Ellen Fetzer
editor

Regenerative Landscapes

Designing the Transition

Cuvillier Verlag Göttingen
Internationaler wissenschaftlicher Fachverlag

Regenerative Landscapes

Designing the Transition

Selected Proceedings of the 2024 Conference of the European Council of Landscape Architecture Schools (ECLAS) hosted from September 7 - 10, 2024, by the Faculty of Architecture, Université Libre de Bruxelles (ULB), in Brussels, Belgium.

Bibliographical information held by the German National Library

The German National Library has listed this book in the Deutsche Nationalbibliografie (German national bibliography); detailed bibliographic information is available online at http://dnb.d-nb.de.

1st edition - Göttingen: Cuvillier, 2025

© CUVILLIER VERLAG, Göttingen, Germany 2025
Nonnenstieg 8, 37075 Göttingen, Germany
Telephone: +49 (0)551-54724-0
Telefax: +49 (0)551-54724-21
www.cuvillier.de

1st edition, 2025
This publication is printed on acid-free paper.

ISBN 978-3-68952-834-8
eISBN 978-3-68952-308-4
ORCID 0000-0003-0920-9823
ISNI 0000000524241949

Editorial

As President of the European Council of Landscape Architecture Schools (ECLAS) it is my great pleasure to introduce these selected proceedings of the ECLAS Conference 2024, hosted at the Université Libre de Bruxelles (ULB) in Brussels. The conference theme, *Regenerative Landscapes – Designing the Transition*, has underscored the critical role of landscape architecture in navigating the complexities of climate change, biodiversity loss, and societal transformation.

We have gathered with almost 300 people in Brussels at a pivotal moment. Our landscapes -both urban and rural- are under unprecedented pressure, with six of nine planetary boundaries already exceeded. This conference provided an opportunity to reimagine landscapes not merely as spaces of adaptation but as active agents of regeneration. The contributions in this volume reflect a shared commitment to fostering landscapes that restore ecological function, enhance social equity, and inspire cultural renewal.

Our thematic tracks have explored the diverse facets of regeneration: from energy and mobility landscapes to foodscapes, hidden landscapes of the global value chain, biodiversity regeneration and democratic landscape transformation. Each theme represents a vital component of the transition towards resilient, equitable, and thriving landscapes. The discussions initiated here will be crucial in shaping the future of landscape education, research, and practice.

I extend my sincere gratitude to the organising team, our hosts at ULB and CIVA Brussels, and the dedicated researchers, educators, and practitioners contributing to this conference. Further, the conference and these proceedings would not have been possible without the TELOS ERASMUS project and its team. TELOS provided the conceptual framework for designing our call for papers guiding the discourse of this conference.

I hope that our 2024 gathering has served as a catalyst for new collaborations and bold ideas, driving the discipline of landscape architecture toward a regenerative future.

Dr. Ellen Fetzer
ECLAS President 2018-2024
European Council of Landscape Architecture Schools

ECLAS
EUROPEAN COUNCIL OF LANDSCAPE ARCHITECTURE SCHOOLS

Contents

Landscape integration of agrivoltaic systems

A methodological approach in research through design and education

Chapter authors

Paolo **Picchi**[1], Alessandra **Scognamiglio**[2], **Gabriele Paolinelli**[1], Anna **Lambertini**[1]

1. DIDA Department of Architecture, University of Florence, Italy

2. ENEA, Italian National Agency for New Technologies, Energy and Sustainable Economic Development, Italy

Keywords: farmers; community, landscape architecture, social-ecological systems, energy

Introduction

Photovoltaics (PV) is widely seen as the main technology that can drive the energy transition faster. The concept of Agrivoltaics (also called agri-PV), making dual use of land for both agriculture and solar energy generation, has been emerging recently (Toledo and Scognamiglio, 2021). Those appear promising in supporting local community energy transition and farming practices, yet not fully exploited since in a early stage in both research projects and implementation. Agri-PV systems are complex systems which require multi- and trans-disciplinarity and co-design (Stremke and Picchi, 2017) and a governance strategy (see e.g. Toledo and Scognamiglio, 2022; Sirnik et al., 2023; Troccoli et al., 2024). EU member states are currently promoting and subsidising agri-PV systems, among the others Italy, Germany, France, where national associations for the development of agri-PV, as the Italian AIAS (Italian Association Sustainable Agrivoltaics) or the French France Agrivoltaisme have been established. Those associations promote the integration of agri-PV systems in the landscape, yet this objective is still vague in definition and approaches, possible methodology and tools, especially with regards to the local community engagement in governance strategy and co-design. Literature currently presents some papers on agri-PV landscape integration that propose some criteria (see e.g. Younas et al., 2019; Fatturoso et al., 2024, Sirnik et al., 2023), yet no one is proposing a design methodological path, intended here as pragmatic series of things to do to approach the agri-PV system landscape integration.

The Social Ecological Systems Framework (SESF) (Ostrom, 1990) is a potential reference, yet this has not been combined with agri-PV yet. The aim of SESF was originally to collect evidence on the variables and institutional arrangements enabling local actors in working together in governance strategies for common-pool resources as renewable energy sources recently defined by Wolsink (2024) as a common-pool resource in need of governance strategies in distributed energy generation (Partelow, 2018). Authors as Partelow and Winkler (2016) affirm that the SESF has been widely combined with concepts from different disciplines beyond social sciences due to its systemic problem solving and pragmatic approach; the concept has evolved in different research mainstream fields related to sustainability goals, focusing on the interdependent linkages between social and environmental change (Fischer et al. 2015; Partelow, 2018). Landscape disciplines too are currently engaging with SESF. Some authors as e.g. Alessa et al. (2008), Vervoort et al. (2012), Zhou et al. (2019), publishing on journals as e.g. Landscape and Urban Planning consider local landscapes as SESs (Zingoni de Baro, 2022). The added value of a SESF approach can be in methodological research when dealing with landscape governance systems in transition, as in the case of agri-PV systems.

The authors of this contribution started from the proposition that agri-PV systems are SESs and that their integration in the landscape depends on the fact that those are designed as SESs interdependent on other SESs by means of governance strategies and co-design processes.

In a recent paper Buckton et al. (2023) affirm in a literature review that the concept of regenerative has encountered numerous applications in different disciplines and fields. The authors stressed the relation between a regenerative lens and SES: a system "cannot be regenerative on its own but only as part of a regenerative ''ensemble'' of interdependent SESs that are mutually supporting each other" (2023, p. 837). The author affirms that a regenerative system would need the individual and mutually reinforcing contributions of five essential qualities: "an embodied ecological worldview, mutualistic interactions, high diversity, agency, and reflexivity" (2023, p. 837). Within to the scope of this contribution authors interpret ecological worldview as the agri-PV systems being part of the web of life and therefore design to not fragment the web; for mutualistic interactions the authors interpret that design must safeguard a high proportion of positive relationships characterized by sense of cooperation, reciprocity and sense of care each other; for high diversity is meant the diversity of the system component, e.g biodiversity, agro-biodiversity, cultural diversity; for agency the authors interpret the fostering of participation and co-creative governance of the agri-PV system, energy justice and the support to farmers; for reflexivity the authors intend the fact that an agri-PV system is an innovation action and therefore require continued experimentation, monitoring and adaptation.
The objective of the presented research is the delineation of a methodological path, a pragmatic sequence of things to do, to design agri-PV systems as regenerative SESs, therefore pursuing the five qualities as identified in Buckton et al. (2023) both in design process and pursued objectives. The approach is developed by means of Methodological Research in a learning by doing and iterative approach, tested in different applications in Italy. The research is funded by Starlight-energy, an international company investing in the development of Agri-PV systems projects and it is advised by ENEA, Italian National Agency for New Technologies, Energy and Sustainable Economic Development.

Setting the methodological path

Designing agri-PV systems as regenerative SES require the engagement of local community to understand the actors, the resources and the existing landscape governance systems and to set design principles (see Partelow, 2018, fig. 1) (Castàn Broto et al., 2019, Picchi et al., 2023). The authors drafted a methodological path in five steps shown in figure one. The methodological path has been centred on the community engagement (steps two and three). We will now briefly describe the steps.

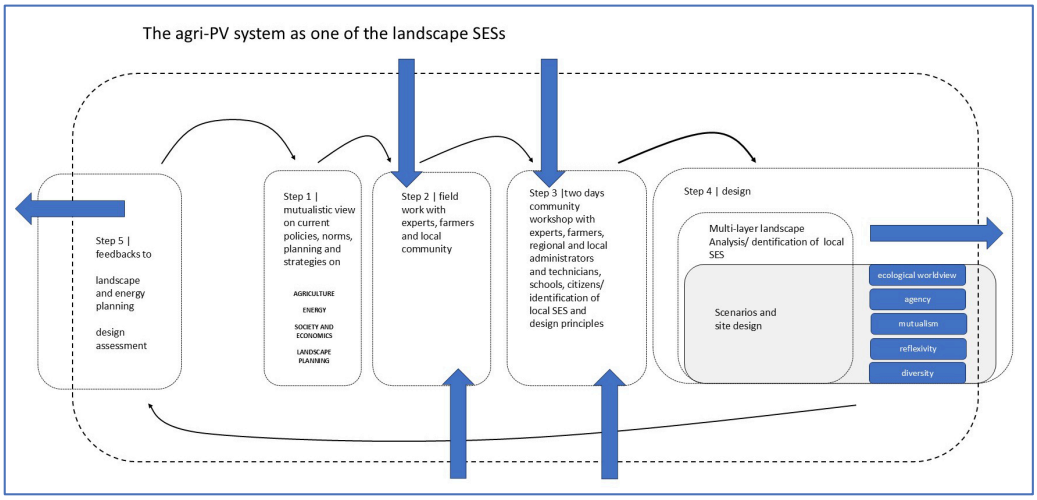

Figure 1: Setting the methodological path

Step one

The step one is in preparation of steps one and two. It foresees a synergetic analysis of the policies, planning previsions and near future developments at site level depending on the local and regional level regulations. The analysis embraces different sectors as agriculture and energy, landscape planning quality objectives, economic strategies and societal challenges. This is functional to set the stage of the agri-PV systems, individuating all the possible synergies with current regional and local planning and development strategies. The step one gives therefore indications on possible relevant stakeholders to contact in step two.

Step two

Step two aims to acquire direct knowledge on the landscape structure. The fieldwork consists of a direct exploration of the landscape and a direct dialogue with the farmers who cultivate those fields and maintain the landscape structure and the nature. It aims at the comprehension of the local and site SES.

Step three

The community workshop is conceived as a process of community imagination and aims at the sharing of themes and values of the landscape to orient possible future transformations of the landscape driven by the agri-PV system. The workshop foresees co-design activities for the conception of design principles creating synergies between energy and agriculture, ecology, recreation and aesthetics. Eligible participants are local farmers, Agriculture Cooperatives, Trade Associations in Agriculture, National or local NGOs active in the experience and maintenance of the landscape, residents. Among experts are eligible Community storytellers, Local experts (historians, archaeologists, agronomists, botanists), Technicians from regional and local administrations, Local representatives of the Cultural Heritage Office. The final aim is to orient codified languages and criteria that can be shared by the community and possibly useful for the assessment of the agri-PV system project as legitimized criteria (step 5) and provide validated design principles for the integration of the agri-PV system in the landscape.

The community workshop includes a first phase aimed at the sharing and reconnaissance of landscape themes and values by the participants, and a second phase of co-design aimed at the shared conception of design principles inherent to energy, agricultural, ecological, recreational and visual themes and values. The first phase consists in an immersive landscape experience and a participatory mapping activity, while the second phase consists in focus groups each one dedicated to landscape themes and issues emerged during the participatory mapping and aiming at the elaboration of design principles to address them.

Step four

The step four is the design phase itself. All the information in steps one, two and three are systematized to build coherent knowledge. In order to represent the collected knowledge landscape maps and profile, and other forms of representation as thematic sheets, info-graphics should be set at different levels and representing the different stakeholders perspectives. At this stage mapping requires an inventive and interpretative effort in the

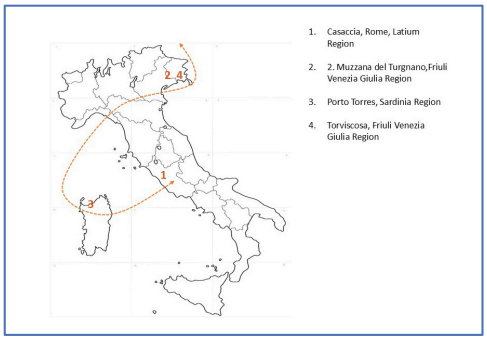

Figure 2: At present, the methodological path has been tested in four applications in 2023-2024

Figure 3: The landscape in Muzzana del Turgnano with crops, poplar groves and drainage systems

way relations in between social-ecological systems can be recognized and valued through the agri-PV system lens: mapping is a design process itself (Corner, 2011; Lambertini, 2013).

Step five

Step five foresees feedbacks for assessment and planning in dissemination activities to policy makers.

Methodological research applications

The research framework foresaw different applications in order to make critical adjustments on the drafted steps along the two years research partnership. At present the methodological path has been tested in four applications in 2023-2024 (figure 2). Due to the limits of this contribution only two of these applications, relevant for the outcomes presentation, are briefly introduced in this section.

Muzzana del Turgnano

The landscape in Muzzana del Turgnano, Friuli Venezia Giulia, is flat with crops rotation with Zea mays, Oriza sativa, Triticum eastivum and set aside grasslands and poplars (Populus nigra) groves for timber production. The landscape is rich in water from resurgences of water coming from the Alps when water encounters heavy clay layers, so wetlands, mostly protected as Natura 2000 sites, are frequent along the resurgence line. The water is canalized in traditional drainage systems which are hot spots for wet habitat. (figure 3). Here land owners and a cooperative of producers of barley for beer are interested the former to rent out their field to agri-PV developers and the latter to cultivate barley in agri-PV system.

The landscape in Muzzana del Turgnano was object of the second year Design Studio at the MSc in Landscape Architecture and a design competition at the University of Florence in 2023-2024. On the 19th and 20th of October 2023, a field visit was organized with the aim aimed to implement steps two and three of the methodological path, respectively the fieldwork and the gathering with the local community of Muzzana del Turgnano. The visit took place in two days. On the first day a field work in the landscape parcels which will host the agri-PV system took place together with the cooperative for barley and land owners, while in the evening a public meeting was held with landowners, farmers, citizens, the Municipality of Muzzana del Turgnano and the Environment Department of the Friuli Region. On the second day, an additional visit to the surrounding landscapes was organized.

Figure 4: Viscose production of viscose from marsh reed (Phragmites australis) neary Torviscosa, with drainage systems as hot spot of wet habitat and biodiversity.

Torviscosa

The landscape in Torviscosa, Friuli Venezia Giulia, is mostly similar to Muzzana del Turgnano, with crops rotation with mainly Zea mays, Oriza sativa, Triticum aestivum and set aside grasslands and poplars (Populus nigra) groves for timber production. The landscape is characterized by water from resurgences and drainage systems too and in the study area it presents a sharp demarcation in between the landscape created during the swamp reclamation in the 19th century and the landscape from the more recent reclamation of the 1930' for the production of viscose from marsh reed (Phragmites australis) (figure 4). The landscape of Torviscosa was object of a community workshop in November 2024. Due to local constraints and community availability the workshop was condensed in one day activity and hosted by the Municipality of Torviscosa and the Farm Tenuta ai Laghi.

In the following section we will report and discuss the outcomes.

Results and discussions

The four applications outcomes suggest that in order for the agri-PV system to be a regenerative SES and to reflect the five qualities embodied ecological worldview, mutualistic interactions, high diversity, agency, and reflexivity (Buckton, 2023) the most relevant steps of the tested methodological approach are the field work and the community workshop. The direct landscape experience and the engagement with farmers and the local community provide the conditions to earn the knowledge necessary for the comprehension of the local landscape governance and the way the agri-PV system can be designed through a proper compromise among all the actors and stakeholders as a true social-ecological system (SES) reflecting the characteristics of a truly regenerative SES.

With regards to these two steps the emerged issues are centred around the sources of knowledge and the exchange of knowledge to increase the mutualistic interactions. Farmers result the main source of knowledge. It is necessary to conduct an attentive field work with them to understand their needs and to understand how the local SESs work, as well as provide them with new knowledge on the way agri-PV systems can support their crops. This is functional to safeguard the qualities of ecological worldview, diversity and agency.

With regards to agency in the last two years authors have been in contact with Italian farmers who are willing to develop agri-PV system, yet concerned about the compatibility of their farming activities with it. In most of cases farmers want to enhance and protect their production from extreme weather events as summer heat wave or late spring storms through agri-PV systems, further they would like to benefit from electricity economic revenue to maintain the landscape. The landscape structure can have relevant cultural and ecological value and is constantly maintained and shaped by farming and farmers machinery standards. To not afflict the

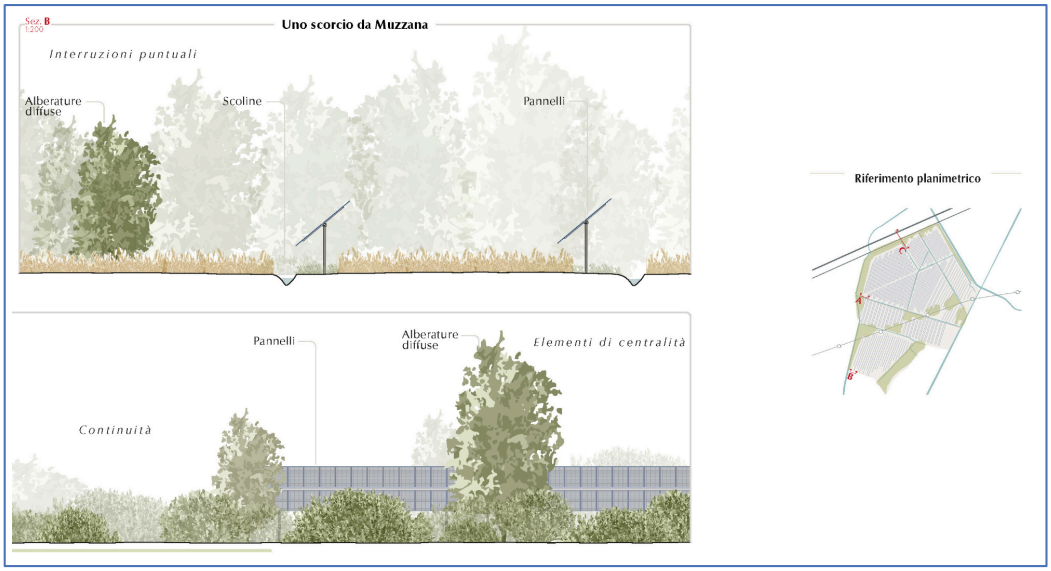

Figure 5: the elaborations show how the designed Agri-PV system fit into the site agri-environmental systems. The PV Trackers rows are aligned to the existing drainage systems (scoline), modules can drop the rain run-off into the scoline.

agriculture production, yet enhance it, agri-PV systems should be designed according to the current landscape structure such as the fields orientations, the drainage systems, the water lines, the hedges systems. A particular attention should be paid to the agri-PV systems with respect to the patch borders as the outcomes from the Design Studio and Competition in Muzzana del Turgnano show: fences and hedges should follow on the field existing borders and integrated in the current landscape ecological network and not creating new ones (fig: 5).

Figure 5: the elaborations show how the designed Agri-PV system fit into the site agri-environmental systems. The PV Trackers rows are aligned to the existing drainage systems (scoline), modules can drop the rain run-off into the scoline. The distance in between rows (pitch) measures minimum 12 meters to enable the farmer's harvester to work along them, yet the pitch is not regular, can be larger or narrower (minimum pitch is six meters to avoid self-shading in between rows) to follow on the existing drainage system (scoline). Since non cultivable, the strip between the tracker row and the scoline can be set for wet habitat development. Further the Agri-PV system hedges are designed on the existing patch hedges, e.g. a drainage collector channel and a linear woodland on the west (Elaboration in step four, Case of Muzzana del Turgnano, Friuli Venezia Giulia) (Dovadoli, Gaspari, Lo Monaco, Zammarchi, 2023, Design Studio Lab 4 PPP, MSc Landscape Architecture, DIDA - University of Florence).

With regards to the knowledge exchange, the community workshops represents a promising tool. In the applications where a community workshop was not systematically organized and fully exploited, the design process resulted not validated by the community, while the resulting agri-PV design was missing concrete support to mutualistic interactions. For example in Torviscosa some difficulties aroused in the stakeholder engagement: the direct involvement of local key actors who in turn reported and invited other key actors (snowball effect) was not so much effective, the workshop reached a peak attendance of 25 participant. A much earlier and professional stakeholder engagement approach would certainly be more effective. Yet the community workshop provided indications on the values of the local landscape and the possible social governance strategies in which agri-PV systems can be engaged in. For example farmers were mentioning how agri-PV system could make crops rotation more competitive than now, and avoid the landscape to turn into a whole and more competitive poplars cultivation. Very clear indications were obtained for the agri-PV

Figure 6: A moment of the community workshop during the focus group tables

systems design in terms of size of the landscape parcels, trackers layout, crops rotation, design of the edges and landscape experience. Those results opened relevant insight on community engagement: there was a positive response from the Local Administration, as this was facilitated in the decision process; there was a positive response from investors, because they received clear and validated indications for a design benefiting the local community in a agency perspective. Furthermore, the workshop showed the potential of bottom-up approaches in addressing the regional level to collect knowledge for planning and regulating agri-PV systems and further creating the conditions for the reflexivity of the system in terms of novel agreements on the innovation and the possible monitoring among parties (figure 6).

Conclusions

Concluding a concrete and functional knowledge of the current landscape social-ecological systems is only obtainable when conducting field work with farmers. Agrivoltraic systems are social-ecological systems and farmers appear to be at the centre of the methodological path in order to effectively integrate agrivoltaics systems in the landscape. Farmers role is central when organizing a community workshop on landscape governance and co-design for agrivoltaic systems.

The five attributes of an agrivoltaic regenrative system embodied ecological worldview, mutualistic interactions, high diversity, agency, and reflexivity can be pursued if the design process is a co-design and it starts from people sharing the landscape values and constraints in a workshop environment. We still need more research and data on energy, food production and other related social-ecological systems performance, yet there is already evidence on the positive nexus, and landscape architects can further support farmers and communities in designing it. Landscape Architecture Education in Agri-PV involved through Design Studios and co-design processes is therefore relevant to train future landscape architects on this topic.

References

1. Alessa, L., Kliskey, A., & Altaweel, M. (2009) "Toward a typology for social-ecological systems", Sustainability: Science, Practice and Policy, 5(1), 31-41.
2. Buckton, S. J. et al. (2023) 'The Regenerative Lens: A conceptual framework for regenerative social-ecological systems', One Earth. Elsevier, 6(7), pp. 824–842. doi: 10.1016/j.oneear.2023.06.006.
3. Castán Broto, V. et al. (2019) 'Transformative capacity and local action for urban sustainability', Ambio, 48(5), pp. 449–462. doi: 10.1007/s13280-018-1086-z.
4. Corner, J. (2011) 'The Agency of Mapping: Speculation, Critique and Invention', The Map Reader: Theories of Mapping Practice and Cartographic Representation, pp. 89–101. doi: 10.1002/9780470979587.ch12.
5. Fattoruso, G. et al. (2024) 'A Spatial Multicriteria Analysis for a Regional Assessment of Eligible Areas for Sustainable Agrivoltaic Systems in Italy', Sustainability (Switzerland), 16(2), pp. 1–28. doi: 10.3390/su16020911.
6. Fischer, J., Gardner, T. A., Bennett, E. M., Balvanera, P., Biggs, R., Carpenter, S., ... & Tenhunen, J. (2015) "Advancing sustainability through mainstreaming a social–ecological systems perspective", Current opinion in environmental sustainability, 14, 144-149.
7. Lambertini, A. (2013). Urban Beauty! Luoghi prossimi e pratiche di resistenza estetica (pp. 1-256). Editrice Compositori. ISBN : 978-887794811-3
8. Oudes, D. and Stremke, S. (2021) 'Next generation solar power plants? A comparative analysis of frontrunner solar landscapes in Europe', Renewable and Sustainable Energy Reviews. Elsevier Ltd, 145(April), p. 111101. doi: 10.1016/j.rser.2021.111101.
9. Partelow, S. (2018) "A review of the social-ecological systems framework", Ecology and Society, 23(4).
10. Partelow, S., & Winkler, K. J. (2016) "Interlinking ecosystem services and Ostrom's framework through orientation in sustainability research", Ecology and Society, 21(3).
11. Picchi, P., Oudes, D. and Stremke, S. (2023) 'Regional Strategy, Municipality Plans and Site Designs for Energy Transition in Amsterdam, The Netherlands: How Sustainable Are Implementation Processes on Different Spatial Levels?', Sustainability (Switzerland), 15(7). doi: 10.3390/su15075876.
12. Ostrom, E. (1990) "Governing the commons: The evolution of institutions for collective action", Cambridge university press.
13. Sirnik, I. et al. (2023) "Circularity and landscape experience of agrivoltaics: A systematic review of literature and built systems," Renewable and Sustainable Energy Reviews. Available at: https://doi.org/10.1016/j.rser.2023.113250.
14. Stremke, S., & Picchi, P. (2017) "Co-designing energy landscapes: Application of participatory mapping and", In Handbook on the Geographies of Energy (pp. 368-379). Edward Elgar Publishing.
15. Toledo, C. and Scognamiglio, A. (2021) 'Agrivoltaic systems design and assessment: A critical review, and a descriptive model towards a sustainable landscape vision (three-dimensional agrivoltaic patterns)', Sustainability (Switzerland), 13(12). doi: 10.3390/su13126871.
16. Troccoli, A., Stone, R., Bardi, U., Breyer, C., & Henggeler, C. (2024) "Rebalancing Regional and Remote Australia: a vision for a global carbon sink while creating sustainable communities", Environmental Research Letters, 19(11), 111003.
17. Vervoort, J. M., Rutting, L., Kok, K., Hermans, F. L., Veldkamp, T., Bregt, A. K., & van Lammeren, R. (2012) "Exploring dimensions, scales, and cross-scale dynamics from the perspectives of change agents in social–ecological systems", Ecology and society, 17(4).
18. Wolsink, M. (2024) "Land Use as a Crucial Resource for Smart Grids—The 'Common Good'of Renewables in Distributed Energy Systems", Land, 13(8), 1236.
19. Younas, R., Imran, H., Riaz, M. H., & Butt, N. Z. (2019). Agrivoltaic farm design: Vertical bifacial vs. tilted monofacial photovoltaic panels. arXiv preprint arXiv:1910.01076, 1-29.
20. Zhou, B. B., Wu, J., & Anderies, J. M. (2019) "Sustainable landscapes and landscape sustainability: A tale of two concepts", Landscape and urban planning, 189, 274-284.
21. Zingoni de Baro, M.E. (2022). Two Social-Ecological Design Approaches to Regenerative Sustainability. In: Regenerating Cities. Cities and Nature. Springer, Cham. https://doi.org/10.1007/978-3-030-90559-0_4