

The relationship between site characteristics of photovoltaic parks and the biodiversity impacts of management actions.

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Submitted to David Leonard, PhD

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ABSTRACT

Biodiversity supports all life on Earth, but its rapid decline due to unsustainable human activities is jeopardizing our planet's balance and resilience. Meanwhile, climate change, driven by fossil fuels is becoming the main driver of biodiversity loss. In response, energy transitions are underway in many regions with a focus on decarbonizing the energy supply by moving away from fossil fuels and towards renewable sources, including photovoltaic systems (PV). However, as large-scale PV parks are increasingly visible throughout European landscapes, their effects on biodiversity have raised concerns due to their extensive land use.

The Solar Park Impacts on Ecosystem Services Decision-Support Tool (SPIES DST) provides guidance towards PV park management actions that promote positive impacts on biodiversity. However, the impact of each management action varies from beneficial to neutral or detrimental depending on the circumstances, such that SPIES DST explains that its outputs should be interpreted considering the specific characteristics of each site.

This study seeks to provide clearer guidance to PV park operators by exploring the relationships between PV parks' site characteristics and the biodiversity impacts of management actions. To this end, comprehensive data sets were developed for three different PV parks in the Czech Republic through site visits and secondary sources. These data packages were distributed to a selection of biodiversity experts, who studied the detailed information about each park and its surrounding environment before evaluating and explaining the potential impact of 36 management actions on each of the three PV Parks. Quantitative and qualitative analyses were performed, and the findings were integrated into a comprehensive discussion of each management action.

The findings confirm the need for decision-makers in PV parks to consider the characteristics of each site when selecting appropriate management actions. In addition, the study identifies specific features that influence the impact of each management action on biodiversity (e.g., presence of invasive species, panel layout, proximity of protected areas); discusses the differences and similarities of the impact of these actions inside and outside the parks; distinguishes the most beneficial and harmful management actions for each of the three PV parks studied; and compares the findings with the guidance provided by SPIES. The study provides PV park managers with new insights into the integration of strategies to restore biodiversity into renewable energy systems to address the interconnected challenges of climate change and biodiversity loss.