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FYI

LANDGEWINN INSIGHTS

Newsletter

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LANDGEWINN

Liebe Leserinnen, liebe Leser,

mit diesem Newsletter informieren wir über neue Fachpublikationen, Veranstaltungen und Meldungen zu ausgewählten Dekarbonisierungstechnologien an der Schnittstelle von Land- und Energiewirtschaft. Neue Publikationen und kommende Veranstaltungen werden auf Basis einer Recherche und externen Hinweise zusammengetragen.

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Bundesministerium
für Wirtschaft
und Klimaschutz

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Der Newsletter wird im Rahmen des Projekts Landgewinn „Energiesystemanalyse von Dekarbonisierungsstrategien der Landwirtschaft“ veröffentlicht, das vom Bundesministerium für Wirtschaft und Klimaschutz (BMWK) gefördert wird. Ziel des Projekts ist die fachlich übergreifende Bewertung der drei landwirtschaftlichen Dekarbonisierungstechnologien Agri-Photovoltaik, Pyrolyse zur Herstellung von Pflanzenkohle sowie klimaneutrale Mobilität in der Landwirtschaft.

Die geteilten Informationen wurden sorgfältig zusammengestellt, dabei übernehmen wir keine Verantwortung für die Inhalte, Richtigkeit und Vollständigkeit der Informationen. Die Suchergebnisse werden entsprechend der Quellen auf Deutsch oder Englisch aufgeführt. Direkte Zitate sind über Anführungszeichen kenntlich gemacht und die Fundstelle angegeben oder auch verlinkt.

Der Newsletter erscheint in einem zwei- bis viermonatigen Turnus. Wir freuen uns, wenn Sie uns für den Landgewinn-Kontext relevante Veröffentlichungen, Veranstaltungen und neue Projekte, die Ihnen über den Weg laufen, zukommen lassen (hannes.bluhm@ioew.de).

Viel Spaß beim Lesen!

Ihr Landgewinn-Team

Neue Publikationen

Paper: The interplay between bioeconomy and the maintenance of long-term soil organic carbon stock in agricultural soils: A systematic review

Christhel Andrade Díaz, Ariane Albers et al.

Link: The interplay between bioeconomy and the maintenance of long-term soil organic carbon stock in agricultural soils

Kurzbeschreibung: “Crop residues' potential for the bioeconomy is often limited well below its full extent to prevent soil organic carbon (SOC) depletion. However, when processed in the bioeconomy, biomass carbon can often be partially recovered in a stabilized degradation-resistant coproduct. This study reviews and interlinks the fundaments between these coproducts’ process-dependent characteristics and the use of soil models to predict SOC turnover by replacing fresh crop residues with bioeconomy coproducts after processing. Different modeling approaches to incorporating stabilized organic matter into soils were investigated, as well as the input data requirements of a variety of soil models. Stemming from a revision of over 600 datasets, we synthesized and proposed average conversion coefficients from biomass C to coproduct […] and their inherent recalcitrance in agricultural soils […] for pyrolysis […] and gasification […] biochar, hydrochar […], digestate […] and lignocellulosic bioethanol solid […] and liquid […] coproducts. This review thus represents a steppingstone towards i) setting the fundaments for adapting soil models to the dynamics between crop residue harvest and return of C under multiple forms and ii) exploring future scenarios involving coproduct return as a strategy to increase the supply of renewable C for the bioeconomy while ensuring the maintenance of SOC stocks.”

Review Paper: What goes in and what comes out: a scoping review of regenerative agricultural practices

Rebecca Voisina, Pierre Horwitz et al.

Link: A scoping review of regenerative agricultural practices

Kurzbeschreibung: “This scoping review examined peer-reviewed and gray literature to explore what a “no-to-low external input” statement means for regenerative agriculture. Five organic amendment inputs (compost extract, manure, mulch, biochar, food systems waste) and four land management processes (livestock management and integration, crop diversity, tillage reduction, comprehensive approach) were identified. Findings include “no-to-low external input” models arising from processes which function to displace external inputs (e.g., synthetic fertilizer). Organic amendment inputs and regenerative land management processes promote biology and improve nutrient cycling at soil, farm, and landscape scales. Regenerative agriculture overlaps with other farming practices including those associated with agroecology and conservation agriculture.“

Tagungsbeiträge aus den Mitteilungen der Gesellschaft für Pflanzenbauwissenschaften:

Einfluss von Pflanzenkohle in Kombination mit Rindergülle und Mineraldüngerstickstoff auf den Ertrag

Emanuel Jaufmann, Harald Schmid und Kurt-Jürgen Hülsbergen

Link: Einfluss von Pflanzenkohle in Kombination mit Rindergülle und Mineraldüngerstickstoff auf den Ertrag

Kurzbeschreibung: „Die Anwendung von Pflanzenkohle kann Bodeneigenschaften und -funktionen verbessern, Kohlenstoff im Boden sequestrieren und zu Ertragssteigerungen führen (Jeffery et al. 2011, Ye et al. 2020). Allerdings ist weitgehend unklar, ob durch Pflanzenkohleanwendung auch Ertragssteigerungen auf Böden gemäßigter BodenKlima-Regionen in gutem Kulturzustand erzielbar sind. In der landwirtschaftlichen Praxis wird Pflanzenkohle zumeist nicht allein, sondern in geringen Mengen als Futterzusatz, zur Geruchs- und Emissionsminderung im Stall oder als Zusatz bei der Güllelagerung eingesetzt, und in Kombination mit organischen Düngern auf betrieblich genutzte Flächen ausgebracht. Die standortspezifisch optimalen Mischungsverhältnisse und Aufwandmengen von Pflanzenkohle und Gülle sowie deren optimale Kombinationen mit Mineraldüngerstickstoff sind bisher unbekannt, weil Dauerversuche fehlen (Umweltbundesamt 2016). In der Initialphase eines faktoriellen Dauerfeldversuches mit Pflanzenkohle, die vor der Anwendung mit Rindergülle vermischt und gelagert wurde und einer zusätzlichen Mineralstickstoffstaffelung wurde der Ertrag der Kulturen Silomais und Winterweizen untersucht.“

Einfluss von Pflanzenkohle auf Ammoniakemissionen nach Gülleausbringung

Winkhart, F., Jaufmann, E., Schmid, H. und Hülsbergen, K.-J

Link: Einfluss von Pflanzenkohle auf Ammoniakemissionen nach Gülleausbringung

Kurzbeschreibung: „Der Einsatz von Pflanzenkohle (PK) im Ackerbau wird zunehmend als potentieller Beitrag zur Entwicklung einer klimaschonenden Landwirtschaft und zur Sicherung der natürlichen Bodenfunktionen diskutiert. Durch die Einbringung von Pflanzenkohle in den Boden kann die Speicherfähigkeit für Wasser und Nährstoffe erhöht werden und damit die Bodenfruchtbarkeit langfristig verbessert werden. Es kommt zu einer dauerhaften Humusanreicherung und die CO2-Bindung der Flächen steigt (Woolf et al., 2010). Die Düngerwirkung kann gesteigert werden und eine kombinierte Anwendung von PK und Gülle kann sich positiv auf die Erträge auswirken (Ye et al., 2020). Bezüglich der NH3-Emissionen bei PK Anwendung gibt es bis jetzt kontroverse Erkenntnisse. Einerseits sollen durch die große Oberfläche der PK Geruch und Emissionen gemindert werden (Clough et al., 2013), anderseits soll sich die PK auf den pH-Wert auswirken und sowohl diesen als auch die NH3-Emissionen erhöhen (Kim et al., 2021). Andere Studien wiederum konnten keinen Effekt der Kohle auf die Emissionen nachweisen (Tan et al., 2018).“

Paper: Biochar Functions in Soil Depending on Feedstock and Pyrolyzation Properties with Particular Emphasis on Biological Properties

Polina Kuryntseva, Kamalya Karamova et al.

Link: Biochar Functions in Soil Depending on Feedstock and Pyrolyzation Properties with Particular Emphasis on Biological Properties

Kurzbeschreibung: “Biochar effects are strongly dependent on its properties. Biochar improves physical soil properties by decreasing bulk density and increasing medium and large aggregates, leading to faster and deeper water infiltration and root growth. Improvement of the chemical properties of soil is connected with pH neutralization of acidic soils, increase of cation exchange capacity and base saturation, providing a larger surface for sorption of toxicants and exchange of cations. Biochar increases the stocks of macro- and micronutrients in soil and remains sufficient for decades. Biochar effects on (micro)biological properties are mainly indirect, based on the improvements of habitat conditions for organisms, deeper root growth providing available C for larger soil volume, higher crop yield leading to more residues on and in the topsoil, better and deeper soil moisture, supply of all nutrients, and better aeration. Along with positive, negative effects of biochar while used as a soil conditioner are discussed in the review: presence of PAH, excessive amounts of K, Ca and Mg, declination of soil pH. In conclusion, despite the removal of C from the biological cycle by feedstock pyrolysis, the subsequent application of biochar into soil increases fertility and improves physical and chemical properties for root and microbial growth is a good amendment for low fertility soils[…]“

Paper: Sludge-derived biochar: Physicochemical characteristics for environmental remediation

Neelaambhigai Mayilswamy, Amrita Nighojkar et al.

Link: Sludge-derived biochar: Physicochemical characteristics for environmental remedation

Kurzbeschreibung: "[…] Straightforward carbonization of sludges to generate biochar adsorbents or catalysts fosters a circular economy, curtailing sludge processing outlay. […] By customizing the processing parameters and biomass feedstock, engineered biochars possess discrete physicochemical characteristics that engender greater efficaciousness for adsorbing various contaminants. This review provides explicit insight into the characteristics, environmental impact considerations, and SWOT analysis of different sludges (drinking water, fecal, and raw sewage sludge) and the contemporary biochar production, modification, characterization techniques, and physicochemical characteristics, factors influencing the properties of biochars derived from the aforestated sludges, along with the designing of chemical reactors involved in biochar production. This paper also manifests a state-of-the-art discussion of the utilization of sludge-derived biochars for the eviction of toxic metal ions, organic compounds, microplastics, toxic gases, vermicomposting approaches, and soil amelioration with an emphasis on biochar recyclability, reutilization, and toxicity. The practicability of scaling up biochar generation with multifaceted, application-accustomed functionalities should be explored to aggrandize socio-economic merits."

Paper: Environmental Analysis of the Valorization of Woody Biomass Residues: A Comparative Study with Vine Pruning Leftovers in Po

Carla L. Simões et al.

Link: Environmental Analysis of the Valorization of Woody Biomass Residues: A Comparative Study with Vine Pruning Leftovers in Po

Kurzbeschreibung: “Evaluating Global Warming Potential (GWP) in waste management scenarios is crucial, especially in light of the escalating global concern for climate change and the pivotal role that waste management plays in mitigating this crisis. This research examines the GWP of three distinct waste management scenarios, each with a unique approach: (1) open burning, a method involving direct combustion with a GWP of 1600.1 kg·CO2eq, chiefly attributed to direct emissions without any mitigation tactics; (2) energy recovery, which capitalizes on converting waste into energy, yielding a GWP of 1255.4 kg·CO2eq, the reduction resulting primarily from avoided heat production; and (3) pyrolysis, an advanced thermal decomposition process that remarkably registers a negative GWP of −1595.1 kg·CO2eq, mainly credited to the carbon sequestration capacity of biochar production and optimal energy conversion efficiency. These outcomes emphasize the ecological merits of waste management approaches that produce lower, or even better, negative GWP values. In particular, pyrolysis emerges as a powerful way of transforming waste management into a potential carbon sink, proving crucial for climate change counteraction. Nevertheless, for effective real-world deployment, the study highlights the importance of addressing technical, economic, and societal challenges, underscoring the need for holistic, interdisciplinary research.”

Infosheet: Pflanzenkohle - Was Akteure aus der Praxis bewegt

Johannes Rupp, Hannes Bluhm

Link: Pflanzenkohle – Was Akteure aus der Praxis bewegt

Kurzbeschreibung: „[...] Die Einführung von Pyrolyse-Anlagen, besonders in ländlich geprägten Regionen, wirkt sich somit vorteilhaft sowohl für die Landwirtschaft als auch den Energiesektor aus und trägt darüber hinaus zum Erreichen der Klimaneutralität bis 2045 bei. Doch was bewegt die Akteure entlang der Wertschöpfungskette in dieser Phase der Produkt- und Marktentwicklung? Was gibt es für Erfahrungswerte und welche Hebel und Hemmnisse für die weitere Verbreitung der Herstellung und Anwendung von Pflanzenkohle lassen sich identifizieren?

Im Rahmen des Forschungsprojektes „Landgewinn“ haben wir uns zu diesen Fragen in einer Online-Diskussion am 05.07.2022 mit verschiedenen Akteuren ausgetauscht: Einem Hersteller und Betreibern von Pyrolyse-Anlagen, einem Projektierer von Pflanzenkohleprojekten, mehreren Vertretern aus den Bereichen Veredelung und Vertrieb von Pflanzenkohle (PK) sowie der Beratung und Qualifizierung von landwirtschaftlichen Betrieben, ebenso wie mit landwirtschaftlichen Anwendern und weiteren Personen aus der Forschung und einem Verbandsvertreter.

In diesem Info-Sheet stellen wir die aus der Diskussion gewonnenen Erkenntnisse und Sichtweisen der Akteure auf die PK dar und geben Empfehlungen für die weitere Entwicklung der PK als Klimaschutztechnologie“

Paper: Biomass residue to carbon dioxide removal: quantifying the global impact of biochar

David Lefebvre, Samer Fawzy et al.

Link: Biomass residue to carbon dioxide removal: quantifying the global impact of biochar

Kurzbeschreibung: "[…] Here we provide a generalized framework for quantifying the potential contribution biochar can make toward achieving national carbon emissions reduction goals, assuming use of only sustainably supplied biomass, i.e., residues from existing agricultural, livestock, forestry and wastewater treatment operations. Our results illustrate the significant role biochar can play in world-wide CDR strategies, with carbon dioxide removal potential of 6.23 ± 0.24% of total GHG emissions in the 155 countries covered based on 2020 data over a 100-year timeframe, and more than 10% of national emissions in 28 countries. Concentrated regions of high biochar carbon dioxide removal potential relative to national emissions were identified in South America, northwestern Africa and eastern Europe."

Paper: Soil carbon sequestration potential bounded by population growth, land availability, food production, and climate change

Sonja G. Keel, Daniel Bretscher et al.

Link: Soil carbon sequestration potential bounded by population growth, land availability, food production and climate change

Kurzbeschreibung: "Improving soil management to enhance soil carbon sequestration (SCS)—a cost-efficient carbon dioxide (CO2) removal approach—can result in co-benefits or trade-offs. Here we address this issue by setting up a modeling framework for Switzerland that combines soil carbon (C) storage, food production and agricultural greenhouse gas (GHG) emissions. The link to food production is crucial because crop types and livestock numbers influence soil organic C (SOC) stocks, through soil C inputs from plants and manure. We estimated SCS rates for the years 2020–2050 for three scenarios, each with two variants for biochar: cover cropping (0.30 t CO2 equivalents [CO2-eq] ha−1 yr−1), biochar addition (0.36–1.8 t CO2-eq ha−1 yr−1) and agroforestry-biochar addition (2.2–2.3 t CO2-eq ha−1 yr−1). Different limiting factors (land and biomass availability, population growth) affected SCS rates and indicated that they cannot be sustained until 2100 under all scenarios (cover cropping: 0.10 t CO2-eq ha−1 yr−1 [2051–2100]; biochar addition: 0.35–1.8 t CO2-eq ha−1 yr−1; agroforestry-biochar addition: 1.0–1.7 t CO2-eq ha−1 yr−1). This information together with the associated GHG emissions is critical for planning net zero strategies and highlights the importance of integrated assessments that capture links between SCS and the food system."

Paper: Potential for biochar carbon sequestration from crop residues: A global spatially explicit assessment

Shivesh Kishore Karan, Dominic Woolf, et al.

Link: Potential for biochar carbon sequestration from crop residues

Kurzbeschreibung: “Global warming necessitates urgent action to reduce carbon dioxide (CO2) emissions and remove CO2 from the atmosphere. Biochar, […] offers a promising solution for carbon dioxide removal (CDR) when it is used to sequester photosynthetically fixed carbon that would otherwise have been returned to atmospheric CO2 through respiration or combustion. However, high-resolution spatially explicit maps of CR resources and their capacity for climate change mitigation through biochar production are currently lacking, with previous global studies relying on coarse (mostly country scale) aggregated statistics. By developing a comprehensive high spatial resolution global dataset of CR production, we show that, globally, CRs generate around 2.4 Pg C annually. If 100% of these residues were utilized, the maximum theoretical technical potential for biochar production from CRs amounts to 1.0 Pg C year−1 (3.7 Pg CO2e year−1). The permanence of biochar differs across regions, with the fraction of initial carbon that remains after 100 years ranging from 60% in warm climates to nearly 100% in cryosols. Assuming that biochar is sequestered in soils close to point of production, approximately 0.72 Pg C year−1 (2.6 Pg CO2e year−1) of the technical potential would remain sequestered after 100 years. However, when considering limitations on sustainable residue harvesting and competing livestock usage, the global biochar production potential decreases to 0.51 Pg C year−1 (1.9 Pg CO2e year−1), with 0.36 Pg C year−1 (1.3 Pg CO2e year−1) remaining sequestered after a century. Twelve countries have the technical potential to sequester over one fifth of their current emissions as biochar from CRs, with Bhutan (68%) and India (53%) having the largest ratios. The high-resolution maps of CR production and biochar sequestration potential provided here will provide valuable insights and support decision-making related to biochar production and investment in biochar production capacity.”

Paper: Assessing Agrivoltaics: Crops Under Solar Panels, or Solar Panels Over Crops?

M. Sojib Ahmed, M. Ryyan Khan

Link: Assessing Agrivoltaics: Crops Under Solar Panels, or Solar Panels Over Crops?

Kurzbeschreibung: “As we strive to sustain the growing population and economies of the nations, we observe a possible competing land requirement for food and renewable energy productions. A possible path forward is adopting and developing agrivoltaics (AV) technology, a system where solar panels and crops share the same land. At first glance, the relative gain from AV depends on the reference system: (i) do we start from a solar farm and add crop underneath? Or (ii) do we start from a cropland and append an appropriately designed panel array over it? In this paper, we compare these two approaches to evaluate the profit gain from AV. We show that, approach-(i) has low relative economic gain. The performance indicator in this case would need to be set by the stakeholders' requirements. While approach-(ii) seemingly has high economic gain, the crop-loss in a cultivable land should be constrained by national policies. Finally, both the approaches are practically valid, and the design constraints would be set through separate set of economic and policy requirements.”

Paper: Design and evaluation of an agrivoltaic system for a pear orchard

Brecht Willockx, Thomas Reher et al.

Link: Design and evaluation of an agrivoltaic system for a pear orchard

Kurzbeschreibung: “Agrivoltaic systems are mostly deployed on arable farm land. An interesting application of agrivoltaics for permanent farming such as pear orchards, is in replacing the protective function of hail nets by semi-transparent PV modules. In this study, a theoretical framework is used to design the optimal agrivoltaic lay-out regarding the levelized cost of electricity, electricity generation and incident irradiance. This incident irradiance is modelled using a 3D light simulation tool, capable of including the light distribution within the canopy walls. Given the practical constraints (orientation, planting distance, maximum wind load, protection function), present in an existing pear orchard, a double-inclined PV structure with a PV module transparency level of 40% was used. This system was constructed in Bierbeek, Belgium. Results of the first year of operation are presented and the models used are validated. It is concluded that this application is promising, with positive effects of the climatological conditions, robust energy generation and a minimum loss of 16% on pear yield. Nevertheless, at this moment, the system is financially unviable and a long-term analysis of the shading effect on crop yield and quality is needed before the large-scale deployment of this technology.”

Paper: Justice-driven agrivoltaics: Facilitating agrivoltaics embedded in energy justice

M. Taylor, J. Pettit et al.

Link: Justice-driven agrivoltaics: Facilitating agrivoltaics embedded in energy justice

Kurzbeschreibung: “Agrivoltaics comprises solar energy generation and agricultural activities co-located to create multi-purpose agricultural solar energy systems. In 2021, the global agrivoltaics sector was valued at USD $3.6 billion and is projected to grow to USD $9.3 billion by 2031. Agrivoltaics projects have successfully attracted increasing investment and research demonstrating the technical, economic, and scientific rationale to advance agrivoltaics as a crucial technology to achieve net zero emissions goals. The legal framework enabling agrivoltaics development is at varying stages of maturity across different jurisdictions. This study provides the first socio-legal study of agrivoltaics development applying an energy justice framework. It comparatively analyses the mature agrivoltaics sectors, laws, and policies in Massachusetts (United States of America) and Japan in a functional comparative analysis with New South Wales (Australia) applying the three principal pillars of energy justice; recognition, procedural, and distributive justice. This study demonstrates how energy justice can generate a framework for regulatory reform. Such reform can facilitate the expansion of agrivoltaics and unlock the full potential of co-locating of solar energy and agriculture.”

Review Paper: Nexus between agriculture and photovoltaics (agri-voltaics, agriphotovoltaics) for sustainable development goal: A review

Aritra Ghosh

Link: Nexus between agriculture and photovoltaics for sustainable development goal

Kurzbeschreibung: “The coexistence of agricultural land and solar photovoltaics (PV) can be named Agriphotovoltaics (APV). APV concept was developed two decades ago however its actual implementation is happening nowadays. APV directly solves SDGs 7, and 11 by generating benevolent renewable energy without damaging the land and keep producing food for people. In this work, a comprehensive review of the APV system is documented. Currently available software tools, field experiment results, and PV for APV are described in this work which identified that for forecasting APV, a more robust tool is required. Vertically placed Bifacial PV, transparent, and semitransparent tilted PVs can be suitable for shade-intolerant crops whereas opaque PVs are appropriate for shade-tolerant crops. The knowledge gap between various stakeholders such as solar PV researchers, agricultural researchers, and land users needs to be more rigorous. Economic and policymakers should share dialogue to improve the growth of APV which not only solves SDG 7, and 11 but also meets the target for SDG 5, 8, 9,12, and 15.”

Prereview Paper: How does Module Tracking for Agrivoltaics Differ from Standard Photovoltaics? Performance & Technoeconomic Implications

Habeel Alam, Nauman Zafar Butt

Link: How does Module Tracking for Agrivoltaics Differ from Standard Photovoltaics? Performance & Technoeconomic Implications

Kurzbeschreibung: “Spatial-temporal sharing of sunlight between solar modules and crops needs to be designed optimally in agrivoltaics (AV). […] For flexible food-energy balancing across various seasons and crop rotations, modules with single or dual axis mobility can be best suitable. AV tracking must be geared towards ensuring a desired sunlight balance that may depend on many factors including the crop type, module array density, socio-economic factors, and local policies. Here, we explore single axis customized tracking (CT) for the mobile AV using a techno-economic model that incorporates design parameters including crop's shade sensitivity, module to land area ratio, and module types, as well as the economic parameters including soft and hardware costs for modules, feed-in-tariff, and crop income. CT is implemented through standard tracking that tracks the sun around noon hours and its orthogonal, i.e., anti-tracking around sunrise and sunset. […] Economic feasibility for AV is evaluated in terms of the ratio (ppr) of the price for the module system customizations to the performance benefit due to the crop income. A case study for Punjab, Pakistan shows that CT schemes for moderate shade sensitive crops and typically dense AV module arrays can require 30 to 40 percent increase in the reference FIT to ensure the food-energy yield threshold of 80 percent relative to standalone food-energy farms for high and low value crops, respectively. CT schemes for a lower crop yield threshold of 70 percent require the corresponding increase in FIT to 10 to 20 percent, respectively.”

Paper: Evaluation of the first agrivoltaic system in Sweden

Pietro Elia Campana, Bengt Stridh et al.

Link: Evaluation of the first agrivoltaic system in Sweden

Kurzbeschreibung: "[…] The main objective of this project was to study how APV systems perform from an energy, agricultural and economic perspective compared to CGMPV systems and agriculture production. […] The aim was pursued by establishing an APV test site,[…] monitoring its performance both from an energy and agricultural point of view, and developing new techno-economic models. Data from the APV test site were used to […] understand how APV systems at northern latitudes affect: 1) the efficiency of the solar modules; 2) crop productivity, and 3) the financial return for ground-based solar PV systems. The first agrivoltaic system in Sweden has been built on a permanent ley grass field, at Kärrbo Prästgård, Västerås, and research activities have been carried out on the ley grass during 2021 and 2022. […], we defined three sub-fields: 1) a sub-field is covered only by the ley grass (reference area), 2) a sub-field is a CGMPV system 11.8 kWp solar PV system with two rows of solar modules with a 30° tilt and 3) the last subfield is a 22.8 kWp APV system with three rows of vertically mounted solar modules, with ley grass between the modules. This field set-up allowed for comparisons between practices (agriculture and electricity generation) and technologies (CGMPV systems versus APV systems). […] The main results of the project in terms of shadow effects on the ley grass showed that the APV system did not significantly affect the productivity of the forage grass in 2021-2022. There was no statistically significant difference between the yield of the samples taken in the APV system and the reference area. Even so, the yield per hectare is reduced by approximatively 10%, when the distance between the vertically mounted solar modules is 10 meters, due to the area under the solar modules that cannot be mechanically harvested. […]"

Review: Knowns, uncertainties, and challenges in agrivoltaics to sustainably intensify energy and food production

Nuria Gomez-Casanovas, Paul Mwebaze et al.

Link: Knowns, uncertainties, and challenges in agrivoltaics

Kurzbeschreibung: "Harnessing solar energy to renewably produce electricity can contribute to climate mitigation while meeting current energy demands. However, utility-scale photovoltaics are land intensive and can compete with food production. Agrivoltaics, which combines both energy and food production, has the potential to reduce competition for land. However, its benefits remain uncertain. Here, we review the literature to assess how agrivoltaics can provide synergistic benefits across the food-energy-water nexus relative to photovoltaic or agricultural systems in isolation. Overall, agrivoltaics has the potential to enhance the sustainability of agricultural land and the resilience of our food and energy systems while helping meet energy and food demands. However, there are obstacles to be surmounted. Interdisciplinary collaborative research actions to gain a holistic and mechanistic understanding of the ecological, environmental, and socio-economic consequences of agrivoltaics, and torealize how new innovations can unravel the potential of this emerging strategy, are urgently needed."

Paper: Ecovoltaics: Framework and future research directions to reconcile land-based solar power development with ecosystem conservation

Csaba Tölgyesi, Zoltán Bátori et al.

Link: Ecovoltaics: Framework and future research directions

Kurzbeschreibung: “Renewable energy production is gaining momentum globally [..] however ground-mounted solar panels have a high land requirement, which leads to conflicts with other land use types, particularly agriculture and biodiversity conservation. The dual land use of agrivoltaics, […], may alleviate farmers' concerns, but less effort has been made to reconcile solar development with biodiversity conservation. Here we provide a framework for creating a win-win situation for this growing challenge using recent literature on solar park habitats complemented with ecological theories. We also highlight important knowledge gaps that future research should address. Our framework uses a unique land-sharing approach and is based on five pillars that cover key aspects of solar park planning and maintenance: (1) eco-smart siting in the landscape, which considers ecological interactions with the landscape matrix and trade-offs between multiple small vs. fewer large solar parks; (2) eco-smart park layout to address the ecological aspects of the spatial configuration of solar park infrastructure; (3) creation of diverse, novel grassland ecosystems with high ecosystem service provisioning capacity using a trait-based ecosystem design approach; (4) management of the novel ecosystem throughout the lifespan of the solar parks; and (5) ensuring stakeholder engagement to integrate this in a viable business model with high community acceptance. With this framework, we open the way for a new multifunctional land use type: the ecovoltaic park.“

Preprint Paper: Solar Energy Modelling and Proposed Crops for Different Types of Agrivoltaics Systems

Uzair Jamil, Thomas Hickey et al.

Link: Solar Energy Modelling and Proposed Crops for Different Types of Agrivoltaics Systems

Kurzbeschreibung: "Canada can radically reduce per capita greenhouse gas (GHG) emissions by aggressively deploying agrivoltaics and reach its goal of cutting emissions by increasing the non-emitting share of electricity generation to 90% by 2030. To help reach this national goal, this study evaluated the potential energy production for vertical bi-facial solar photovoltaic arrays as well as the solar irradiation reaching the ground with three different spacings (5m, 15m and 45m) and three different Canadian farming locations (London, Calgary and Winnipeg) using SPADE software. The crops currently grown in each of the three regions were identified and their sunlight requirements were analyzed. Based on the amount of solar radiation reaching the ground surface and the solar requirements of the crops, inter-row spacings that were suitable for agrivoltaic applications for the three locations were identified. Next the land acreage of a select few crops, which were proven to be satisfactory for agrivoltaic systems, were identified for each province and their electrical energy potential was ascertained using SAM. The results indicate that more than 84% of the total national electricity requirements can be met by employing agrivoltaics on agricultural land where these crops are cultivated in the three provinces."

Dissertation: Nachhaltige Landnutzung Dank Doppelernte. Eine Mehrdimensionale Politikanalyse der Agri-Photovoltaik-Diffusion in Deutschland

Stephan Schindele

Link: Nachhaltige Landnutzung Dank Doppelernte. Eine Mehrdimensionale Politikanalyse der Agri-Photovoltaik-Diffusion in Deutschland

Kurzbeschreibung: „In den kommenden Jahrzehnten werden auf lokaler Ebene Flächennutzungskonkurrenzen und Interessenskonflikte um eine nachhaltige Agrarflächennutzung zunehmen. Steigender Nahrungsmittelbedarf steht einer weltweit sinkenden intakten Agrarflächenverfügbarkeit gegenüber. Gleichzeitig beanspruchen der Siedlungsflächenanstieg (Ausweisung neuer Industrie- und Wohngebiete, Verkehrsinfrastruktur) sowie der für den Klimaschutz notwendige Ausbau von herkömmlichen Photovoltaik-Freiflächenanlagen weitere landwirtschaftliche Nutzflächen. Die Agri-Photovoltaik kann diese Interessenkonflikte zwar teilweise entschärfen, indem sie eine landwirtschaftliche Tätigkeit mit der Solarstromproduktion auf einer Agrarfläche kombiniert. Doch welches Ressort ist in Deutschland zu welcher Phase im Agri-PV-Innovationsprozess zuständig? Welche Gesetzgebungen wirken innovationshemmend zur Agri-PV-Markteinführung? Wie werden Ambivalenz (Konfliktniveau) und Ambiguität (Unsicherheiten) gegenüber Agri-PV in der Ministerialverwaltung des Bundes bewertet? Welchen Beitrag kann die Agri-PV für den Erhalt von Agrarflächen in Deutschland leisten? Wie müsste eine Agri-PV-Politik aus einem Guss koordiniert sein, damit die Agri-PV-Diffusion gelingt? Im Arbeitsschwerpunkt Wirtschaft und Politik des inter- und transdisziplinären APV-RESOLA-Projektes wurde eine Policy-Analyse durchgeführt. Hierbei wurden Barrieren der gesetzlichen Rahmenbedingungen zur Agri-PV-Markteinführung in Deutschland identifiziert. Indem eine Agri-PV-Pilotanlage im realen Umfeld umgesetzt wurde, konnten durch das Baugenehmigungsverfahren kommunalpolitische Widerstände erfasst werden. Auf Landes- und Bundesebene wurden Experteninterviews und Gruppenfachgespräche mit der Ministerialverwaltung, Parlamentariern sowie Vertretenden von Industrie und Interessensverbänden aus Agrar- und Solarwirtschaft geführt. Der Agrarflächenerhalt durch die Substitution von PV-Freiflächenanlagen durch Agri-PV wurde für Deutschland bis 2045 simuliert und Methoden entwickelt, wie im Agrarsektor gemäß Diffusionstheorie die Agri-PV-Innovatoren und Frühen Übernehmer ermittelt werden können.“

Kapitel in „Optimierung von Energieversorgungssystemen“: Modellierung von Optimierungsproblemen im Energiesektor mit O-EMOF

Janet Nagel

Link: Modellierung von Optimierungsproblemen im Energiesektor mit O-EMOF

Kurzbeschreibung: „Es wird eine konkrete Studie der B.A.U.M. Consult Group vorgestellt. Die Studie untersucht die Entwicklung und den Aufbau elektrifizierter Landmaschinen und ihre Integration in elektrische Netze, um mehr Klimaschutz durch Batterien, Photovoltaik und den Einsatz von elektrischen Landmaschinen zu erreichen. Im Rahmen der Studie wird der Einsatz voll elektrischer Landmaschinen im Zusammenspiel mit dem lokalen Stromnetz und der Stromerzeugung durch Photovoltaik betrachtet. Eine Elektrifizierung von Landmaschinen kann durch den Einsatz von Batterien oder den direkten Anschluss der Landmaschine an das lokale Stromnetz durch ein Kabel erfolgen. Der Einsatz elektrifizierter Landmaschinen hat Auswirkungen auf das jeweilige lokale Stromnetz.

Das zu einem landwirtschaftlichen Betrieb gehörende ländliche Ortsnetz wurde in die Betrachtung mit einbezogen. Die zukünftige Smart-Grid-Infrastruktur soll einen lokalen Ausgleich zwischen Erzeugern und Verbrauchern ermöglichen. Es werden die zugrundliegenden Ansätze der Wirtschaftlichkeitsberechnungen mathematisch und als Quellcode sowie deren Umsetzung als Applikation vorgestellt. Zum Abschluss werden weitere Modellierungsbeispiele aus OEMOF aufgeführt.“

Sonstige Neuigkeiten

Website: "Beyond Carbon Sequestration: The Wide-Ranging Applications of Biochar"

"European Biochar Industry Consortium e.V."

Link: The Wide-Ranging Applications of Biochar

Kurzbeschreibung: Übersicht über alle Anwendungsmöglichkeiten von Biochar

Pressemitteilung: TFZ Bayern veröffentlicht Agri-Photovoltaik-Leitfaden

„Wir möchten Landwirtinnen und Landwirten, Kommunen und anderen Interessierten einen niederschwelligen Einstieg in das Thema geben“, sagt Malte Stöppler, wissenschaftlicher Mitarbeiter am TFZ. Der Leitfaden spannt den Bogen von der Auswahl unterschiedlicher Solarmodul-Typen, die sich für Agri-PV eignen, bis hin zur Privilegierung potenzieller Agri-PV-Flächen. Er hält zudem eine Checkliste der notwendigen Planungsschritte bereit. Das Erklärvideo ist als Einführung gedacht. Hierbei führt ein fiktives Landwirte-Ehepaar durch die unterschiedlichen Stationen im Planungs- und Genehmigungsprozess.“

Link zum Artikel von Solarthemen Media GmbH vom 01.11.2023

Podcast: New Science Says Biochar is Very Permanent

Nori, Inc.

Kurzbeschreibung: „Wir möchten Landwirtinnen und Landwirten, Kommunen und anderen Interessierten einen niederschwelligen Einstieg in das Thema geben“, sagt Malte Stöppler, wissenschaftlicher Mitarbeiter am TFZ. Der Leitfaden spannt den Bogen von der Auswahl unterschiedlicher Solarmodul-Typen, die sich für Agri-PV eignen, bis hin zur Privilegierung potenzieller Agri-PV-Flächen. Er hält zudem eine Checkliste der notwendigen Planungsschritte bereit. Das Erklärvideo ist als Einführung gedacht. Hierbei führt ein fiktives Landwirte-Ehepaar durch die unterschiedlichen Stationen im Planungs- und Genehmigungsprozess.“

Link zur Podcastfolge

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Institut für ökologische Wirtschaftsforschung (IÖW) GmbH, gemeinnützig

Potsdamer Str. 105
D-10785 Berlin
Tel. +49-30-884594-0
Fax +49-30-8825439

www.ioew.de

Kontakt:

Rosalin Blessing

Email: rosalin.blessing@ioew.de

Tel. +49-30-884594-44
Email: hannes.bluhm@ioew.de