

MSc thesis topic announcement: **Management practices of farmers for pollination and pest control**

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Hosting departments: ESS – iDiv, Leipzig; Community Ecology UFZ Halle; IFA – ZALF, Müncheberg

Insects are highly relevant organisms in agricultural production systems, as they contribute to valuable ecosystem services such as pollination and biological pest control, which can increase yield and reduce the need for pesticide application (Sutter and Albrecht 2016). Currently, insects are experiencing tremendous decrease in biomass as well as diversity (Hallmann et al. 2017; Jankielsohn 2018; Klein et al. 2007), compromising their contributions to ecosystem services. Insects are very mobile organisms affected by management practices at larger scales than the individual farm (Kremen et al. 2007). Intensification of agricultural land use that leads to a decrease in habitat areas, degradation of habitat quality and loss of connectivity between habitats are major causes for declining trends (Mupepele et al. (2019). The first measure of the action program for insect conservation (Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit 9/4/2019), to counteract the decrease in insect diversity and biomass, focusses on promoting landscape heterogeneity in agricultural landscapes. The implementation and success of such a policy relies on various instruments and stakeholders (Marselle et al. 2020), farmers being the most relevant ones shaping agricultural landscapes. However, it is yet to be disentangled what is the considerations of farmers towards semi-natural habitats and whether or not they apply a landscape-scaled management approach in their fields.

In the context of the INTERCEDE project, this Master project will collect and analyze information on the land management practices (i.e. pesticide application, crop rotation, agri-environmental schemes, etc.) and the role of farmers shaping agricultural landscapes by conducting interviews with farmers and farmers' organizations. This master thesis will be embedded and contribute to the ongoing research project where we investigate the effects of landscape heterogeneity and land-use intensity on pollination and pest control services in 12 study sites in Saxony-Anhalt.

Objectives:

- Determine the land use intensity and crop production of 12 agricultural sites and surrounding landscape.
- Explore the perception of farmers (land managers or land owners) regarding the role and importance of the arthropod community towards their agricultural activities.
- Identify whether farmers implement a landscape scale management approach towards managing biodiversity.
- Investigate how farmers consider the management of semi-natural areas.

Methods/tasks:

- Design a questionnaire to investigate land management practices of 12 study sites in Saxony-Anhalt, including qualitative and quantitative questions;
- Conduct questionnaires with farmers;
- Analyze questionnaire results.

Expected outcome and time plan:

This work will constitute the Master thesis of the candidate and contribute to at least one scientific publication within the INTERCEDE project.

Task	Month					
	1	2	3	4	5	6
Literature review: look at scientific basis (case studies, facts, data) for the action programme for insect conservation, Mupepele et al. 2019						
Establish contacts to farmers through Diana from farmers association (maps of study area should be ready by then)						
Design questionnaire/refine quantitative questions						
Conduct farmers survey (aim at min. 12 questionnaires)						
Data analysis						
Write thesis						

Relevant literature:Farmers perspective on conservation of pollinators:

Marselle et al. 2020; Munyuli 2011; Tarakini et al. 2020; Hevia et al. 2020

Agricultural policies and insect conservation policies:

Schoof et al. 2020; Bundesministerium für Umwelt and Naturschutz und nukleare Sicherheit 2019; Lorna J. Cole et al. 2020; Albrecht et al. 2020; Kleijn et al. 2015; Brühl and Zaller 2020

Insects in agriculture:

Connelly et al. 2015; Klein et al. 2007; Holzschuh et al. 2013; Jankielsohn 2018

For more information and/or submitting your application in either German or English, as one PDF file, send an email to: maria.kernecker@zalf.de.

Publication bibliography

Albrecht, Matthias; Kleijn, David; Williams, Neal M.; Tschumi, Matthias; Blaauw, Brett R.; Bommarco, Riccardo et al. (2020): The effectiveness of flower strips and hedgerows on pest control, pollination services and crop yield: a quantitative synthesis. In *Ecology letters* 23 (10), pp. 1488–1498. DOI: 10.1111/ele.13576.

Brühl, Carsten; Zaller, Johann G. (2020): Meinungsartikel Rückgang der biologischen Vielfalt. Inwiefern ist eine unzureichende Umweltverträglichkeitsprüfung von Pestiziden mitverantwortlich? In *Mitt Umweltchem Ökotox* 26 (1), pp. 3–7.

Bundesministerium für Umwelt; Naturschutz und nukleare Sicherheit (Eds.) (2019): Aktionsprogramm Insektenschutz. Gemeinsam wirksam gegen das Insektensterben.

Bundesministerium für Umwelt, Naturschutz und nukleare Sicherheit (9/4/2019): Aktionsprogramm Insektenschutz. Available online at https://www.bmu.de/fileadmin/Daten_BMU/Pool/Broschueren/aktionsprogramm_insektenschutz_kabinettversion_bf.pdf, checked on 10/2/2020.

Connelly, Heather; Poveda, Katja; Loeb, Gregory (2015): Landscape simplification decreases wild bee pollination services to strawberry. In *Agriculture, Ecosystems & Environment* 211, pp. 51–56. DOI: 10.1016/j.agee.2015.05.004.

Hallmann, Caspar A.; Sorg, Martin; Jongejans, Eelke; Siepel, Henk; Hofland, Nick; Schwan, Heinz et al. (2017): More than 75 percent decline over 27 years in total flying insect biomass in protected areas. In *PloS one* 12 (10), e0185809. DOI: 10.1371/journal.pone.0185809.

Hevia, Violeta; García-Llorente, Marina; Martínez-Sastre, Rodrigo; Palomo, Sara; García, Daniel; Miñarro, Marcos et al. (2020): Do farmers care about pollinators? A cross-site comparison of farmers' perceptions, knowledge, and management practices for pollinator-dependent crops. In *International Journal of Agricultural Sustainability* 43 (3), pp. 1–15. DOI: 10.1080/14735903.2020.1807892.

Holzschuh, Andrea; Dormann, Carsten F.; Tschamntke, Teja; Steffan-Dewenter, Ingolf (2013): Mass-flowering crops enhance wild bee abundance. In *Oecologia* 172 (2), pp. 477–484. DOI: 10.1007/s00442-012-2515-5.

Jankielsohn, Astrid (2018): The Importance of Insects in Agricultural Ecosystems. In *AE* 06 (02), pp. 62–73. DOI: 10.4236/ae.2018.62006.

Kleijn, David; Winfree, Rachael; Bartomeus, Ignasi; Carvalheiro, Luísa G.; Henry, Mickaël; Isaacs, Rufus et al. (2015): Delivery of crop pollination services is an insufficient argument for wild pollinator conservation. In *Nature communications* 6, p. 7414. DOI: 10.1038/ncomms8414.

Klein, Alexandra-Maria; Vaissière, Bernard E.; Cane, James H.; Steffan-Dewenter, Ingolf; Cunningham, Saul A.; Kremen, Claire; Tschamntke, Teja (2007): Importance of pollinators in changing landscapes for world crops. In *Proceedings. Biological sciences* 274 (1608), pp. 303–313. DOI: 10.1098/rspb.2006.3721.

Lorna J. Cole; David Kleijn; Lynn V. Dicks; Jane C. Stout; Simon G. Potts; Matthias Albrecht et al. (2020): A critical analysis of the potential for EU Common Agricultural Policy measures to support wild pollinators on farmland. In *Journal of Applied Ecology* 57 (4), pp. 681–694. DOI: 10.1111/1365-2664.13572.

Marselle, Melissa R.; Turbe, Anne; Schwartz, Assaf; Bonn, Aletta; Colléony, Agathe (2020): Addressing behavior in pollinator conservation policies to combat the implementation gap. In *Conservation biology : the journal of the Society for Conservation Biology*. DOI: 10.1111/cobi.13581.

Munyuli, Théodore (2011): Farmers' perceptions of pollinators' importance in coffee production in Uganda. In *AS 02* (03), pp. 318–333. DOI: 10.4236/as.2011.23043.

Mupepele, Anne-Christine; Böhning-Gaese, Katrin; Lakner, Sebastian; Plieninger, Tobias; Schoof, Nicolas; Klein, Alexandra-Maria (2019): Insect conservation in agricultural landscapes: An outlook for policy-relevant research. In *GAIA - Ecological Perspectives for Science and Society* 28 (4), pp. 342–347. DOI: 10.14512/gaia.28.4.5.

Schoof, Nicolas; Luick, Rainer; Paech, Niko (2020): Respekt für das Insekt? Analyse des Aktionsprogramms Insektenschutz der deutschen Bundesregierung unter besonderer Beachtung transformativer Zugänge. In *Zeitschrift für Naturschutz und Landschaftspflege* 95 (7), pp. 316–324.

Sutter, Louis; Albrecht, Matthias (2016): Synergistic interactions of ecosystem services: florivorous pest control boosts crop yield increase through insect pollination. In *Proceedings. Biological sciences* 283 (1824). DOI: 10.1098/rspb.2015.2529.

Tarakini, Gugulethu; Chemura, Abel; Musundire, Robert (2020): Farmers' Knowledge and Attitudes Toward Pollination and Bees in a Maize-Producing Region of Zimbabwe: Implications for Pollinator Conservation. In *Tropical Conservation Science* 13, 194008292091853. DOI: 10.1177/1940082920918534.