Managing solar parks for nature

Climate change and ecosystem degradation are two of the biggest challenges we face. Solar parks offer an untapped opportunity to help restore the UK's ecosystems as well as providing low carbon energy for all to enjoy.

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Energy & Environment Research & Innovation

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Highlights

- **Land use change for solar parks presents an opportunity to address the urgent and interdependent challenges of mitigating climate change and ecosystem degradation.**
- **As well as providing low carbon energy, solar parks can provide important benefits for biodiversity and ecosystem services.**
- **Improved management of solar parks for ecosystem services and natural capital will deliver to multiple policies, including the government's net zero target, the post-Brexit Agriculture Bill, the Defra 25 Year Environment Plan and the National Planning Policy Framework, as well as biodiversity targets such as those set by the Convention on Biological Diversity.**
- **The free-to-use Solar Park Impacts on Ecosystem Services (SPIES) tool, produced through a collaboration between researchers and stakeholders, is an evidence-based online resource that shows how solar parks can be managed to maximise ecosystem service provision.**
- **The SPIES tool can be used by the solar industry, farming community, nature conservation bodies, local authorities and policy makers to provide robust scientific input to solar park development and management decisions.**

Significant quantities of land in the UK are being put aside for solar parks, but this does not need to be detrimental to vibrant and healthy local environments. However, given the rate of solar park deployment, we rapidly need to determine how best to manage them.

Solar capacity has increased much faster than predicted over the past decade; by the end of 2019, there were 580 gigawatts of photovoltaic capacity installed globally, of which 13.4 gigawatts were built in the UK. In 2018, 70-72% of photovoltaic panels installed in Europe were deployed as utility scale (>1 megawatt) ground-mounted solar parks. Many solar parks are built on low-grade or otherwise intensively managed agricultural land, creating an opportunity to enhance biodiversity and return the fields to more natural ecosystems.

This briefing outlines a new tool, developed through a collaboration between academics and stakeholders, which shows how restoration of the natural world can be achieved through appropriate design and management of solar parks.

The science

Recent assessments have underlined the need to address climate change, stem the loss in biodiversity and reverse the degradation of ecosystems that the planet has experienced in recent decades. These tasks are urgent and interdependent.

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of global primary energy.

The Intergovernmental Panel on Climate Change (IPCC) has drawn the connection between rising temperatures, poor land management and the degradation that we see in the natural world, while also emphasising the contribution of land use change to climate change.[1] It has also shown the need to make deep and rapid reductions in greenhouse gas emissions to stabilise global temperature rise at 1.5°C above pre-industrial levels – the goal set by the Paris Agreement – and highlighted the role of renewable energy required to achieve this. By 2050, the IPCC says, renewables (including bioenergy, hydropower, wind and solar) will have to supply 52-67% of global primary energy.[2]

The recent global assessment by the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) also stressed the global need to stem the dramatic loss of nature. The current rate of global change in nature is unprecedented in human history, with land-use change having the largest negative impacts. Current lifestyles are having severe impacts: around one million species are threatened with extinction unless action is taken to reduce biodiversity loss.[3]

Nature in the UK has followed this global trend, suffering dramatically from centuries of habitat loss, management changes, development and persecution, according to the 2019 State of Nature report, a snapshot of trends in British nature published every three years by a wide collaboration of nature-focused organisations.[4] For example, since 1970 there has been a 13% decline in average species' abundance, 15% of species have been classified as threatened and 2% have become extinct.

The UK needs to restore and protect its natural assets in tandem with its efforts to reduce emissions to net zero, a target that was set in law in 2019. The Committee on Climate Change, an independent government advisory body, has emphasised the need for a coherent approach between these two imperatives. The Committee's report on how to achieve the net zero target highlights the challenges of reducing land use emissions, but also the potential for the land and forests to act as a carbon sink.[5] Its report on land use stresses that policies which harness the land to sequester emissions could have positive side-effects for biodiversity, ecosystem services, and resilience to climate impacts.[6]

1 2019, IPCC, Special Report on Climate Change and Land

2 2018, IPCC, Special Report on Global Warming of 1.5°C

3 2019, IPBES, Global Assessment Report on Biodiversity and Ecosystem Services

4 2019, The State of Nature partnership, State of Nature Report

5 2019, Committee on Climate Change, Net Zero – The UK's contribution to stopping global warming

6 2020, Committee on Climate Change, Land use: Policies for a Net Zero UK

Introduction to SPIES

Despite the potential for a growing solar industry to tackle environmental issues, the impact of solar parks on nature is little understood. Academics at Lancaster University and the University of York, alongside the solar industry, ecologists, nature conservationists, and farming stakeholders, have developed a new online tool, known as Solar Park Impacts on Ecosystem Services (SPIES), that can help practitioners make more informed environmental management decisions.

SPIES is an interactive summary of the best available evidence of the impacts of land management on ecosystem services and biodiversity. The tool brings together 704 pieces of evidence extracted from 457 peer-reviewed academic articles, collected during a systematic review of the relevant literature, and is specifically tailored to the UK landscape.

Users can choose whether to arrange this evidence by 'ecosystem service', which generates a list of management interventions that will affect the achievement of a desired environmental outcome, or by 'management actions', which generates a list of environmental outcomes that are achieved by certain management interventions. This ensures that the tool is useful both to people who want to manage their solar park with particular environmental outcomes in mind, and those who want to know the impacts of their proposed or existing management decisions. In both cases, the outcomes are categorised by both the direction and scale of the impact. The tool shows the spread of evidence, allowing users to infer the likelihood of an impact and where evidence is limited. The user can access the source of the evidence and a brief summary, assuring transparency and enabling the users to navigate to the underpinning scientific articles if required.

Among the ecosystem services considered are air quality, climate, flooding, soil quality and erosion, food provision, opportunities for educational and spiritual interactions, and habitat and biodiversity maintenance. Management actions including grazing, drainage, the construction and maintenance of habitats, chemical inputs, soil and vegetation management, planting and cutting of hedges and trees, and mowing regimes.

Policy context

The UK government has adopted a legally binding target to reduce emissions to net zero by 2050. It is a target that the Committee on Climate Change deemed "technically feasible but highly challenging" in its recent net zero report, pointing out that it will not be met based on the current policies and rate of reductions in emissions. While the Committee neither attempts to predict nor prescribe the future technology mix in its report, the report imagines a "sensible mix" where electricity is generated from 95% renewables and low-carbon sources by 2050, including 4 gigawatts per year of solar power.

By 2050, the Climate Change Committee suggests that the UK electricity mix may comprise

95%

renewables and low-carbon sources, including 4 gigawatts of solar photovoltaics.

The government had previously accepted the Committee's advice, made in its fifth carbon budget, that the carbon intensity of the power sector should be reduced to below 100 grams of CO_2 per kilowatt hour by 2030, although this was in line with the government's previous less ambitious target to reduce emissions to 80% below 1990 levels by 2050.[7] To achieve this, an additional 50-60 terawatt hours of low-carbon generation would need to be contracted to come online by 2030 – but it is unlikely that this volume of generation will take place without government-backed contracts, which de-risk investments and reduce project costs.[8] In a positive move for solar power, the government announced a consultation in March 2020 on whether to again allow wind and solar projects to compete for Contracts for Difference, reversing a move under former prime minister David Cameron in 2016 to prevent wind competing for government subsidies. The sixth carbon budget is due to be published in September 2020, and will set out a pathway to meeting the 2050 net zero target.

In 2014, the government announced that it would no longer allow farmers to claim payments through the EU's Common Agricultural Policy (CAP) if their land was used for solar panels – a move intended to ensure that food and crops remained the priority. However, the CAP will no longer apply in the UK following its departure from the EU. The post-Brexit Agriculture Bill is currently progressing through Parliament, a replacement for the CAP which will change how farmers receive subsidies tied to their land. The current iteration of the proposed legislation says that farmers will receive support in exchange for providing public goods: for managing land in a way that protects the environment, mitigates or adapts to climate change, protects plant health, or improves soil quality.[9] It is uncertain whether solar parks would be eligible for these payments, which could be pivotal in informing management decisions.

In 2011, the government released a strategy outlining how it planned to apply biodiversity targets that had been set by the Convention on Biological Diversity and the EU,[10] although recent official analysis showed that there had been insufficient progress on the majority of the goals.[11] Future policy on biodiversity and ecosystems will be guided by the government's post-Brexit Environment Bill, which is currently moving through Parliament. Among other things, this enshrines the principle of "biodiversity net gain" into the planning system.[12] Defra's 25 Year Environment Plan also includes the principle that any new development should result in "net environmental gain", with habitats for wildlife restored or created.[13]

The UK's National Planning Policy Framework (NPPF), which sets out the government's planning policies, also demands that planning policies and decisions should take "opportunities to achieve net environmental gains".[14] The government's guidance provided to local authorities, which expands on how the NPPF should be applied, stipulates that decisions to grant planning permission for solar parks should consider the quality of the agricultural land and whether the proposal allows for continued agricultural use or biodiversity improvement around arrays. It encourages construction of solar parks on brownfield and non-agricultural land, provided it is not of high agricultural value.[15]

[7] 2015, Committee on Climate Change, The Fifth Carbon Budget

[8] 2019, Committee on Climate Change, Net Zero Technical Report

[9] 16 January 2020, Agriculture Bill

[10] 2011, Biodiversity 2020: A strategy for England's wildlife and ecosystem services

[11] 2019, United Kingdom's 6th National Report to the Convention on Biological Diversity

[12] 30 January 2020, Environment Bill

[13] 2018, Defra, A Green Future: Our 25 Year Plan to Improve the Environment

[14] February 2019, National Planning Policy Framework

[15] 2015, MHCLG, Guidance: Renewable and low carbon energy

Implications for industry, government and farmers

The SPIES tool will be a useful asset to those planning and maintaining solar parks as it explicitly links the impacts of management decisions on ecosystems using robust scientific evidence. The SPIES tool will support planning applications by illustrating how solar parks could contribute to the UK's environmental and biodiversity targets, including net environmental gain. SPIES provides links back to the underpinning scientific articles, which can provide important additional information when making site-specific decisions. The options presented by SPIES can help developers decide which ecosystem enhancements will be the most appropriate at the particular location.

SPIES can also provide valuable support to local authorities, which are required to consider the environmental benefits and disadvantages of proposed developments, including net environmental gain. For the national government, SPIES is an example of the sort of tool that could be used to inform land management decisions on-the-ground, potentially contributing to post-Brexit legislation and boosting the chance of meeting environmental targets.

For those farmers who rent agricultural land to solar developers, SPIES can highlight management actions that will enhance biodiversity and ecosystem services while also continuing to produce agricultural products, increasing the farmers' chances of claiming public goods payments.

The ultimate beneficiary of SPIES is nature itself. The tool has been designed to maximise the positive ecosystem impacts of land use change for solar parks. By providing the solar industry and farmers with the robust scientific information they need to make environmentally friendly management decisions, there is the potential for land converted to solar parks to be transformed into wildlife-rich habitats, with healthy hedgerows, wildflower meadows and nectar-rich areas where birds and insects can thrive.

Real world application

SPIES has already been used commercially. Ecological consultants Wychwood Biodiversity have employed the tool during assessments of various solar parks to determine the potential for land management decisions to improve ecosystem services. These have been undertaken at sites owned by communities, Belltown Power and NextEnergy Capital (NEC). At NEC's Emberton solar farm, the SPIES assessment reinforced the importance of wildflower areas and tussock grass margins to encourage pollination. Wychwood is putting these predictions to the test, conducting annual surveys at ten NEC sites, measuring the presence of plants, insects and birds – a practical evaluation of how the ecosystem is actively responding to the implemented decisions, which can be compared to the predictions made by SPIES. To date, the real world outcomes have aligned well with the SPIES output.

Resources

SPIES website (with links to the tool, explainer video, & case study): www.lancaster.ac.uk/spies

Peer-reviewed journal article: Randle-Boggis, R. J., White, P. C. L., Cruz, J., Parker, G., Montag, H., Scurlock, J. M. O. and 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, pp. 109775.

https://www.sciencedirect.com/science/article/pii/S136403212030071X (open access)

At NEC's Emberton solar farm, the SPIES assessment reinforced the importance of wild flower areas and tussock grass margins to encourage pollination.

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About the Energy & Environment Research & Innovation Team

The Energy & Environment Research & Innovation team is based within Lancaster Environment Centre and Energy Lancaster at Lancaster University. They further understanding of the environmental implications of the low carbon energy transition, working in collaboration with academics and stakeholders across the UK and internationally. For further details please see: www.energyenvironment.co.uk and follow @Energy_Environ on Twitter.

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