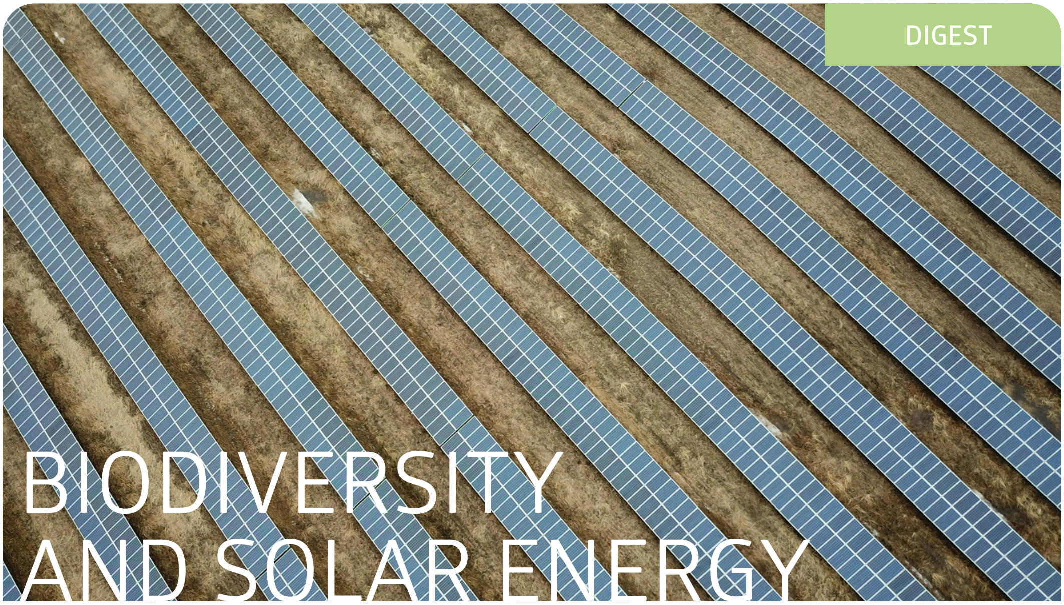
DIGEST



BIODIVERSITY AND SOLAR ENERGY

Effectiveness of measures and recommendations for reducing the impacts of ground-mounted solar panels on biodiversity

The deployment of ground-mounted photovoltaics is accelerating in France within the context of an energy transition aimed at achieving carbon neutrality by 2050. This trajectory involves greater electrification of energy uses and a ramp-up of renewable energy sources. Ground-mounted photovoltaic panels represent a strategic option for producing low-carbon electricity at scale. However, this development raises major environmental issues, particularly for biodiversity. Ground-mounted installations occupy large areas, often in open, agricultural or (semi-)natural environments, and may have negative effects on wildlife, habitats and ecological connectivity.

In this context, measures to mitigate the effects of solar energy installations on biodiversity are increasingly being implemented. Yet their limited evaluation of operational feedback, and insufficient knowledge sharing at the national level. Better documenting these measures, identifying the most effective ones, and structuring monitoring efforts have become shared priorities for public authorities, developers, land managers, and the scientific community.

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What do we mean by the effectiveness of mitigation measures?

Despite their silent operation and electricity generation without direct emissions, ground-mounted photovoltaic panels can have various impacts on terrestrial wildlife. These effects concern many species groups: birds, bats, insects, reptiles, amphibians, and mammals. Impacts vary according to the local ecological context, the type of development, management practices and project phases, including construction, operation and decommissioning (see the “Biodiversity and photovoltaics” fact sheet). This synthesis confirms that the evidence base is in its infancy, geographically concentrated and thematically limited, **but it makes it possible to identify the first documented action levers and the gaps that need to be addressed to rigorously assess the effectiveness of measures in the years ahead.**

KEY FINDINGS OF THIS SYNTHESIS

- Studies are concentrated mainly in **North America and Europe.** France has only a very limited number of publications where the results are directly transferable.
- The species groups covered are very limited. **Insects are the most represented across studies, while birds and bats are very poorly documented**. No specific studies were identified for the other groups: small and large mammals, amphibians, reptiles, and gastropods.
- Results mainly concern **variations in species activity** (e.g., presence, behaviour, reproduction) or t**he structure of local-scale communities** (e.g., diversity, abundance, and species composition).
- The main measures studied fall into two categories: **direct actions beneficial to biodiversity** (e.g. habitat improvement or maintenance, vegetation management) and **characteristics of the photovoltaic panels themselves** (e.g. reflectance, texture, orientation).
- Most publications are based on in situ studies conducted directly at operating solar panel parks . **They rely on before-after observations or comparisons between sites.**
- **Most of the studies report positive effects of the measures implemented on wildlife.** However, these results should be interpreted with caution: effects are often measured over short time-scales, at a small number of study sites, and with relatively few repeated observations over time. These limitations make it difficult to determine whether the findings can be applied to all other sites and contexts.

THE MITIGATION HIERARCHY

A fundamental approach to managing the environmental impacts of ground-mounted photovoltaic plants.

In response to identified impacts, French regulations require project developers to implement the mitigation hierarchy's four-step framework (Avoid, Reduce, Restore, Compensate) throughout all phases of ground-mounted photovoltaic power plant development. This principle, which now lies at the heart of environmental planning, aims to avoid significant impacts on biodiversity at the earliest possible stage, reduce those that cannot be avoided, and pay for or create conservation gains elsewhere as a last resort when restoring natural systems in the areas harmed by the given project is not possible.

Avoid

Avoidance is the priority step. It relies first on spatial planning: projects should primarily be located on already artificialised or developed land, such as car parks, brownfield sites or areas alongside infrastructure, in order to minimise pressure on sensitive natural environments. The implementing decree for the 2023 law on the acceleration of renewable energy production (APER) incorporates this approach by excluding productive agricultural areas and areas of high ecological value, except where justified. **Avoidance also involves taking ecological corridors, nesting or wintering sites of sensitive species into account, and excluding projects located on migration routes or wetlands.**

Reduce

Impact reduction relies on technical measures and site management. Good practices include using wildlife-permeable fencing, eliminating night-time lighting, and setting panel heights to facilitate species movement. Ecological vegetation management, such as late mowing or grazing, also benefits pollinators and nesting birds. To limit visual attraction, less reflective or patterned panels can be used. For bats, it is recommended that photovoltaic plants be located away from roosts and wooded corridors, while hedgerows and woodland edges should be preserved. Acoustic or visual deterrent devices are currently being tested.

Offset (Compensate)

Compensation remains complex and is still rarely implemented in practice. **It may involve restoring open habitats away from the project, creating refuge habitats such as wetlands, flower-rich meadows or hedgerows, or funding targeted conservation measures.** However, compensation measures must be adapted to the species affected and maintained over time in order to produce a measurable ecological effect. This therefore requires rigorous monitoring, which remains uncommon to date.

The current priority is to better assess the actual effectiveness of mitigation measures. Effective implementation of the ARC sequence depends on several conditions: **coherent spatial planning, accurate diagnostic tools at an early stage, robust monitoring protocols and regular assessment of measure effectiveness.** These elements are still partial or unevenly applied.

MEASURES TO MITIGATE THE IMPACT OF GROUND-MOUNTED PHOTOVOLTAIC PLANTS ON BIODIVERSITY

Presented here are the key results, potential co-benefits and limitations of measures aimed at mitigating the impact of ground-mounted photovoltaic power plants on biodiversity. This synthesis of knowledge provides a concrete and nuanced view of what empirical work currently shows about the effectiveness of these measures, while bearing in mind that the evidence remains fragmented and context dependent. Studies are based on a limited number of sites, species, and experimental conditions, often at small scales and over short time-scales. In addition, most experiments have been conducted using simulated photovoltaic panels, outside real operating conditions, and only one study concerns bats. Further research is therefore needed to confirm the transferability of the results observed at operational photovoltaic power plants.

Legend:

Number of studies · Insects · Birds · Bats · Link to studies

HABITAT IMPROVEMENT AND BIODIVERSITY-ENHANCING MEASURES

5

At ground-mounted photovoltaic power plants, habitat creation or restoration consists of transforming initially simplified areas, often lawns or former cropland, into more structured and diverse environments.

The challenge is to consider the solar power plant as an integral component of the landscape, capable of supporting diverse flora and fauna, rather than as a purely technical site. In practice, this may involve establishing diverse flower-rich meadows, restoring degraded soils, maintaining taller vegetation or fallow areas, or adding features such as hedgerows, shrub patches or small wetlands.

Scientific studies show that observed responses depend strongly on the local context, previous land use and the time elapsed since the measures were implemented.

The measure in detail

- Targeted habitat improvement at ground-mounted photovoltaic plants can increase the richness and abundance of pollinators, insects, soil organisms and nesting birds.
- The presence of habitat mosaics and woody elements in solar parks increases bird abundance and diversity compared with large-scale cropland areas.
- Soil restoration through organic amendments and vegetation transfers promotes mesofauna and decomposition processes.
- Converting cropland or lawns into flower-rich meadows and structured habitats is associated with substantial gains in plant diversity and marked increases in pollinators, sometimes with indirect benefits for neighbouring crops.

Effectiveness of the measure

Overall, the available studies suggest that biodiversity management or restoration practices implemented within solar parks, such as establishing flower-rich meadows, extensive vegetation management or structural habitat diversification, can promote the diversity and/or abundance of several faunal groups, particularly pollinators, beneficial insects and birds. These positive effects are generally observed compared with more intensive management practices or surrounding agricultural landscapes.

Nevertheless, responses vary according to the taxa studied and local habitat characteristics. Moreover, the number of studies remains limited, and they are often conducted at a small number of sites and over relatively short monitoring periods. The heterogeneity of the measures implemented and assessment protocols prevents a strong consensus from being reached on the effectiveness of specific measures.

VEGETATION MANAGEMENT: GRAZING

1

Grazing-based vegetation management at ground-mounted photovoltaic power plants can be an alternative to purely mechanical maintenance practices (e.g., mowing, strimming), with the aim of limiting inputs, reducing disturbance and benefiting certain components of biodiversity, particularly soil fauna. However, the actual effects of these practices remain poorly documented for ground-mounted photovoltaic plants.

The measure in detail

- Grazing-based vegetation management at photovoltaic plants could, at site level , increase soil organic matter and promote the abundance and biological quality of arthropod communities. However, these positive effects could be locally offset beneath panels when animals remain there and compact the soil. Under both management approaches, inter-row areas could act as soil biodiversity hotspots within photovoltaic plants.

Effectiveness of the measure

The study results are promising, suggesting a potentially beneficial effect of the measure. However, further research based on more homogeneous protocols and a larger body of data is needed to confirm these results and strengthen the available evidence base.

MODIFICATION OF
INFRASTRUCTURE DESIGN

1

Changes to the design and layout of ground-mounted photovoltaic power plants (mounting type, spacing between rows, fixed-tilt versus tracking system) strongly influence local microclimatic conditions and, in turn, soil invertebrate communities.

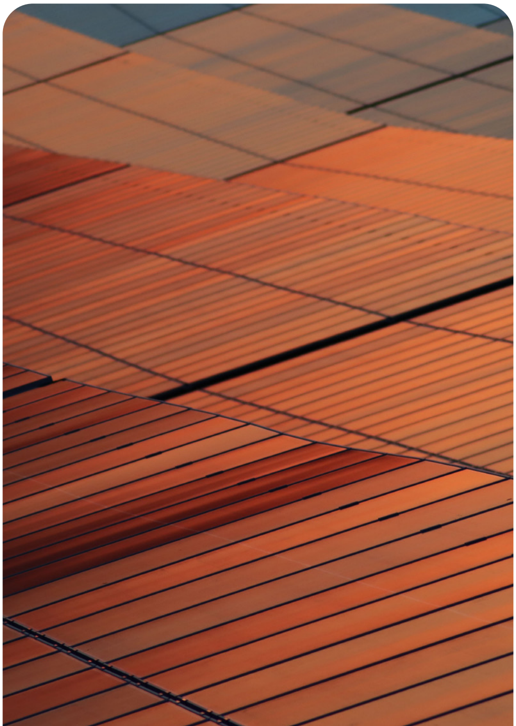
These design parameters could act as potential levers for limiting impacts on biodiversity or, conversely, as factors that may intensify disturbance in already fragile environments. Our literature review identified only one study addressing the effects of ground-mounted photovoltaic panels in relation to these design aspects, providing an initial insight into this category of mitigation measures.

The measure in detail

The design of ground-mounted photovoltaic power plants influences both the soil-level microclimate and the composition of arthropod communities: closely spaced fixed-mount systems can create very hot and dry conditions between rows while providing cooler and more humid micro-refuges beneath panels, whereas more widely spaced solar-tracking installations appear to generate less pronounced microclimatic gradients. These results suggest that design choices (spacing, orientation, structural type, consideration of soil conditions) could be used as mitigation levers limiting impacts on soil fauna in desert environments.

Effectiveness of the measure

The study results appear promising and suggest a potentially positive effect of the measure assessed. However, the level of evidence remains limited, as this conclusion is based on a single study conducted at two sites that were not directly comparable and over a relatively short monitoring period. These elements alone do not make it possible to generalise the effectiveness of the measure or the resulting recommendations.



PANEL SURFACE TREATMENTS TO REDUCE THE "LAKE/MIRROR" EFFECT

5

The texture, patterns or coating of photovoltaic panel surfaces, as well as their ability to reflect or polarise light, strongly influence their interaction with wildlife.

Solar panel surface treatment involves modifying panel surfaces using lines, grids, matte or anti-reflective coatings, microtextures or even wires, in order to reduce reflectivity and attractiveness to wildlife.

The measure in detail

- Adding grids or non-polarising white borders fragments the reflected light signal, reducing the attractiveness of several insect groups by a factor of more than 10, with a limited loss of active surface area, in the order of 1 to 5%.
- Anti-reflective matte glass reduces reflected polarisation and significantly decreases attractiveness to horseflies in direct sunlight. However, effects vary according to species and conditions: some mayflies even show a preference for these surfaces under diffuse light.
- Bio-inspired microtextured coatings, such as those mimicking the surface of rose petals, also appear promising for reconciling energy yield with a reduction in polarised light pollution, making panels almost invisible to certain sensitive species.
- In bats, adding fine wires or cords to smooth surfaces modifies the acoustic signature perceived through echolocation, which can greatly reduce the likelihood that bats mistake these surfaces for water. These simple structural adaptations could therefore be considered for installations.

Effectiveness of the measure

Available results point to generally high effectiveness of measures aimed at breaking up the "smooth homogeneous surface" appearance of photovoltaic panels, particularly in reducing interactions with insects. These studies therefore suggest that the optical and mechanical design of panels can be a relevant lever in strategies to mitigate impacts on wildlife.

ACOUSTIC DETERRENCE

1

Acoustic deterrence is a mitigation approach that remains little explored in the context of ground-mounted photovoltaics, where interactions between installations and birds are less well documented than in the wind energy sector. The principle involves emitting sound signals perceived as disturbing or threatening in order to reduce bird presence or roosting near infrastructure.

The measure in detail

- Installing a commercial sound-based bird deterrent device (i.e., alarm/sound waves) operating only during the day appears to prevent landings and reduce crow (Corvus spp.) activity in the immediate vicinity. However, the evidence remains weak and requires confirmation through multi-site monitoring over a longer period.

Effectiveness of the measure

Available results suggest that acoustic deterrence can limit landings and reduce crow activity in the immediate vicinity of installations, indicating potential short-term effectiveness.

However, feedback from other contexts shows that birds often become habituated to this type of device, limiting its effectiveness over time and making it more appropriate as a one-off or complementary measure rather than a long-term solution. This approach was not specifically developed to reduce the impacts of photovoltaic parks on birds, but rather to prevent certain forms of material damage. Moreover, strictly speaking, it does not constitute an impact-reduction measure under the Mitigation Hierarchy in the absence of a demonstrated ecological impact, such as collisions, and should therefore be regarded as exploratory.

Finally, this measure may generate its own ecological effects by creating areas that are less suitable for biodiversity, highlighting the need to assess its potential impacts before any wider deployment.

As part of a collaborative process to build knowledge on measures to mitigate the impacts of ground-mounted photovoltaic power plants on biodiversity, the French Biodiversity Research Foundation (Fondation pour la recherche sur la biodiversité, FRB) invited representatives of the photovoltaic sector (developers, consultancies), public bodies such as Ademe, international conservation organisations such as IUCN, and research institutes to share their views. The experts discussed the findings of this synthesis and shared practical insights based on their experience with projects carried out in France.

The discussions converged on a central finding: biodiversity measures cannot be standardised: their relevance depends on the ecological context, species present, l and uses and local constraints.

Experts highlighted the value of measures such as ecological connectivity, wildlife-permeable fencing, wildlife crossings, refuge areas without signage, as well as the creation of ponds, roosts, nest boxes or hibernacula, combined with differentiated management of vegetation and soils.

However, the effectiveness of these measures remains difficult to demonstrate. Monitoring approaches are heterogeneous, data are rarely pooled, control sites are scarce, and robust BACI (Before–After–Control–Impact) protocols are difficult to integrate into operating schedules. These limitations hinder the comparability of results and the systematic use of lessons learned.

Operational constraints are also numerous: fire protection, agricultural constraints, insurance requirements, costs, environmental compensation and sometimes conflicting requirements between stakeholders. In agrivoltaics, which combines agricultural production and energy generation on the same land, these tensions are particularly pronounced because agricultural production, safety, profitability and biodiversity must be reconciled within the same area.

To make progress, experts recommend strengthening ecodesign, standardising monitoring, promoting data sharing, and structuring cooperation among stakeholders. Under these conditions, some ground-mounted photovoltaic power plants could contribute to the preservation or restoration of open habitats.

FOR THE SCIENTIFIC COMMUNITY

The scientific community working on the impacts of ground-mounted photovoltaic power plants on biodiversity can support the development or improvement of risk-reduction technologies. The recommendations below support the generation of knowledge on the effectiveness of measures implemented.

Recommendation		Specific research actions to undertake
Priority research areas	Broaden the contexts studied and taxonomic groups	Expand research across sites in France and Europe, prioritising Mediterranean, tropical and, where relevant, arid environments.
		Develop dedicated studies on pollinators, birds, bats, small and large mammals, reptiles and amphibians.
	Diversify the types of measures assessed	Test habitat and vegetation management measures systematically for vertebrates, including their seasonal effects.
		Assess different deterrence approaches (e.g., acoustic, visual and lighting-based) and infrastructure design options.
		Direct R&D efforts towards understanding the influence of panel height and row spacing, soil restoration, and measures to support pollinators and small wildlife, especially in agrivoltaic systems.
Study design and methodology	Strengthen the robustness of experimental designs	Implement BACI (Before–After–Control–Impact) designs with replication and multi-year monitoring.
		Explicitly account for confounding factors in analyses
		Increase field-based testing of solutions developed under ex situ conditions and extend this testing to a wider range of environmental contexts and experimental settings.
		Harmonise metrics between controlled settings and real sites to enable direct comparison of measure effectiveness.

Standardisation of methodologies and data sharing	Develop harmonised protocols and indicators	Contribute to developing common monitoring frameworks by taxon, with indicators and frequencies shared nationally.
		Stabilise research protocols over time to identify robust trends.
		Publish datasets associated with research on photovoltaic power plants in open access.
		Document and publish results, including neutral or negative findings, ensuring transparency regarding funding and conflicts of interest.
Closer cooperation with the industry	Co-design monitoring with field stakeholders	Involve developers, consultancy firms and site managers from the design stage of research protocols and BACI designs.
		Contribute scientific expertise to collective initiatives (Renewable Energy and Biodiversity Observatory, programmes such as BIODIVoltaïque).
		Identify developers' priority knowledge needs and translate them into research questions.
		Contribute to operational guidance and "photovoltaics and biodiversity" training programmes.
Knowledge sharing and training	Improve the dissemination of knowledge	Translate research findings into operational recommendations for ecodesign guides and existing technical tools.
		Build the capacity of consultancy firms, developers, and public services through training and workshops.
		Combine scientific knowledge and field experience to continuously improve practices in order to prioritise the most effective measures.

The Global Biodiversity Framework recommends that the private sector, representatives of the photovoltaic industry, developers and consultancy firms regularly and transparently monitor, assess and disclose biodiversity-related risks, dependencies and impacts across supply and value chains, and provide consumers with the information needed to promote sustainable consumption patterns.

Recommandation		Specific actions
Measure selection and ecodesign	Prioritise measures considered beneficial to biodiversity	Implement fencing and wildlife crossings designed according to species and context, with appropriate maintenance.
		Provide bat roosts, ponds and hibernacula for amphibians and reptiles, as well as nest boxes adapted to the local context.
		Maintain natural areas without panels within power plants where relevant for biodiversity.
		Use local seed as much as possible and reseed using seed produced at the power plant.
		Avoid locating projects in areas of high ecological sensitivity.
Vegetation and soil management	Adapt management to reconcile fire protection, agriculture and biodiversity	Limit comprehensive “clean-up” practices that impoverish habitats and may become counterproductive for ecosystem resilience.
		Where possible, adjust mowing and grazing schedules to reduce conflicts with periods favourable to wildlife.
		Integrate soil restoration (infiltration, erosion, post-construction compaction) into project design and management.
		Experiment with differentiated vegetation-management regimes, particularly in agrivoltaic systems, taking insurance and agricultural constraints into account.

Monitoring and assessment	Systematically integrate ecological monitoring and assessment measures into projects	Plan monitoring from the project design stage, including a baseline, defined indicators and, where possible, control areas.
		Allocate sufficient human and financial resources for multi-year monitoring and more robust protocols.
		Facilitate site access for monitoring and research teams.
		Submit monitoring data to government agencies.
Regulatory and economic trade-offs	Anticipate tensions between biodiversity, wildfire prevention, agriculture, insurance and offsetting.	Identify wildfire prevention requirements at an early stage (legal brush-clearing obligations, local requirements) and co-develop solutions with the relevant authorities that are compatible with ecological objectives.
		Work with farmers and livestock breeders on requirements to control certain plant species and on the scope for possible adjustments.
		Integrate the costs of biodiversity offsetting and ecological management into the economic model to avoid costly and late-stage revisions.
		Draw on eco-design guidelines and lessons learned from previous projects to prioritise measures that deliver the greatest ecological benefits while taking constraints into account.
Cooperation and knowledge sharing	Strengthen cooperation with researchers and local stakeholders.	Participate in collective initiatives (observatories, collaborative programmes such as BIODIVoltaïque, and "agrivoltaism" approaches).
		Contribute to training and cross-sector knowledge-sharing initiatives by sharing both successful experiences and challenges encountered in the field.
		Involve local authorities, associations and local residents in discussions on the choice of measures, and present monitoring results to strengthen project acceptance.

FOR STATES AND GOVERNMENT AGENCIES

States, and public authorities more broadly, must ensure that operators and developers comply with their biodiversity obligations in order to protect the species and ecosystems on which our quality of life depends. The following recommendations contribute to this objective.

Recommandation		Specific actions
Regulatory framework and compensation	Clarify and stabilise environmental compensation requirements	Clarify the criteria for determining the scale of compensation measures and their relationship with forest or agricultural areas.
		Limit situations of double compensation and make the framework clearer for project developers.
		Make “no-regret” measures (avoiding high-sensitivity areas, contributing to open-habitat conservation) core project expectations rather than bonuses.
Coordination of public policies	Better coordinate biodiversity, fire protection and agricultural policies	Harmonise the interpretation of French Legal Brush-Clearing Obligations (in french: obligations légales de débroussaillement, OLD) and fire-protection requirements across departments to reduce conflicting requirements.
		Adapt vegetation-management requirements (including control of certain species) so that they remain compatible with biodiversity objectives.
		Establish inter-ministerial and interdepartmental coordination (environment, agriculture, fire protection, etc.) to provide a coherent framework for projects.
Standardisation of monitoring	Establish national ecological monitoring frameworks	Coordinate the development of harmonised species-specific monitoring protocols, with indicators, frequencies and methods shared across the sector.
		Stabilise these monitoring protocols over time to enable trend analysis over 10 to 15 years.
		Include explicit pre- and post-project monitoring requirements in permitting procedures, where possible using BACI (Before–After–Control–Impact) designs.

Data and transparency	Centralise and make use of environmental data	Support the Renewable Energy and Biodiversity Observatory as a national data platform and resource centre.
		Encourage sharing of raw data and transparency regarding funding and conflicts of interest to facilitate analyses and meta-analyses.
Support for R&D and ecodesign	Direct R&D towards measure effectiveness and soil resilience	Fund programmes targeting the influence of panel height and inter-row spacing on habitats and wildlife movement.
		Support work on soil restoration and conservation (infiltration, erosion, post-construction compaction).
		Encourage studies on pollinators, small wildlife and vegetation management in agrivoltaic contexts.
		Prioritise projects that compare measure effectiveness rather than multiplying isolated studies.
Guidance and training	Develop ecodesign guidance and build capacity	Support the production and updating of ecodesign and “ecovoltaics” guidance for photovoltaic plants, informed by the literature and field experience.
		Support dedicated “photovoltaics and biodiversity” training for government services, consultancies, developers and farmers.
		Incorporate lessons learned from pilot projects, particularly agrivoltaic projects, into these tools.
Third-party guarantor role	Strengthen the role of the State as an arbiter and facilitator	Organise a structured analysis of submitted monitoring results and provide feedback to project developers.
		Actively participate in local dialogue forums to help arbitrate between safety, agricultural and biodiversity requirements.
		Help provide a clear and stable framework that enables economic and scientific stakeholders to plan and invest for the long term

RESEARCH

Expand the range of contexts studied:

By covering a greater diversity of environments—arid, Mediterranean and tropical—particularly in mainland France and France's overseas territories.

Rebalance efforts among species groups:

By developing studies dedicated to pollinators, birds and bats, as well as small and large mammals, reptiles and amphibians.

Diversify the types of measures:

By going beyond panel surface treatments and habitat measures alone, and also testing vegetation management, fence permeability, deterrent devices, infrastructure design and compensation measures.

Strengthen the robustness of study designs:

By prioritising, where possible, BACI approaches, multi-year monitoring, independent replicates and explicit consideration of confounding factors.

METHODOLOGY

Standardisation:

Greater standardisation would be beneficial. Harmonising protocols (sampling areas, monitoring frequencies, response indicators) and reporting formats (basic statistics, uncertainties, detailed description of methods) would facilitate comparisons between studies and future meta-analyses.

Transparency:

Transparency regarding funding and conflicts of interest, together with sharing raw data where possible, would strengthen confidence in results and their reuse.

MANAGEMENT

Embed assessment within the projects themselves:

Each implementation of a measure (e.g., vegetation management, design adaptation, panel-based devices, fencing arrangements, compensation) represents an opportunity to integrate structured monitoring with an appropriate comparator. Photovoltaic plants can thus become genuine experimental sites for testing and comparing measures under real-world conditions, at limited marginal cost. This requires closer partnerships among developers, consultancies, land managers, and researchers.

The recommendations presented in this synthesis should be considered within the broader context of the ecological transition, as ground-mounted photovoltaics will continue to expand. The question is therefore not simply to "reduce impacts" on an ad hoc basis, but to build a solid evidence base capable of guiding the planning, design, and management of solar parks towards solutions that genuinely benefit biodiversity.

Accelerating and structuring the generation of knowledge on measuring effectiveness is a key condition for sustainably reconciling solar development with the conservation of ecosystems. Operators, developers, planners, and public authorities have a responsibility to understand impacts, reduce their magnitude, and report on their biodiversity-related risks and dependencies. **Support from the Mirova Research Center has enabled the FRB to analyse the issue and update knowledge on the effectiveness of proposed solutions for reducing the impact of ground-mounted photovoltaic plants on biodiversity.**

This article was written within the framework of the **"Impact of Renewable Energy Sources on Biodiversity"** programme. This research funding programme led by the **French Foundation for Biodiversity Research (FRB)** and the **Mirova Research Center** aims to better assess the impact of renewable energy sources on biodiversity and deliver operational recommendations for best practice to those working in the renewable energy sector.

Read the full publication :

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