Spatial analysis of possible AgriPV parks from a landscape quality perspective

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Background

The Netherlands is facing considerable challenges while aiming to reduce 95% of greenhouse gas emissions by 2050, compared to 1990 levels. Solar energy presents a key energy source, giving rise to the installation of photovoltaic panels on roofs and development of solar power plants (SPP) with agriphotovoltaics (APV) solutions. There are several drawbacks to enable energy transition in such a short time, such as scarce of land, environmental challenges and public opposition. APV along other SPP solutions may change the landscape quality (LQ) and raise concerns by local inhabitants, other landscape users and policy makers.

Materials / methods

This paper presents the first development phase of a decision support tool, which enables evidence-based decisions on the type, location and spatial extent of SPP. The tool offers solutions for decision-makers, so they will be able to make relevant solutions to implement SPP along with APV innovations in the landscape, while maintaining the public support and enhancing LQ. The objective of the study was to develop scenarios for SPP to produce 250 TJ renewable energy (the 2030 aim of Wageningen municipality) and assess the LQ of each scenario.

For the study site was chosen on open peatland in the western part of Municipality of Wageningen, the Netherlands (Figure 1). This study analyzed the distribution of seven types of SPP under consideration of LQ with the main variables of functional, experiential and future value, related to social interest (economic, social and ecological).

The LQ values were appointed according to economic production of the land and distribution of different types of SPP. The weight system of social interest was used to assess the LQ values for each type of SPP. Buckwheat, as one of the suitable crops used on peatland, was chosen for economic analysis.

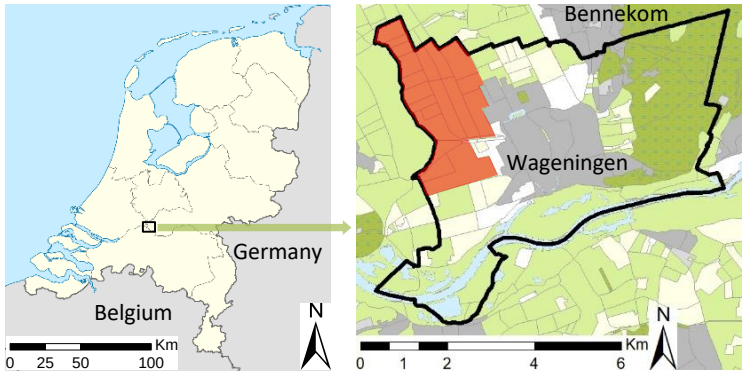

Figure 1: Left: map of the Netherlands. Right: Location of the study area (in red) in the Municipality of Wageningen (black line).

Results

The highest LQ values were shown by the APV scenario. The lowest LQ value was noticed by the scenario with southern orientation and 15% distribution of photovoltaics (PV) arrays. The highest LQ difference between landscape with PV and without PV installation showed east-west and south (15% density) orientation (27,4 LQ points). The smallest LQ loss demonstrated APV solution with 7,5 LQ points (Figure 2).

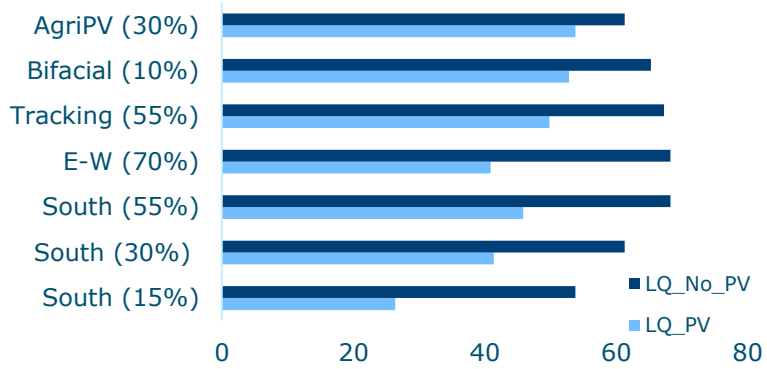

Figure 2: LQ points according to seven types of SPP comparing to the LQ of agricultural land without PV installations. E-W stands for east-west orientation, LQ_No_PV stands for LQ without PV installations, LQ_PV stands for LQ with PV installations and numbers in brackets stand for density of PV arrays.

Conclusions

The APV scenario demonstrated the lowest LQ loss among all types of SPP, comparing to the land without PV arrays. Furthermore, the APV scenario permits additionally crop production in the same area and creating a multifunctional landscape. The created tool provides policy makers, developers and stakeholders with alternative SPP scenarios, each one with different LQ and surface to choose from. The general public and decision makers will learn what options exist to realize SPP in terms of technology (types), location and spatial extent and with that rising public support for energy transition.

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