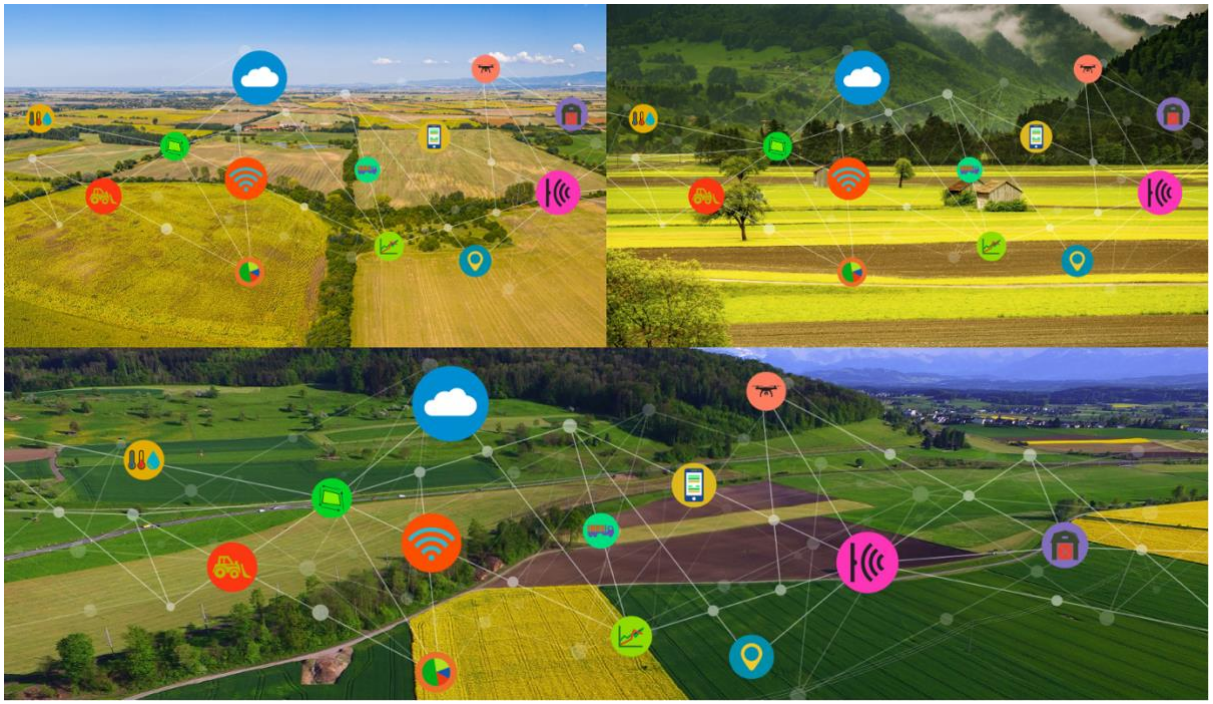
D4AgEcol

DIGITALISATION FOR AGROECOLOGY

Newsletter – Issue 3

March 2024



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1. Welcome Address from the Coordinator

Welcome to the third newsletter of the Coordination and Support Action (CSA) "Digitalization for Agroecology" (D4AgEcol). We are excited to provide you with the latest updates on the progress of our project and share information about upcoming activities. With this newsletter, we want to keep you informed and engaged in our mission to harness the potential of digitalization as an enabler for agroecology.

A highlight of 2023 was certainly the contribution of D4AgEcol partners to the 6th GIATE Symposium on Agri-Tech Economics for Sustainable Futures (https://www.agritechecon.co.uk/) at Harper Adams University, where also our annual meeting took place. The discussions with symposium participants and our external expert advisory board significantly contributed to advancing our planned activities toward fulfilling our ambitious goals. Now, that we are in the second year of our project we are focussing on the assessment of the potentials of digital tools and technologies to enable the transition to agroecology. We have agreed on a set of indicators, which may help to evaluate the contribution of digital tools and technologies to agroecology. Further we developed the concept of the digital tool scoping workshops, which enable a holistic analysis of the potentials of specific tools. This includes the potential to enable agroecology and the potential adoption due to the comparative advantage of the technology and the ease to use the technology, just to mention two relevant aspects. In this newsletter and on our website you can find some of the results of the workshops. Besides continuing with the digital tool scoping workshops throughout this year we focus now on clustering activities with other Horizon Europe projects and identifying needs for action in research and policy to unfold the potential of digitalisation for agroecology.

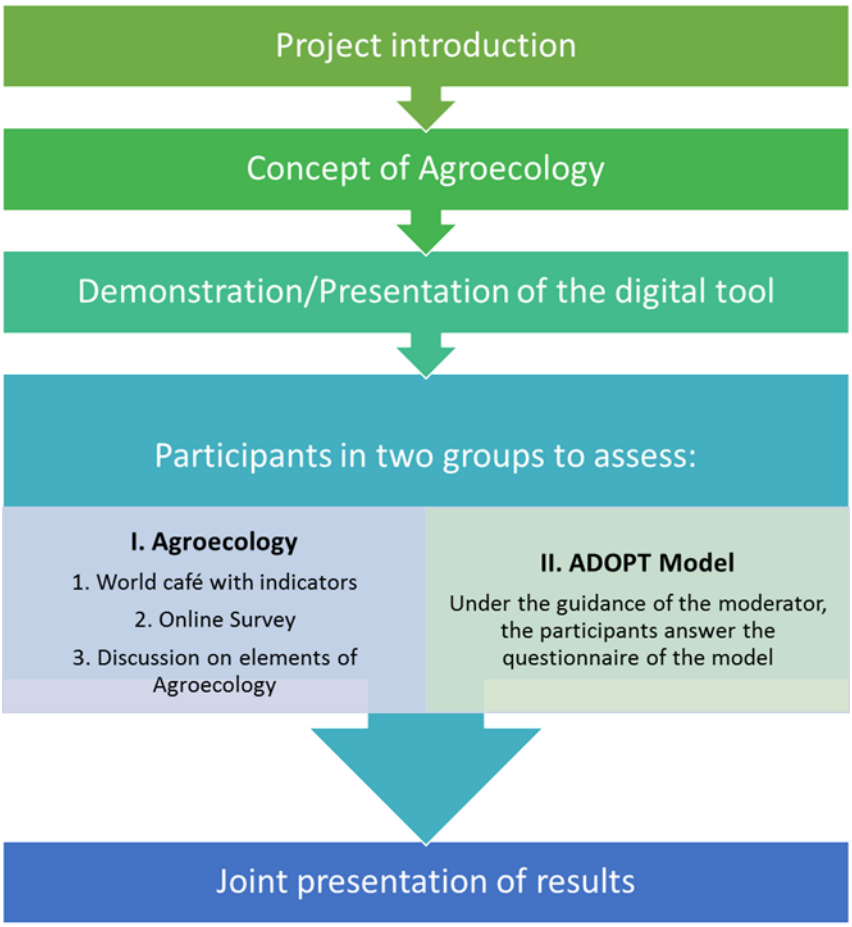
Your Coordinator D4AgEcol: Andreas Meyer-Aurich

2. Checklist on Indicators

In WP2 a list of indicators was developed, based on an extensive literature review as well as a small survey among the members of the D4AgEcol-consortium. The goal of these indicators is to act as a basis for the assessment of digital technologies in the European context and their contribution to the 10 elements of agroecology. Therefore, for each of the 10 elements of agroecology developed by the FAO, a set of 6-7 indicators was developed. Since the underlying concept of agroecology is broad, the developed indicators do not represent agroecology in its entirety and certain aspects have not been included. They do, however, represent selection of important aspects of agroecology. Further, they have been developed under the lens of digital technologies, thus framing them in a way that is conducive to digital technologies being assessed. The indicators which were selected based on a literature review were further reduced in their number through a survey. This final set of 30 indicators allows for an easier assessment of digital technologies during the digital tool scoping workshops, which it constitutes the basis for.

3. The Concept of Digital Tool Scoping Workshops

Core means of interactions about possible impacts and implications of digital tools and technologies for agroecology are the Digital Tool Scoping Workshops, being performed in ten living labs across Europe. The consortium agreed upon a protocol for conducting the workshop to simultaneously get insights of the compatibility of the digital tools and technologies with the concept of agroecology and investigate the adoption potential of the innovations. The announcements and the outcomes of the DTSW of the project can be found here: https://d4agecol.eu/digital-tool-scoping-workshops/.



Weed mapping on cereal crop fields ('Thistle tool')

The University of Copenhagen (UCPH) hold the project's first DTSW on 29th September 2023, in its campus in Taastrup, Denmark. The workshop explored the potential of the so-called 'Thistle Tool', an unmanned aerial vehicle (an UAV, or drone), a precision farming tool used for mapping root weeds' patches on cereal crops, to enable site-specific, pre-harvest herbicide treatments, avoiding unnecessary chemical treatments in areas without weed. The workshop included a demonstration of an automated, GPS controlled robot for precision spraying of chemicals.

The workshop was attended by 18 participants, 11 of whom attended the agroecology indicator evaluation session, and 7 the thistle tool ADOPT assessment. The participants represented different stakeholders, including farmers, academics, policymakers, and farm advisory services, among others.

The group work was preceded by a presentation about the tool, its development's history, potential, and use to create a weed map, and by a presentation about the potential development of automated spraying systems, namely the development of a low-cost system that promises to be more affordable for the final users. A practical session presented both the imaging technology object of the workshop, and the automated precision spraying, so the participants had the chance to observe the tools in action, and have been briefed about how the two technologies complete each other to obtain a reduction in chemical plant protection substances applied to the field up to 90%. In the discussion about the tool's potential effect on the different aspects of agroecology, the participants pointed out some direct effects, such as a positive effect on efficient use of resources, and farm profitability.

Perhaps less obviously, the discussion pointed out how not only the state-of-the-art of the technology, but also the possible future developments can positively affect many other agroecological principles. For example, recycling is seen as a side-effect of using the tool, especially if the imaging tool is used for monitoring the state of the crop, and not only for thistle control. The same technology can be used for a broader scope, including monitoring stress (e.g., water stress), increasing resilience. If farmers are granted full access to the data created, it would also enable co-creation and sharing of knowledge. An element of agroecology extensively discussed as one of the most beneficial for farmers, increasing participation and opening new scenarios for crop management. Farmers could also take part in the future development of such tools, if the data are freely available. Control over data and supporting policies have been mentioned as the main mitigating factor to reduce the risk of exploitation of farmers' data (ensuring responsible governance). All stakeholders highlighted the lost of control over data as the single most important risk. Data availability, protection, and ownership were highlighted as critical factors affecting synergies: the tool has high potential, but there was no agreement on neither positive nor negative effects on synergies, as they depend on who controls the access to data (public services and advisors were mentioned as the possible gatekeeper), and the costs related to the use of them. Similarly,

the tool is not fostering diversity as a direct effect, but the potential future developments of the technology might play a significant role in increasing diversity at both farm and habitat levels.

Virtual Fencing Technology

Harper Adams University coordinated their first DTSW on 13th October 2023. This workshop focused on virtual fencing technology applied to grazing systems in the UK. 17 stakeholders participated in this workshop. 10 stakeholders attended the agroecology indicator evaluation section, while 7 stakeholders participated in the virtual fencing ADOPT tool assessment. A brief economic analysis based on HFH-MOLP modelling was presented to project participants. The main outcomes of the workshop have been that the virtual fencing technology may provide different benefits depending on the level of intensity of livestock grazing operations. For intensive grazing systems, virtual fencing is economically outperformed by conventional electric fencing, while in extensive grazing systems, virtual fencing is a promising tool to achieve agroecological farming with an ecology conservation focus.

The two agroecology elements on which the virtual fencing technology may have the highest impact are Diversity and Co-creation and sharing of knowledge. In terms of Diversity, the virtual fencing technology analysed may offer several benefits including: (i) an increased protection from livestock grazing for certain species such as ground nesting birds; (ii) an improved landscape connectivity due to the absence of physical barriers; and (iii) the possibility to integrate livestock with arable crop production so to promote the principles of regenerative agriculture. Among the potentially negative effects of the technology on diversity are several technical issues related to battery life and connectivity in vegetation-dense areas, which may partially or completely hinder the potentially positive diversity effects of this technology. In relation to the Co-creation and sharing of knowledge element, participants understand that the data generated by the virtual fencing system may be useful to analysis certain trends, but they criticised the complexity in visualising and making sense of such data. Some participants also criticised the fact that farmers can provide feedback to private companies but nothing more. This is interpreted as a limitation in farmers' power to contribute to technology development.

As to the ADOPT tool assessment of virtual fencing, the predicted adoption rate for conservation graziers in the UK is 75%. The time to reach peak adoption was estimated at 11

years. Some of the most sensitive ADOPT tool questions are the scale of the enterprise, the short and long-term profit benefits, the environmental costs and benefits, risk exposure, and the ease and convenience of technology use. An important issue has been the recent update to the virtual fencing collar batteries. The new battery models undergo frequent technical malfunctions, which hampers farm operations and consequently the profitability of the technology. In terms of environmental costs and benefits, it was generally acknowledged that scientific evidence of environmental benefits as a result of virtual fencing adoption is currently lacking. More scientific evidence is required in terms of soil carbon sequestration and biodiversity benefits in farm systems using virtual fencing in the UK.

Automated Robots in Sugar Beet Farming

The Bavarian State Research Center for Agriculture (LfL) conducted its DTSW on the 28th November 2023. The workshop entitled as "Deploying Automated Robots in Sugar Beet Farming" took place at the LfL site. The focus was on exploring the potential of utilizing automated hoeing and sowing robots in sugar beet farming, particularly in Eastern Bavaria. The event attracted approximately 20 participants from diverse backgrounds, including sugar beet farmers, agricultural administration representatives, environmental conservationists, technology manufacturers, scholars from various scientific fields and members of agricultural associations.

The workshop commenced with a warm welcome to all attendees and an overview of the objectives by the organizers. Participants were introduced to the D4AgEcol project. The event then proceeded with presentations focusing on the use of field robots, notably highlighting the Farmdroid FD20, a subject later discussed in the ADOPT workshop part with potential users.

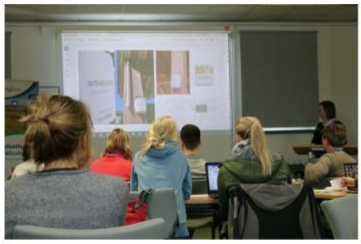


In Bavaria, where sugar beet cultivation is prevalent, the challenges confronting this industry, such as labor availability and pesticide reduction, were thoroughly examined. An intriguing outcome of the discussions was the divergent assessment of robot deployment in conventional versus organic farming methods. Participants acknowledged the nuanced considerations involved in integrating robotics within different agricultural practices, emphasizing the need for tailored approaches. Another parallel part of the DTSW delved into the impact of autonomous hoeing and sowing robotics on agroecology indicators. Participants engaged in lively discussions and provided insights into how such technological interventions

could influence agricultural ecosystems and promote sustainable practices. The exchange of ideas facilitated a deeper understanding of the complex interplay between automation and ecological balance. The workshop generated significant interest among participants, fostering meaningful dialogues and exchanges of knowledge. It served as a platform to promote the principles of agroecology while exploring innovative solutions to contemporary agricultural challenges. Overall, the event was deemed a success, thanks to the active participation and collaborative spirit of all attendees. It underscored the importance of interdisciplinary cooperation in advancing agricultural technologies that are both efficient and environmentally sound.

Sensor-based health management in cattle farming

A group of farmers, stakeholders and animal health experts discussed the potentials of animal health sensors for Agroecology on January, 18th at the Research and Teaching Station for Animal Husbandry and Breeding in Groß Kreutz. After the thematic introduction and the presentation of the technology, the experts found that a rumen bolus can contribute to animal health benefits by the detection of i.e. infections at a very early stage, contribute to higher efficiency of milk production systems as well as having a positive impact on the working conditions. The automatic recording, evaluation and notification via the app enables the herd manager to organize his daily routine more flexibly, which was rated very positively. The presented bolus product by smaXtec can record and transmit temperature, acceleration and pH out of the cows' rumen and can help to monitor the cows' health. As a downside a potential recycling of the sensor after the use is not yet possible, which somewhat diminishes the benefits. The fear that work would become more and more distant from the animal was another negative potential impact expressed by the experts. The adoption analysis identified a significant adoption potential of the bolus, which very much is determined by the expected benefit. During a tour of the farm, the participants had the opportunity to get to know other innovative technologies that are used and evaluated in scientific experiments. There was plenty of opportunity for exchange and discussion, e.g. over lunch together. All in all, a very successful and fruitful day.



4. General Assembly at HAU

In September 2023 partners of the D4AgEcol project met together with the external expert advisory board (EEAB) and our project officer to review the state of the art of the project and agree on next steps to be done. Special emphasis was laid on the communication of the protocol for the Digital Tool Scoping Workshops, the platform for digital tools and technologies and the design of upcoming workshops for the policy roadmaps. Stefan Pfeiffer from our sister project PATH2Dea reported to the partners of D4AgEcol upcoming activities and opportunities for clustering. Finally, our EEAB and the project officer recognized the significant challenge and important mission of our project. They provided guidance on essential tasks and alluded to additional aspects that had not yet been addressed.

5. D4AgEcol participation in conferences

To be written here some highlights from the D4AgEcol participation in past conferences e.g. ECPA conference, GIATE Symposium, Agritechnica 2023.

During the D4AgEcol session of the 6th GIATE Symposium on Agri-Tech Economics for Sustainable Futures, Andreas Meyer-Aurich gave a keynote on the interaction of digitalisation and agroecology. He underscored the potentials while also addressing key bottlenecks that need to be overcome. Harper Adams University staff presented a first agroecological evaluation of autonomous mechanical weeding in the UK. A study titled “A multi-objective optimisation analysis of autonomous mechanical weeding in arable farming” was published in the 6th GIATE Symposium proceedings. This analysis built on the adapted HFH-LP model developed in D4AgEcol.

AGRITECHNICA - On November 15th, 2023, the D4AgEcol project actively participated in the session titled "Smart Agricultural Technology – exploring the contributions of digitalization to biodiversity: Opportunities and challenges of smart agricultural technology." During this session on the *Green Productivity* main stage, key contributors from the D4AgEcol project, namely Olivia Spykman from LfL (Bavarian State Research Center for Agriculture), Andreas Meyer-Aurich from ATB (Leibniz Institute for Agricultural Engineering and Bioeconomy), and Ameli Kirse from LIB (Leibniz Institute for the Analysis of Biodiversity Change), delivered concise presentations and engaged in discussions regarding the impacts of digitalization on

biodiversity. The session was coordinated by GIL (Society for Information Technology in Agriculture, Forestry, and the Food Industry) and moderated by Friederike Schwierz (ATB).

6. Let's meet at upcoming Events!

EVENT	DATE	LOCATION	D4AgEcol Partner
GIL	27 – 28 February	Hohenheim, Germany	ZALF, LfL
98th Annual Conference of the Agricultural Economics Society	18 - 20 March	Edinburgh, UK	HAU
AgEng	01 – 03 July	Athens, Greece	AUA, ATB
IFMA Congress	07 – 11 July	Saskatoon, Canada	UCPH
16th International Conference on Precision Agriculture	21-24 July	Manhattan, Kansas, USA	HAU
Landscape 2024	27 – 29 September	Berlin, Germany	ZALF, ATB

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For more information visit our website:

www.d4agecol.eu

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