Effects of management and solar panels on plant community composition in photovoltaic parks

Louison Bienvenu*[1,2,3], Arnaud Lec'hvien[4], Elise Kebaili[3], Bertrand Schatz[5], Raphael Gros[4], Armin Bischoff[4], and Francis Isselin-Nondedeu[4,6]

[1]Cités, Territoires, Environnement et Sociétés – Université de Tours, Centre National de la Recherche Scientifique : UMR7324, Centre National de la Recherche Scientifique – France
[2]Institut méditerranéen de biodiversité et d´cologie marine et continentale – Avignon Université : UMR7263, Aix Marseille Université : UMR7263, Institut de recherche pour le développement [IRD] : UMR237 : UMR7263, Centre National de la Recherche Scientifique : UMR7263, Avignon Université, Aix Marseille Université, Institut de recherche pour le développement [IRD] : UMR237, Centre National de la Recherche Scientifique – France
[3]Engie Green – ENGIE, ENGIE – France
[4]Institut méditerranéen de biodiversité et d´cologie marine et continentale – Avignon Université : UMR7263, Aix Marseille Université : UMR7263, Institut de recherche pour le développement [IRD] : UMR237 : UMR7263, Centre National de la Recherche Scientifique : UMR7263, Avignon Université, Aix Marseille Université, Institut de recherche pour le développement [IRD] : UMR237, Centre National de la Recherche Scientifique – France
[5]Centre d'Ecologie Fonctionnelle et Evolutive – Université Paul-Valéry - Montpellier 3, Ecole Pratique des Hautes Etudes, Centre National de la Recherche Scientifique, Institut de Recherche pour le Développement, Institut National de Recherche pour l'Agriculture, l'Alimentation et l'Environnement, Institut Agro Montpellier, Université de Montpellier – France
[6]Cités, Territoires, Environnement et Sociétés – Université de Tours, Centre National de la Recherche Scientifique : UMR7324, Centre National de la Recherche Scientifique – France

Résumé

The area of French photovoltaic parks (PVs) is constantly increasing. According to the Pluriannual Energy Program, a further increase from 18.000 ha today to 44 000 ha up to 2028 is expected. PVs represent novel ecosystems dominated by open grasslands and patches of shaded areas with still largely unknown structure and functioning. They require management by mowing or grazing to prevent shrub encroachment. Solar panels change environmental conditions at small scale, in particular due to shading. According to the position within PV, we can distinguish, three main micro-habitats : edges (unshaded areas in PV), inter-rows between panels (alternating shade) and under panels (constantly shaded). The aim of our study is to assess **the effects of management and these micro-habitats on plant communities.** This represents the first large-scale on PV plant biodiversity conducted with a standardized method.
We selected 14 parks in the French regions Nouvelle Aquitaine (8 PVs) and PACA (6 PVs), all being 4-7 years old, and formerly occupied by forests or shrubland. Seven PVs are managed by grazing (mainly by sheep) and seven PVs by mowing. In each PV, we set up four blocks comprising three plots in each microhabitat resulting in a split-plot design 168 plots in total. We identified and visually estimated the cover of all (vascular) plant species, We tested

*Intervenant

the effects of management and microhabitats on plant community structure and indicators (total plant cover, species richness, Pielou evenness) using linear mixed models. In addition, we assessed the effects of these variables on the species composition using distance-based redundancy analysis (dbRDA).
Results of dbRDAs showed that the PVs in PACA presented a higher variation in community composition than in NA. The effects of microhabitat and management were significant on plant species composition. On average, species richness and Pielou evenness were, respectively, 40% and 32% lower under panels than in the edge. The effect of grazing on species richness, plant cover and Pielou evenness was significiantly but it depended on region. Management effects did not depend on microhabitats resulting in a non-significant management x microhabitat interaction. The strong effect of solar panels on diversity advocates for differential conservation and restoration strategies.

Mots-Clés: plant community, photovoltaic parks, ecological management, microhabitat