many other services including food production, afforestation, and biodiversity protection. It is important to consider the trade-offs between using land for energy as opposed to providing other services. A natural capital approach offers the opportunity to quantify some of these trade-offs to inform decision-making. My research shows how when the value of ecosystem services is taken into consideration, the optimal locations for new energy infrastructure changes.[5] In particular, by including the value of carbon, the best locations to grow bioenergy crops changes significantly, highlighting the potential social welfare gains that could be realised.

11. Decisions must be made regarding how best to use land within the UK. This involves determining whether land would be best for afforestation, growing bioenergy crops or food production etc. There are synergies that should be capitalised on, for example if consumers switch towards more plant-based diets, as per the current trend, this may free up land which could be used to grow bioenergy crops.

12. Ensuring these decisions are made in a way which satisfies the ambitions of both the Net Zero Strategy and the 25-year environment plan, as well as ensuring the energy transition is just, will be essential.

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