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Ecological intensification for managing biodiversity in agricultural systems - A systematic review

Ida Schou Brandis

Dissertation submitted as partial requirement for the conferral of

Master in Environmental and Sustainability Studies

Supervisor: Doutora Vânia Andreia Malheiro Proença, Investigadora, MARETEC, Instituto Superior Técnico, Universidade de Lisboa

Co-supervisor: Doutora Fernanda Paula Martins e Castro, Professora Associada, ISCTE, Instituto Universitário de Lisboa

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My biggest thanks goes to Doutora Vânia Andreia Malheiro Proença, my supervisor and key for success, that have worked with me and helped me with valuable guidance thought this educational process.

Thanks go to my family for the patience and support.

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Abstract

The intensive farming has been linked to biodiversity loss. However, food production is required to increase to meet the growing demand of the world population. For long-time security, ecological intensification, based on the intensive and smart use of ecosystem services is proposed as a solution. This systematic review investigated the inclusion of ecological intensification in research studies, the motivation (mitigation of impacts on biodiversity or production concerns) behind its adoption by different agricultural interventions (organic farming, integrating farm management or agri-environmental schemes) and identified the associated ecosystem services. A total of 258 articles were included in the final list for review. Most studies were motivated by the mitigation of agricultural impacts on biodiversity, organic and integrated farm management were the most represented, and most studies focused on regulating ecosystem services. No association between motivation and agricultural intervention was found. Examples of ecological intensification were identified in 65 studies (25%); among these, the ones only motivated by biodiversity conservation restricted their analysis to regulating services, while the studies motivated by both production and biodiversity conservation also addressed other types of ecosystem services, namely provisioning services. Moreover, studies assessing agri-environmental schemes often did not include ecological intensification, these studies were mainly motivated by the mitigation of agriculture impacts, in particular, on biodiversity values related to cultural services. Overall, review findings suggest that studies focusing both on biodiversity and agriculture tend to be more motivated by the mitigation of impacts of agriculture, and address less the contribution of biodiversity to agricultural production. This suggests a window of opportunity for agricultural management to strengthen the synergies between biodiversity and production.

Keywords:

Ecological intensification, ecosystem services, biodiversity, agri-environmental schemes, organic farming, integrated farm management.

Resumo

A agricultura intensiva tem causado perda de biodiversidade. No entanto, é necessário aumentar a produção de alimentos para responder ao aumento da população. A intensificação ecológica apresenta-se como uma solução para conciliar segurança alimentar e proteção da biodiversidade. Este estudo analisou a inclusão de práticas de intensificação ecológica em 258 artigos científicos, a motivação (conservação/mitigação de impactos na biodiversidade ou melhoria da produção) para o uso dessas práticas por diferentes tipos de intervenção agrícola (agricultura biológica e integrada, medidas agroambientais) e identificou os serviços de ecossistema associados. A conservação/mitigação de impactos, a agricultura biológica e integrada, e os serviços de regulação foram, respetivamente, a motivação, intervenções e serviços de ecossistema mais frequentes. Não foi encontrada uma associação entre motivação dominante e tipo de intervenção. Foram identificadas práticas de intensificação ecológica em 65 estudos; entre estes, os estudos motivados por conservação/mitigação focaram essencialmente serviços de regulação, enquanto estudos motivados tanto pela produção como pela conservação da biodiversidade também abordaram outros serviços, nomeadamente provisão de alimento. Não foram detetadas práticas de intensificação ecológica na maioria dos estudos sobre medidas agroambientais, estes estudos têm a conservação/mitigação de impactos como a principal motivação. Os resultados desta revisão sugerem que os estudos sobre biodiversidade e agricultura tendem a ser mais motivados pela conservação ou mitigação de impactos da agricultura na biodiversidade, do que pelos contributos da biodiversidade para a produção agrícola. Tal sugere a existência de uma janela de oportunidade para fortalecer a sinergia entre biodiversidade e produção no âmbito das políticas para a agricultura.

Palavras-chave: Intensificação ecológica, serviços dos ecossistemas, biodiversidade, medidas agroambientais, agricultura biológica, agricultura integrada.

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Glossary of acronyms

ABT - Aichi Biodiversity Targets
AES – Agri-environmental schemes
CAP – Common Agricultural Policy
CBD – Convention on Biological Diversity
CICES – Common International Classification of Ecosystem Services
FAO - Food and Agriculture Organization of the United Nations
IFM – Integrated farming management
MEA - Millennium Ecosystem Assessment
SDG – Sustainable development goals

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1 Introduction

Food security and biodiversity conservation are key challenges for the 21st century (Glamann et al. 2017). Increased food production needs to happen with minimized harm to biodiversity (Pretty et al. 2010). The green revolution of the 1970s assumed that chemical fertilizers could maintain and increase the soil fertility, enabling more intensifying practices (UN, 2013a). These practices caused organic matter in cultivated soils to decrease in the 20th century, leading to a decline in soil fertility and productivity (UN, 2013a). Moreover, between 11-15% of all global emissions come from farms, specifically industrial practices relying on chemical fertilizers, petrol for heavy machinery and methane from the high density of livestock (UN, 2013b). While industrial agriculture is causing high cost to the environment, hunger continues to be a global challenge (UN, 2013c). By 2030 the greenhouse gas emissions from agriculture methane (CH_4) and nitrous oxide (N_2O) are expected to increase by 35-60%, in response to population growth and diet change (UN, 2013d). Although the industrialized agriculture has succeeded in reducing hunger, by the increased food production since the 1990s, its expansion also resulted in biodiversity loss (Kremen et al. 2012, Bommarco et al. 2013 & FAO, 2017). With a population growth expected to reach 9 billion by 2050 (Tittonell, 2014), food production needs to consider biodiversity conservation in order to provide long-term security (Kremen et al. 2012).

Biodiversity conservation and food security have until recently been dealt with separately, having their own respective scholar debates and understanding, but the awareness of the interrelation between these two issues in the way to deal with a growing human population have brought them together (Glamann et al. 2017). Conventional farming still relies on external inputs. Although there have been improvements, climate change, water pollution, degradation of land and losses in biodiversity are still happening, and the exceeded planetary boundary for human modification of the nitrogen cycle requires the intensive agriculture in the future to be input critical (UN, 2013e). Seufert et al. (2017) argue that since the primary purpose of agriculture is production, the environmental impact should be examined by per unit output rather than per unit area, which indicates that higher yield by intensive farming could counteract the impacts because more land could be taken out of production for restoration of natural ecosystem. The actual goal and challenge is to enhance food security, ensure sufficient availability, access, and utilization of nutritious food. A growing food demand from an increasingly wealthy population, together with the negative externalities to biodiversity, show that food and biodiversity are part of a complex socio-ecological system (Fischer et al. 2017). About 47% of the total European Union territory is occupied by agriculture. The intensifying farming practices from the 1940s have been linked to a widespread decline of several farmland species such as birds, mammals, arthropods, and flowering plants (Randall et al. 2012). One of the key messages from the United Nations "Wake up before it is too late" review of trade and environment (UN, 2013) is that the agricultural development needs a paradigm shift from the "green revolution" to an "ecological intensification". This paradigm shift indicates a significant and rapid change from farming, based on monocultures and industrial production, depending on the high supply of external inputs, to a diversity of regenerative and sustainable production systems, also including small-scale farmers. Agricultural management needs to be seen as a holistic approach, recognizing that in addition to agricultural goods, agro-ecological systems also provide public goods and services, such as landscape, energy, biodiversity, soil, water and recreation (UN, 2013d).

1.1 International goals towards the enhanced sustainability of farming systems

Future agriculture should adapt to reduce the impacts on biodiversity and reduce emissions causing climate change, by mitigation and adaptation actions promoting more resilient societies (European Commission. 2013a & 2015). In 2015, the parties to the United Nations adopted, at the Conference of the Parties in Paris (COP 21), the Sustainable Development Goals (SDG) towards 2030, which entered into force in 2016. The vision for this new sustainable development agenda is that "*We recognise that people are at the centre of sustainable development and, in this regard, we strive for a world that is just, equitable and inclusive, and we commit to work together to promote sustained and inclusive economic growth, social development and environmental protection and thereby to benefit all*" (UN, 2012).

Each of the 17 goals has specific targets to be achieved within the next 15 years. The Sustainable Development Goals related to farming are recognized as SDG 2, SDG 12, SDG 13, SDG 15. SDG 2 - Zero hunger - has the aim to end hunger and malnutrition, with the commitment to the universal access to sufficient, safe and nutritious food all year around. This is achieved by a resilient agriculture and a sustainable food production system. For boosting the agricultural productivity, the access to land, technology, markets and the international infrastructure and technology investment cooperation should be equal (UN, 2015, Goal 2). SDG 12 - Responsible consumption and production - for achieving development and economic growth, goods, and services should be produced to improve the life quality. The use of natural resources, toxic materials, pollutants and waste should be minimized throughout the whole production and consumption process, to enable development and sustainable growth (UN, 2015, Goal 12). SDG 13 - Climate action – focus on a key threat to development, which is climate change; this goal calls for an urged action to combat climate change and minimize its disturbance. For building a resilience and adaptive capacity to the effects of climate change, with low-carbon pathways and to speed up the reduction of greenhouse gas emissions, an international cooperation is needed (UN, 2015, Goal 13). SDG 15 - Life on land - this goal focuses on sustainable management of forest, restoration of degraded land, combating desertification, and biodiversity loss and reduce the natural habitat degradation (UN, 2015, Goal 15).

In addition to the SDGs, the Aichi Biodiversity Targets (ABT), adopted by the parties to the Convention on Biological Diversity (CBD) at the 10th conference (COP 10) in 2010, are also relevant to guide actions towards sustainable farming systems. The 20 Aichi targets are part of the CBD strategic plan for 2011-2020 (UN, 2012). The 20 targets are grouped into 5 strategic goals: "Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society" (Strategic Goal A), "Reduce the direct pressures on biodiversity and promote sustainable use" (Strategic Goal B), "Improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity" (Strategic Goal C), "Enhance the benefits to all from biodiversity and ecosystem services" (Strategic Goal D), and "Enhance implementation through participatory planning, knowledge management and capacity building" plans (Strategic Goal E)". While several of the ABT are relevant in guiding the management of agricultural systems, three of them are particularly relevant for sustainable food production: ABT 3 (subsidies and incentives harmful to biodiversity should be eliminated by 2020 and be replaced by incentives positive for conservation and the sustainable use of biodiversity), ABT 7 (the areas under agriculture, aquaculture and forestry should by 2020 be managed sustainably for ensuring biodiversity conservation), and ABT 14 (restoration and safeguarding ecosystems that provide essential services, like services related to water, and contribute to health, livelihoods, and well-being) (CBD, 2010).

Also at the global level, the Food and Agriculture Organization of the United Nations (FAO) sets four strategic objectives for food production: 1) Help eliminate hunger, food insecurity and malnutrition; 2) Make agriculture, forestry and fisheries more productive and sustainable; 3) Reduce rural poverty; enable inclusive and efficient agricultural and food systems; 4) Increase the resilience of livelihoods from disasters (FAO, 2013a). Of special relevance is the second objective, which states the importance of innovative agricultural approaches for increasing productivity, natural resource conservation and efficient and sustainable use of inputs. It is required a holistic view of the agriculture sector with the natural resources connected to it, introduced by technologies and sustainable production, that promote the conservation and ecosystem service use (FAO, 2013a).

At the European level, the EU Biodiversity Strategy for 2020 recognizes the need for reversing the degradation of biodiversity and ecosystem services in the region. It is composed of 20 actions divided by six headline targets. Out of the six headline targets, Target 3, on sustainable agriculture and forestry, is of special interest. This target states that the efforts to reduce the biodiversity and ecosystem services degradation are far from sufficient, especially with the knowledge of the important benefits these provide and calls for a measurable improvement by 2020 (European Commission, 2011). The European Commission has included the questions on how to best produce sustainable food, including protection, maintenance, and enhancement of biodiversity on farmland into the recent consultation of the Common Agricultural Policy, and by that confirming the need of understanding the benefit provided by biodiversity in order to ensure value for money and continue to improve the agri-environmental schemes (Randall et al. 2012). Rural development is considered to be fundamental for climate change mitigation and adaptation, by “restoring, preserving and enhancing ecosystems dependent on agriculture and forestry” and “promoting resource efficiency and supporting the shift towards a low carbon and climate resilient economy in the agriculture, food and forestry sectors” (European Commission, 2013a &2015).

All the international strategies and goals described above recognize the relevance of biodiversity and ecosystems for human well-being in particular, in regard to food production, but also their vulnerability to human activities, and consequently, the urged need for implementing approaches such as ecological intensification which intends to work together with ecosystem services and biodiversity, enhance and restore ecosystem functioning, while maintaining or enhancing the levels of agricultural production.

1.2 Ecological intensification

Ecological intensification (Figure 1.1) has been proposed as a solution to cope with the challenge of providing food security while minimizing the degradation of biodiversity and environment (UN, 2015). More specifically, ecological intensification aims to reduce the reliance on external inputs by reestablishing soil and landscape ecosystem services, and optimizing ecosystem services to maintain or enhance food production.

Sustainable intensification is another strategy for enhanced food productions, which overlaps and can be confused with the concept of ecological intensification. Both sustainable- and ecological intensification are referred to in the scientific and development literature as alternative sustainable production models to feed the world today and in the future (Bommarco et al. 2013, Pretty et al. 2011, Doré et al. 2011 & Kremen et al. 2012). Sustainable intensification focus on the smart use of external inputs to increases production, while reducing negative environmental impact, while ecological intensification focus on the intensive and smart use of ecosystems' natural functionalities to increase production. While sustainable intensification works at the scale of the single crop or agricultural field, ecological intensification goes beyond that, since support and regulation services are underpinned by the complexity of ecological processes at a landscape scale (Tittonell, 2014).

In Europe where agricultural activity already attains high yields these are often dependent on unsustainable levels of external inputs. In such case, the challenge for ecological intensification is to reduce this reliance while maintaining high productivity through the reestablishment of soil and landscape ecosystem services. Where productivity is not that high, production could be enhanced through the optimization of ecosystem services rather than by increased external inputs (FAO, 2013b). Ecological intensification has the challenge to re-establish the ecosystem services on a landscape scale in order to provide ecological resilience, which in hand could reduce the dependence of external inputs, and enable the maintenance of production levels (Bommarco et al. 2013 & FAO, 2013b). Ecological intensification promotes multifunctional agro-ecosystems, proposing landscape approaches, that in an intelligent way make intensive use of the natural functionalities of the regulating ecosystem services, to produce the same or more than conventional farming (Tittonell, 2014). By strengthening the contribution of ecosystem services to agricultural production, agricultural systems can reduce the reliance on external inputs and sustain agricultural productivity (Bommarco et al. 2013).

Figure 1.1 represents some options for ecological intensification management, with the link to their impact on the regulating ecosystem services.

Figure 1.1: *Examples of effects of ecological intensification practices on regulating ecosystem services: 0 no impact, (+) likely but unproven positive impacts, - overall negative impacts, + moderate positive impacts, ++strong positive impacts. Information adapted from table 1 in Bommarco et al. 2013.*

With the need for reduced agricultural impact on the environment and ecosystem services and a continued high food production, the plots in Figure 1.2 show the safe space (in green), where the production optimally should be within. As illustrated the current situation (a) does not fulfill the global need for food, and by continuing the same way (c) the food production could have a small increase but with extremely high impact to the environment and ecosystem services. Ecological intensification (b) provides a solution, which moves into the safe space and increases the food production with less negative impacts on ecosystem services and environment.

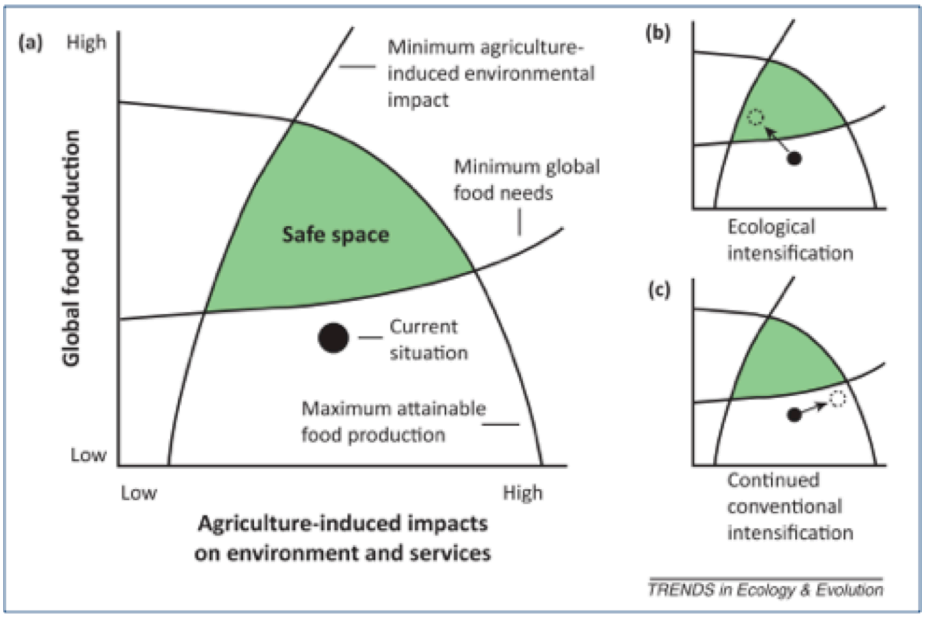

Figure 1.2: *Agricultural limits and alternatives for global food production in the current situation (a) and two scenarios for the future, ecological intensification (b) and continued conventional intensification (c), adapted from Bommarco et al. 2013.*

1.3 Ecosystem services and biodiversity

Biodiversity is the "the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within species, between species and of ecosystems" (CBD, 1992). Changes to biodiversity have effects on ecosystem's functioning, resilience and the supply of ecosystem services, which have impacts on human well-being (MEA, 2005).

Ecosystem services are the benefits and value that people receive from ecosystems, through their functions and processes (Bullock et al. 2011 & MEA, 2005). The Millennium Ecosystem Assessment (MEA) divided the ecosystem services into four categories, namely: provisioning, regulating, cultural and supporting services (MEA, 2005). Provisioning, regulating and cultural services provide services that are enjoyed by people while the supporting services underpin those three categories (Heines-Young. et al. 2010 & MEA, 2005). In the follow up of the MEA, a new classification, the Common International Classification of Ecosystem Services (CICES), has been proposed, which provides a classification of the final ecosystem services (Heines-Young et al. 2013), the aim is to avoid double counting in ecosystem assessments, particularly in economic valuation. Intermediate services, namely supporting services, that are not directly enjoyed by people are either not included in the CICES classification or included under regulating and maintenance services. The CICES classification will be used in this thesis (Table 1.1). Specified, the two-level categorization used by Boerema et al. (2017), which builds on the CICES classification system.

Table 1.1: *Sub-categories of provisioning, regulating and cultural ecosystem services (adapted from Boerema et al. 2017).*

Provisioning	Regulating	Cultural
1. Food production	8. Water Purification	17. Recreational & Tourism
2. Water Provisioning	9. Water Regulation	18. Scientific & Educational services
3. Materials & Fibre	10. Air Quality Regulation	19. Heritage, Cultural, Bequest, Inspirational & Art
4. Energy & Fuel	11. Soil Quality Regulation	20. Aesthetic Services
5. Genetic Resources	12. Soil Retention	21. Symbolic, Sacred, Spiritual & Religious Services
6. Medicinal Resources	13. Climate Regulation	
7. Ornamental Resources	14. Pollination	
	15. Life Cycle Maintenance	
	16. Biological Control	

Human activities, agricultural land use in particular (Seufert et al. 2017), have caused worldwide ecosystem changes leading to severe biodiversity loss and affecting the delivery of provisioning services, thus threatening long-term sustainable development worldwide (Bullock et al. 2011 & CBD, History of the Convention). By managing diversity both in-field and off-field ecologically intensive farming systems, compared to conventional systems, have the ability to provide higher levels of regulating ecosystem services (Tittonell, 2014), such as pest regulation, crop pollination, and soil nutrient cycling which support food production (Seufert et al. 2017). Ecosystem services are valued differently, the provisioning services like food, fiber, and energy are valued high, regulating services tend to be undervalued because the value to humans is indirect (Heines-Young et al. 2010 & Bommarco et al. 2013). However, regulating services underpin agricultural production, therefore, their deterioration can limit production output. The integration of ecosystem services, such as pest control, water retention and nutrient cycling into the agricultural management can have long-term positive impacts on agricultural production, maybe even at reduced cost (MEA, 2005) and have less negative externalities than an increased conventional intensification (Bommarco et al. 2013). As human life depends on biodiversity and ecosystems, degradation needs to slow down or be reversed (MEA, 2005 & UN, 2015). Because it is indicated that a full restoration of the historical characteristics of biodiversity and ecosystem services is not always beneficial or possible, it is suggested that it is sufficient and more easily achieved to restore an ecosystem until it delivers the required services (Bullock et al. 2011).

1.4 Interventions in agricultural systems

Ecological intensification cannot be generalized into one single model or intervention, as the practices depend on the context, the specific ecosystem, and landscape (Tittonell, 2014). Interventions such as organic farming, integrated farm management, and agri-environmental schemes, are often considered for their ability to conserve biodiversity in temperate Europe (Randall et al. 2012). These interventions may include ecological intensification practices that minimize anthropogenic inputs by managing the regulating ecosystem services, such as to improve biological pest control, insect pollination, and minimize environmental impacts, support- and increase biodiversity on farmland (Bommarco et al. 2013). The next sections provide a general introduction to the three interventions in consideration: organic farming, integrated management farming management, and agri-environmental schemes. Organic and integrated farming are options within the agri-environmental schemes and conventional farming could choose options within the schemes to improve biodiversity.

1.4.1 Organic Farming

The main goal of organic farming is to produce food as natural as possible so that the natural life-cycle is respected and human environmental impact is minimized (European Commission, 2017a & EU, 2007). In 2007, the European Council of Agriculture Ministers agreed on a new regulation for organic production, which respects the natural cycles and systems. To achieve biological sustainability, mechanical production processes and land-related production should be used and without the use of GMOs. These aims were set as a new course in developing organic farming: i) sustainable cultivation systems; ii) a variety of products with high quality; iii) environmental protection get higher focus; iv) biodiversity gets more attention; v) animal protection gets higher standards; vi) consumer confidence and interest protection. Preferable is the utilization of a closed cycle of resources, where internal on-farm resources are being used, rather than external inputs, but in cases where external inputs have to be used, they should be organic and from other organic farms, natural substances, naturally obtained or the mineral fertilizer should be of low solubility.

Table 1.2: *Definition of the main agricultural interventions and strategies considered in this thesis.*	
Conventional farming	-Is defined as mainstream agriculture dominantly practiced today, representing both high-input and low-input systems, depending on the region (Seufert et a. 2017).
Organic farming	-Is a farming system following organic certification guidelines (e.g., avoid synthetic fertilizers and pesticides) and that is intentionally organic (excluding organic-by-default systems that do not apply synthetic inputs due to lack of access) (Seufert et a. 2017).
Integrated farming management	-Aims to minimise pesticides and fertilisers use through better targeting, and integration with cultural control of weeds, pests and diseases (Randall et al. 2012).
Ecological intensification	-Based on intensive and smart use of the natural functionalities offered by the ecosystem to increase or continue high agricultural production (Gonzáles de Molina & Casado, 2017 & Tittonell, 2014).
Sustainable intensification	-Refers to a production form that delivers increased food production by continued intensification of the existing agricultural land, without adverse impact to the environment, in a way that the future capacity of food production is not undermined (Gonzáles de Molina & Casado, 2017).
Agri-environmental schemes	-Is a scheme, which financially compensates farmers for any income loss due to the introduced measure, meant to increase environment and biodiversity (Kleijn &Sutherland 2003). Organic farming and integrated farming management are part of the options.

In cases where no other suitable alternatives exist, synthetic resources and inputs can be permitted in organic production, to a minimum and where appropriate for a limited time (European Commission, 2017b & EU, 2007). Organic food has experienced an increased demand as a result of the rising concerns about sustainability, environmental impact and health effects (Randall et al. 2012). Organic management has clear benefits to wildlife biodiversity at farmland, typically 40 to 50% increase in organism abundance (Seufert et al. 2017). According to the Food and Agriculture Organization of the United Nations (FAO), organic agriculture is a system that instead of external agricultural inputs relies on ecosystem management. Synthetic fertilizers and pesticides, additives and irradiation, veterinary drugs and genetically modified seeds and breeds are replaced with management that is on-site specific and ought to increase and maintain soil fertility, prevent pest and diseases in the long run. Biodiversity, biological cycles, and biological soil activity are through the holistic production management system being promoted and enhanced (FAO, 1999). Many of these management types are in hand with ecological intensification management options (Figure 1.1) (Bommarco et al. 2013). The International Federation of Organic Agriculture Movements (IFOAM) describes four principles of organic agriculture: i) the principle- of health, ecology, fairness, and care; ii) the health of soil, plant, animal, humans, and planet should be sustained and enhanced as one, not divided; iii) ecological systems and cycles are the basis, in which organic agriculture should work together with, imitate and sustain, and iv) fairness should be ensured through relationships with regards to the common life and environmental opportunities. A precautionary and responsible management provides care and protection for health and well-being of today's people, future generations and the environment (IFOAM).

1.4.2 Integrated farming management (IFM)

Also called integrated crop management is considered as an alternative to organic farming, by using improved targeting methods and integrated cultural control of diseases, pests, and weeds. IFM aims to minimize the need for fertilizers and pesticides. (Randall et al. 2012 & Alvarez et al. 2001) According to LEAF-Linking Environment and Farming (http://www.leafuk.org/leaf/farmers/LEAFs_IFM/Whatisifm.eb), a UK agricultural organization, integrated management farming delivers sustainable farming through a whole farm business approach. Its management enriches the environment and local communities' engagement by applying the best out of both modern technology and the traditional methods, delivering prosperous farming. IFM is said to not only be environmentally responsible and socially acceptable, but even efficient and providing a profitable production (LEAF, Retrieved: 16.02.17). IFM aims to optimise and sustain all use of on-farm resources, which include staff, machinery, capital, soil, water, air, wildlife habitats, archaeological features, and landscape. Easily said it increases the productivity while protecting the valuable resources (LEAF, Retrieved: 16.02.17). The James Hutton Institute which does research in developing the needs for LEAF describe IFM as follows: commits to good animal welfare and husbandry; uses appropriate cultivation techniques and efficient soil management; uses crop rotations; has minimized reliance on fertilisers and chemicals for crop protection; relies on a careful selection of seed varieties; contributes to maintain rural communities and landscape; contributes to enhance wildlife habitat; commits to team spirit through communication, training and involvement (http://www.hutton.ac.uk/learning/leaf/ifm).

Integrated crop management is considered by the European Commission to be of particular importance, having the capacity to ensure a good environmental outcome in modern farming (Randall et al. 2012). The holistic approach to sustainable agriculture that integrated crop management offers includes socio-economic and environmental factors, with the aim of long-term benefit. Soil, pest, water and landscape management, seed and planting material, crop rotation and nutrition are carefully selected for the particular local condition and climate. It adapts to changing conditions, combining new research and technologies with the local knowledge (CABI, Retrieved: 27.02.17).

1.4.3 Agri-Environmental Schemes

Environmental concerns are increasingly important in the Common Agricultural Policy (CAP). The largest amount of EU´s funding goes to the rural development measures, directed to incentives towards sustainable management of natural resources, ecosystem preservation and increased valorisation of the landscapes diverse environment and condition (European Commission, 2013b). The EU-Agricultural policy introduced the agri-environmental schemes as early as in the late 1980s, and it became compulsory for all member states by 1992 (European Commission, 2017c). Farmers who voluntary subscribe to commitments related to the environmental preservation and maintaining the countryside are provided with payments. The payment to farmers for delivering environmental services is meant as encouragement to protect and enhance farmland environment. The farmer’s transfer to farming techniques that are environmental-friendly requires a minimum commitment of 5 years. The farmer is economically compensated for the additional costs and income losses relating to the adoption of environmental-friendly farming practices.

Environmental outcomes provided by agriculture are being demanded by society, this is where the compensation payment helps as an encouragement in the adoption process to levels of production or agricultural activities that improve the environment, with less concern for profitability. Some of the commitments under the national and regional agri-environmental schemes include extensive farming in environmental favour, low-intensity pasture systems management; organic agriculture and integrated farm management; conservation of high-value habitats- and their biodiversity; preservation of landscape and historical features. For instance, ecological compensation areas such as strips of herbaceous and wildflower in intensively farming landscapes are of high value. They support a rich diversity and density of plant, insects, and birds, as well as diverse and highly productive communities of mammals, which are important for maintaining biodiversity in agricultural landscapes (Aschwanden et al. 2007). Transparency and applicability at all levels of a farming system make it a tool important for the achievement of environmental goals (European Commission, 2017c).

The effectiveness of the Agri-environmental schemes to conserve or increase biodiversity has been examined in several studies (Kleijn et al. 2006 & Kleijn et al. 2003). The various outcomes are strongly influenced by how the scheme is implemented and designed (Kleijn et al. 2006). Inadequate location of the measure, pure coverage of the necessary resources or the landscape structure, can reduce the positive outcomes of agri-environmental schemes (Randall et al. 2012). Moreover, there is often a dependency on payments, that is, the use of good environmental practices are only maintained as long as payments are given (e.g Albrecht et al. 1998). Moreover, agri-environmental schemes often pay for the implementation of environmental-friendly farming practices; instead of monitoring and paying for the output of that implementation (i.e., payment-by-results; Reed et al. 2014 & Birge et al. 2017).

1.5 Objectives

As introduced, intensive food production is today a cause of environmental impacts, affecting biodiversity and ecosystem services that are crucial for long-term food security. Ecological intensification has been put forward as a solution to increase food security today and in the future, by introducing a management approach that uses biodiversity and ecosystem services to support agricultural production, while maintaining or even increasing the level of production (Bommarco et al. 2013). Economic costs and benefits estimates associated with integrating ecosystem services into farming practices are increasing in availability, demonstrating the economic benefits that agricultural production is receiving from regulating and supporting environmental services, as well as the cost associated with these targeted managements (Bommarco et al. 2013).

Ecological intensification interventions should not cause a decrease in production, for both the farmer' profit and for food provisioning. The farming community decision on adapting ecological intensification strategies is affected by the final output yield, economic costs, and benefits (Bommarco et al. 2013). According to recent ecosystem service valuation studies the economic benefits from restoration are suggested to outweigh the economic costs (Bullock et al. 2011), and the land can perform the same or more functions in agroecosystems managed correctly, without increased land costs (Gonzáles de Molina et al. 2017). Another main goal of ecological intensification relates to the need for improving biodiversity condition and minimizing environmental impacts from agricultural activity. These goals are particularly relevant where agricultural production is approaching maximum yields, but should also be a priority for closing existing yield gaps around the world to support food security (Bommarco et al. 2013). The management and use of ecological processes, such as in ecological intensification, is suggested to be beneficial for modern agriculture, ensuring an environmentally friendly production (Bommarco et al. 2013).

In summary, ecological intensification emerges as a potential response to the current challenge of increasing food production while minimizing environmental impacts. While interrelated, the motivations for the adoption and support of ecological intensification can be primarily linked to environmental sustainability concerns or to food production, and in the latter case to better food quality or reduced production costs.

The objective of this thesis is to assess the current relative importance of each of these motivations, to better understand which factors are driving the adoption of ecological intensification and also to identify potential knowledge gaps that could be explored in future research. More specifically, a systematic review of literature will be conducted to address the following questions:

1. Which of the motivations; enhanced food production or mitigation of impacts on biodiversity, is the primary motivation behind the adoption of agricultural interventions (organic farming, integrated farm management, and agri-environmental schemes) that can make use of ecological intensification approaches, specified into two sub-questions:

a. Do the interventions primarily aim to restore or conserve biodiversity to mitigate the impact of agricultural activity?

b. Do the interventions primarily aim to enhance biodiversity to promote, increase agricultural production or increase economic profit?

Further, I wish to obtain the current practice of ecological intensification by reviewing the studies for management that could be related to ecological intensification,

2. Do the studies include examples of practices related to ecological intensification?

Since ecological intensification is about smart use of biodiversity and ecosystem services for enhanced agricultural production, the review will identify which ecosystem services are more often subject to direct management.

3. Which ecosystem services are being included in studies, and of concern for agricultural activity?

2 Methods

2.1 Systematic review: general goals and methods

"A systematic review is a literature review that is designed to locate, appraise and synthesize the best available evidence relating to a specific research question to provide informative and evidence-based answers" (Boland et al. 2013, p.3). It is considered the best way to synthesize the findings from several studies that address the same question, following clearly defined and transparent steps (Boland et al. 2013). Academic and scientific communities have increasingly recognized the value of systematic reviews (Boland et al. 2013 & CEE, 2013). Doing systematic review requires the development of a research question, a critic analysis and a synthesis of findings and finally the use those findings to generate recommendations. Systematic reviews can in combination with expert judgment bring to surface decisions about new interventions or policy changes (Boland et al. 2013 & CEE, 2013). For the current review, the guidelines from the "Collaboration for Environmental Evidence" (CEE, 2013), together with "Doing a Systematic Review- A Student's Guide" (Boland et al. 2013) have been used.

The first step towards a systematic review is the production of a systematic map, which may be used to inform one or more systematic reviews. Accordingly, part of the review for this thesis made use of an existing systematic map about "The effectiveness of integrated farm management, organic farming and agri-environment schemes for conserving biodiversity in temperate Europe", produced by Randall and James (2012). Their method will be described briefly in the next subsection. A systematic map results from a literature search and delivers an overview of the available evidence, nature, volume and characteristics of the literature on a particular field. Systematic maps are used to narrow down (previously) open-framed questions, on the basis of the evidence available (CEE, 2013). Systematic maps are therefore used to identify and categorize relevant literature into factors that can be useful to structure systematic reviews (Randall et al. 2012). Systematic reviews and systematic maps are robust, repeatable and transparent scientific methods, which systematize the available literature on the specific topic under study (CEE, 2013).

Systematic reviews may be complemented with meta-analysis. A meta-analysis is a quantitative synthesis, which summarizes the data sets of all included studies in a weighted manner regarding their reliability and sample size in order to construct one larger data set that provides the summarized result (CEE, 2013). The meta-analysis is not required in a systematic review but can be performed if the included studies contain sufficient similar data and is sensible to combine them (Boland et al. 2013). As the objective of this thesis is to understand the motivations behind implementing ecological intensification techniques, and not to assess the effects of the several techniques, which would require dedicated searches for quantitative data for each technique, only the systematic review was conducted.

2.2 The Randall and James systematic map

"The effectiveness of integrated farm management, organic farming and agri-environment schemes for conserving biodiversity in temperate Europe - A systematic map" by Randall and James (2012), provided a comprehensive database relevant to the goals of the present thesis, hereafter designated as "database I". In particular, their literature search is focused on three main types of farming intervention: integrated farm management, organic farming, and agri-environmental schemes. Hence, as this database includes interventions for biodiversity conservation, it is considered highly relevant for studying ecological intensification, which is about biodiversity conservation and ecosystem service improvement for supporting or increasing agricultural production. The summary of the review methods used by Randall and James (2012) are summarized in table 2.1.

Table 2.1: *Summary of the methods used by Randall and James (2012).*

Searches	Online literature databases and additional web searches were performed to identify relevant literature. From each data source the first 50 hits were further examined. The search was done in English. In order to pick up all variants of farm, farming etc., the wildcard (*) was used with "farm". Search strings: -Farm*AND biodiversity; -Organic AND biodiversity; -Farm*AND (diversity or abundance) not fish; -Agri-environment*(farmland or farming) AND bird*(Farm*AND invertebrate*) not fish; -Agri-environment* AND biodiversity. Each search result was imported, saved separately and a record was made including the date of search, database name, search term, number of hits, date limits of database and notes. A final library incorporating all the separate libraries was made.
Screening articles for relevance	First all duplicates were automatically removed, then the library was searched for relevant topics by using the following inclusion criteria. Relevant subjects include some aspect of farmland biodiversity or species diversity, on all scales. The biotopes; ponds, farm woodland

	and orchards were excluded. Countries of studies included within temperate Europe were defined as no countries south of France, Switzerland Austria, Hungary and Romania and all countries west of Russia. Relevant interventions included some elements of increased farmland biodiversity; organic farming, integrated farm management, agri-environment schemes and specific options and biotopes that could be considered as part of one of these three interventions. Conventional farming was used as comparator. Outcome of relevance was considered to be studies including: any effects on organism(s) excluding bacteria, fungi and agricultural pest; measurement of biodiversity; biodiversity differences or similarities between farm types; biodiversity differences or similarities when changes on farmland performed. Any type of study investigating farmland biodiversity was considered also correlative- and manipulative studies. Excluding pure review papers, statistical models or ecology studies. Only studies published in English language were included. No applied date restriction, only the individual databases limits. To exclude irrelevant references in the initial library, filtering keywords in the title was made. The references were only screened for relevance in title and then by title and abstract, due to the high amount of relevant literature captured. References accepted were used to form a searchable database. Each stage of the screening process a record including numbers of references obtained and excluded.
Data extraction	Keywords generated from the primary question, topics reported in the subject and expert knowledge were used to describe, categorise and code the studies. The articles were categorised with: author, full reference, publication date, type of publication, length of study, country of study, spatial scale of experiment, farming system, farming intervention/prescription, biotope, organism, outcome, and experimental design. The organisms in the studies were categorised into general groups and some subgroups according to function. First the articles were coded by one reviewer then scrutinised by another.
Final database	To describe the scope of the research and identify knowledge gaps the authors created a searchable database, which can be used for further analyses. The database is available as supplementary material of the article describing the systematic map.

2.2.1 Literature retrieval from the database

From the total Randall and James (2012) database of 743 articles, 241 articles were considered relevant for inclusion in the final stage of the systematic review (Figure 2.1). The included articles were then searched for at B-on (http://www.b-on.pt), Google Scholar (https://scholar.google.pt) and a general web search, or requested directly from the author at Researchgate (https://www.researchgate.net). From the 241 articles, 168 articles were obtained and included for full-text review (Figure 2.1).

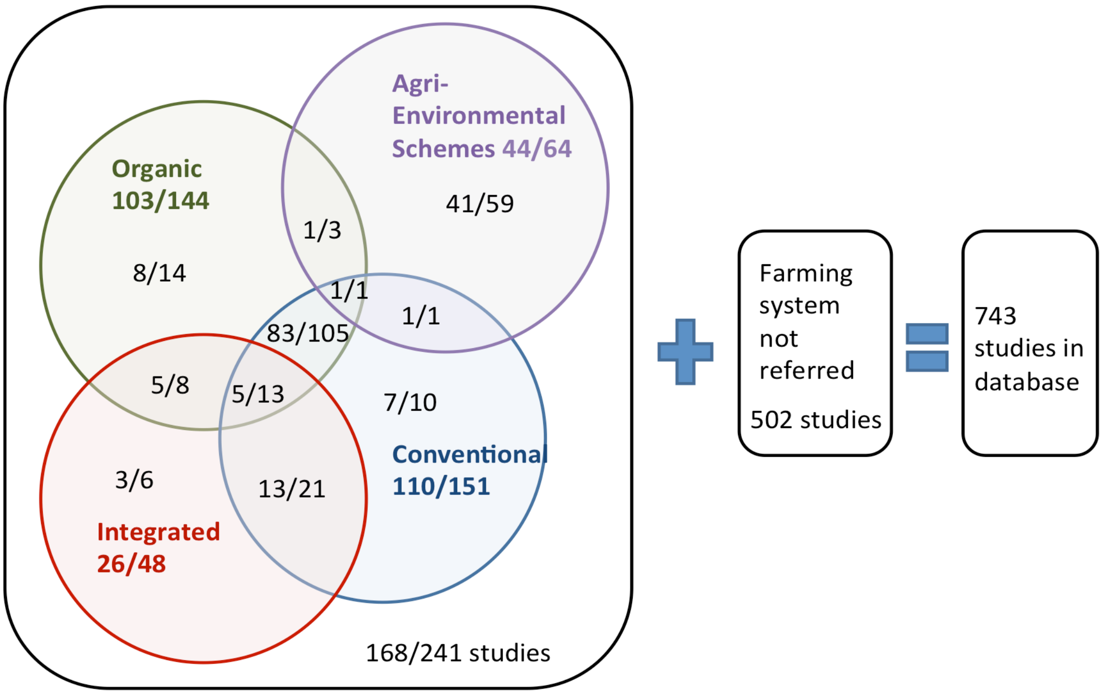

Figure 2.1: *Number of studies addressing the four agricultural intervention types in database I, each circle indicates the retrieved/initial number of selected articles.*

Articles not found in English were excluded. Also, because Randall and James (2012) focus on interventions for biodiversity conservation, a bias towards biodiversity conservation motivations may exist, so it was necessary to cover this gap by complementing with a new literature search using keywords that cover agricultural production, as described in the next section.

2.3 Complementary literature search and database

2.3.1 Search methods

As the Randall and James (2012) systematic map (database I) is about interventions for biodiversity conservation, the primary motivation of the included literature may be biased towards biodiversity conservation and less towards the effects on production. In order to cover this gap a complementary and independent search of articles was conducted, which includes both biodiversity and production related search terms. It has been decided to do the search only in B-on (http://www.b-on.pt), as this search engine includes several of online databases used by Randall and James 2012 and listed in Boland et al. 2013.

The search was performed in B-on, limited to the following disciplines: agriculture and agribusiness, biology, botanic, environmental science, economy, consumer health and zoology, and to English. The search strings (Table 2.2) were searched for in the full text and the hits were sorted by relevance.

Description of search process:

- The six searches were done 10.05.2017, with the time interval 01.01.1950- 31.04.2017, a record of the total number of hits was saved.
- Because of the high number of articles and the limited time, the first 300 articles within each search, sorted by relevance, were selected for further screening totalizing 1800 articles.
- Duplicates were removed automatically using B-on tools; the final list, after merging the six B-on searches, included 1043 articles.

Table 2.2: *Search strings and number of hits by search. Searches were conducted using B-on search engine on 10.05.17.*			
Search string	**Date limits**	**Total hits**	**Included articles**
1: Farm* AND Organic AND (product* OR yield) AND Biodiversity	01.01.1950-31.04.2017	21 526	300
2: Farm* AND Organic AND (product* OR yield) AND Biodiversity AND "Ecosystem services"	01.01.1950-31.04.2017	4010	300
3: Farm* AND Integrated AND (product* OR yield) AND Biodiversity	01.01.1950-31.04.2017	19 668	300
4: Farm* AND Integrated AND (product* OR yield) AND Biodiversity AND "Ecosystem services"	01.01.1950-31.04.2017	4820	300
5: Farm* AND Agri-environment AND (product* OR yield) AND Biodiversity	01.01.1950-31.04.2017	1 573	300
6: Farm* AND Agri-environment AND (product* OR yield) AND Biodiversity AND "Ecosystem services"	01.01.1950-31.04.2017	575	300
Total number of hits and included articles		**52172**	**1800**

2.3.2 Study inclusion criteria

The inclusion criteria used when searching for studies that include both production and biodiversity is similar to those used by Randall and James (2012), to enable the combined used of data.

Relevant subject: Studies including biodiversity or species diversity on farmland related to food production. When mentioned that the crop production is used for biofuel and not for food production, the articles are excluded. As in Randall and James (2012), all biotopes were included, except ponds, farm woodland, and orchards. Similarly, includes studies were conducted west of Russia and not south of France, Switzerland Austria, Hungary and Romania, as defined in the systematic map as temperate Europe.

Relevant interventions: Integrated farm management, Organic farming, and Agri-environmental schemes. Articles that mention conventional farming alone or together with one of the other agricultural interventions, as an overall comparator, will also be included.

Comparator: Conventional farming is included in some studies as a comparator to agri-environmental schemes, integrated management farming, and organic farming.

Type of outcome: Any measure of biodiversity, crop production or ecosystem property was considered. Effects of interventions on any organism, excluding fungi and bacteria, namely differences or similarities in biodiversity on different farm types, and differences or similarities in biodiversity following management changes on farmland were considered.

Types of study: "Any type of study that investigated biodiversity on farmland was considered, including correlative studies and manipulative studies but not pure- ecology studies, statistical models or review papers. Only primary research studies were incorporated into the final systematic map" (Randall and James, 2012).

Language: Published in English.

Date: The searches were limited to include articles in the time from 01.01.1950 to 31.04.2017.

2.3.3 Study quality assessment

In stage two, full-text assessment for inclusion the following study quality assessment was searched for:

- Clear aims
- Clear and repeatable methodology
- Outcomes that are measured accurately and reliably
- Findings reported consistently with the methodology employed and the empirical data provided

These study quality assessment criteria are adapted from Reed et al. (2014). Non-compliance with just one of the above criteria was sufficient to exclude an article from the review.

2.3.4 Screening process

The first screening was performed on title and abstract:

- Inclusion and exclusion of the 1043 articles was recorded, 4 duplicates were manually detected and removed (number of studies after this step = 1039).
- After screening title and abstract, 522 articles were included and 517 excluded.
- At this stage, there was a high barrier for exclusion, and many articles were excluded in the next stage. Typical exclusion reasons were the non-compliance with the geographic location rule (i.e., countries outside temperate Europe) and with the biotope rule (ponds, farm woodland, and orchard), as defined in the inclusion criteria, and fish or sea studies, as defined in the inclusion criteria (Table 2.1). If it was a review or a meta-analysis, ergo no primary study, this was also a reason for exclusion. Where none of the obvious reasons for exclusion was detected in the title or abstract the article was included for the next examination.

The second screening was performed on objectives and methods:

- First, the articles had to be downloaded, 10 articles were excluded because of limited access, and the total number for second stage screening was now 512. Mendeley was used for organizing the articles.
- This screening stage resulted in 164 included articles and 348 excluded articles. The systematic review stages are described in (Figure 2.2)

The third screening was performed on full text:

- 69 articles were excluded at this stage, the final number of studies included for full-text review was 95 articles. This final list will be hereafter designated as "database II" (Figure 2.2).

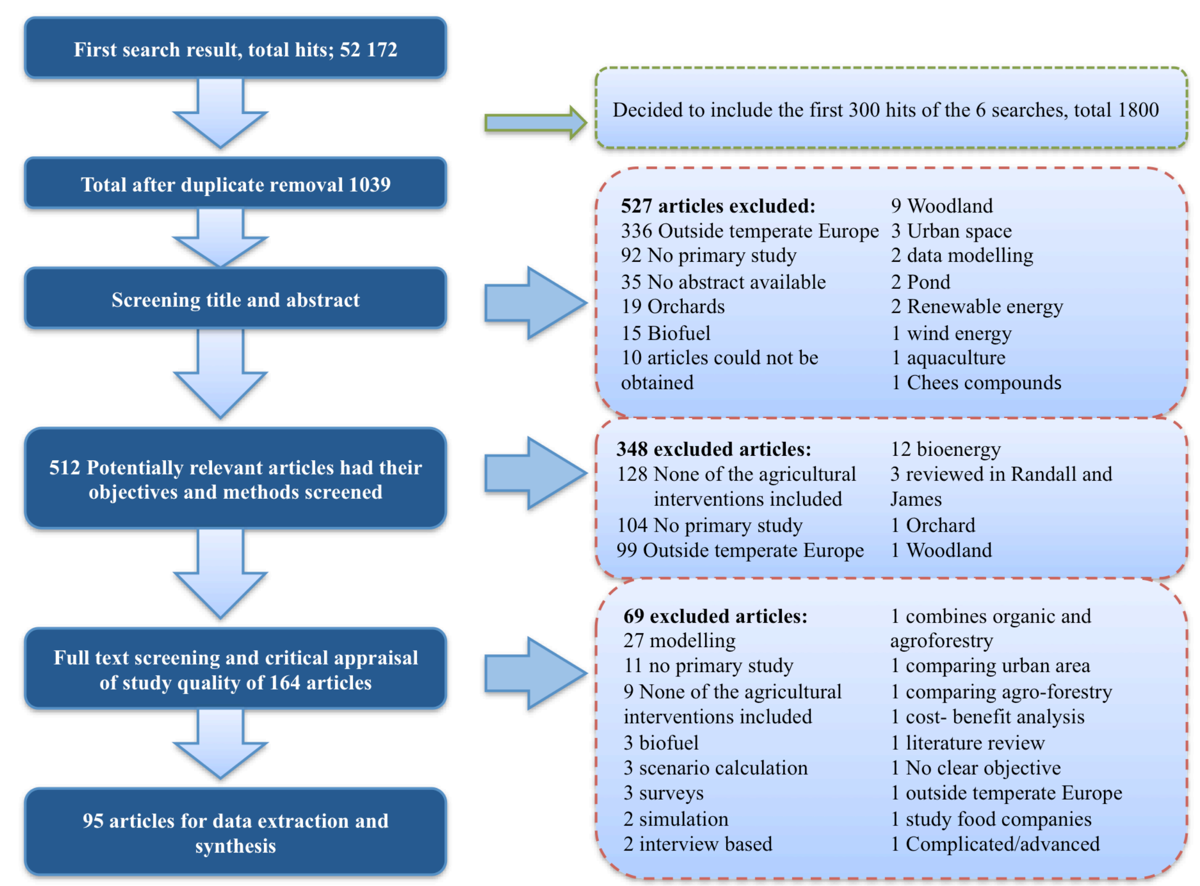

Figure 2.2: *Database II: summary of systematic review stages.*

2.4 Data extraction

The full-text review was performed on the 168 articles retrieved from database I, and on the 95 articles from database II. Some of the required data for this systematic review were already available from the supplementary material made by Randall and James (2012) and were directly included in the review table, which compiled the data to be used in data analysis. In addition, other data required for this systematic review were extracted from the studies added to the review table. In relation to the objectives, a data extraction strategy (Table 2.3) was defined and followed to ensure that all the relevant data needed for answering this thesis research questions were included as elements to be extracted from the articles in the full-text review. The full-text review of the articles in database I revealed five articles that should have been excluded by the authors because they did not meet the geographic location rule. This resulted in a total of 163 articles in database I.

Table 2.3: *Data extraction strategy.*

<table>
<tr><th colspan="2">Topic</th><th>Data extracted</th><th>Section reviewed</th></tr>
<tr><td colspan="2">Study objective</td><td>Brief description of the main objective of the study</td><td>Abstract and introduction</td></tr>
<tr><td rowspan="2">Question 1: Which of the motivations: enhanced food production or mitigation of impacts on biodiversity is the primary motivation behind the adoption of agricultural interventions (Organic farming, Integrated farm management and Agri-environmental schemes) that can make use of ecological intensification approaches?</td><td>1a: Do the interventions primarily aim to restore or conserve biodiversity to mitigate the impact of agricultural activity?</td><td>Assess motivation (Yes/No):

Biodiversity conservation is a primary concern?</td><td>Introduction</td></tr>
<tr><td>1b: Do the interventions primarily aim to enhance biodiversity to promote agricultural production?</td><td>Assess motivation (Yes/No):

a) Increase or support food production is a primary concern?

b) Food quality is a primary concern?

c) Reduce production costs through biodiversity management is a primary concern?</td><td>Introduction</td></tr>
<tr><td colspan="2">Question 2: Does the study include examples of interventions related to ecological intensification?</td><td>List any ecosystem services providing organism or landscape elements that are explicitly described as being managed to directly or indirectly enhance agricultural production</td><td>Methods and results</td></tr>
</table>

Question 3: Which ecosystem services are being associated with agricultural production?	Ecosystem service categories: Identify and list the ecosystem services related to agricultural production that are addressed by the study.	Methods and results
	Variables measured: Identify and list the variables measured in the study that are related to ecosystem services.	Methods and results
Other information	Identify the valuation method (monetary, health, yield etc.)	Methods and results
	Identify the cultivated crop (wheat etc.)	Methods
Study outcome	Briefly describe what is the primary outcome of the study relevant to the review	Abstract, results and discussion /conclusion

Data on ecosystem services was extracted from the reviewed studies using the two-level categorization model in Boerema et al. (2017; Table 1.1). Regulating services, in particular, were searched for their relevance for ecological intensification practices, namely for the potential to be enhanced by the agricultural interventions and to support agricultural production (Table 2.4).

Table 2.4: *Search terms for extracting data on regulating ecosystem services in reviewed studies. Adopted from the Boerema et al. (2017).*

Regulating service	**Search terms**
Water regulation:	Water regulation, water flow, water quantity, water retention, flood prevention/attenuation, drought prevention/attenuation
Soil quality regulation:	Soil quality, soil formation, soil fertility, nutrient cycling, decomposition, microbial processes
Soil retention:	Soil retention, erosion, soil conservation
Pollination:	Pollination
Biological control:	Biological control, pest
Climate regulation:	Climate regulation, carbon sequestration

2.5 Data synthesis and presentation

A table in excel was used to collect details of the studies included. Both general and specific data relevant to the questions were registered. Narrative synthesis and statistical testing are used to describe the extracted data, this approach has the advantage when dealing with broader questions (Boland et al. 2014), such as the question to be answered in this thesis.

2.6 Statistical testing

Chi-square tests of independence were used to test the association between the following categorical variables: agricultural intervention type, dominant motivation, the inclusion of ecological intensification and ecosystem services. Chi-square tests require the observance of the following assumptions to be considered reliable: the data need to be categorical and the variables need to consist of two or more independent groups (i.e., all observations were measured independently), expected frequencies should be higher than 5 (SPSS Tutorials, 2017). When the chi-square test indicates a statistically significant association, the Cramer's V was inspected to assess its strength (SPSS Tutorials, 2016a). Cramer's V varies between 0 and 1, with 0 meaning no association and 1 perfect association, values > 0.5 may be interpreted as a strong association, and values > 0.3 (and < 0.5) as moderate association.

SPSS was used to compute expected frequencies and compare to the observed frequencies; the test for association was considered to be statistically significant if $p < 0.05$ (2-sided asymptotic significance) (SPSS Tutorials, 2017). When there is a significant association, the residuals (i.e., the difference between observed and expected frequency) should be further investigated, namely standardized residuals. The standardized residuals are calculated z-scores which can be compared to the critical values on the scale between -1.96 and +1.96, which correspond to the alpha value of 0.05, to determine if the variable is independent or not (SPSS, 2016b). A standardized residual higher than 1.96 indicates that the association was observed more than expected by chance (i.e., overrepresented), if lower than -1.96 indicates that the association was observed less than expected by chance (i.e. underrepresented) (Logan, 2010). Values between -1.96 and 1.96 suggest that variables are independent. In some cases, the standardised residuals may have a poor fit to the standard normal distribution, not enabling the detection of significant deviations from expected frequencies. An alternative is the inspection of the adjusted residuals, which could be better for detecting variables association (Logan, 2010).

Because it is recommended that the count of observed frequencies for each pair of categories should be over 5 (and if less, for no more than 20% of cells) (SPSS Tutorials, 2017), data were aggregated in larger and meaningful groups when needed to enable statistical testing (Logan 2010). Sample size requirements were verified and satisfied for all tests.

3 Results

3.1 Main features of the reviewed literature

A total of 258 articles, 163 from the database I and 95 articles from database II, were accepted for review. The distribution of agricultural interventions in each of the databases is shown in (Figures 3.1 and 3.2). Database II shows a higher number of articles including conventional agriculture and agri-environmental schemes than studies including organic and integrated farming, whereas Database I shows a higher coverage of articles including organic farming and conventional farming. Also, as figures 3.1 and 3.2 show, most of the articles include more than one intervention.

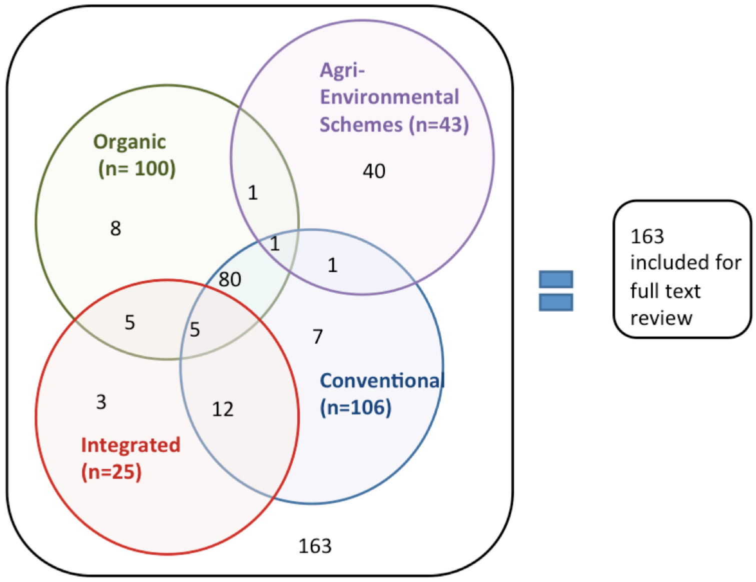

Figure 3.1: *Final number of studies per intervention in Database I.*

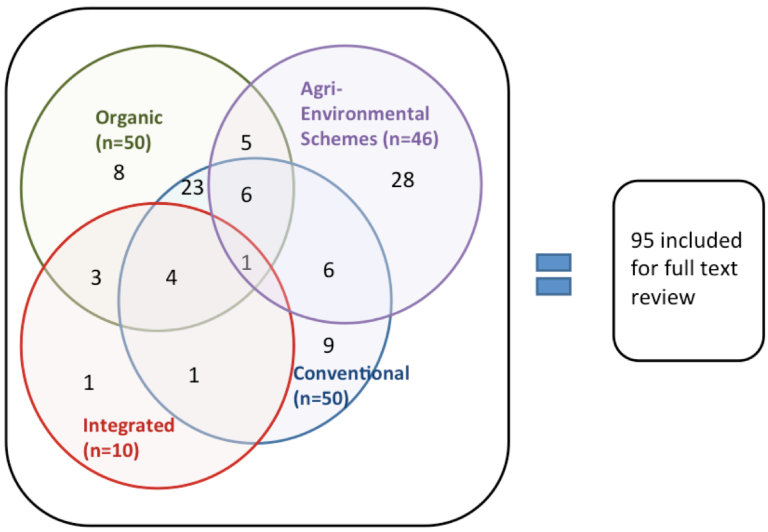

Figure 3.2: *Final number of studies per intervention in Database II.*

Reviewed articles are distributed in a time interval from 1992 to 2017 (Figure 3.3). Since Randall and James (2012) searched for articles up to 2010, references in database I are restricted to that time range, and all the articles after that year are from the database II. Even though the search for articles in database II used a time interval starting in 1950, the oldest hit is from 2007, the reason for this is probably due to sorting of search hits by relevance.

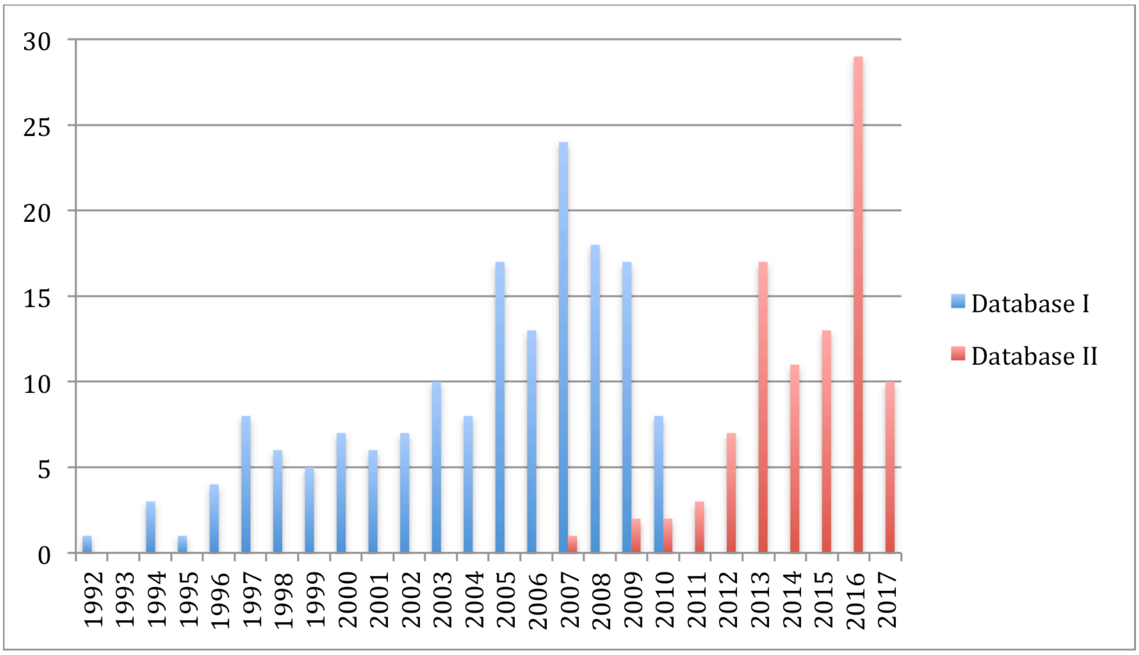

Figure 3.3 *Number of studies per year, database I and database II.*

Regarding the geographical distribution of the studies, the review database includes studies from 18 countries within temperate Europe, with the UK being the most represented country (Figures 3.4 and 3.5).

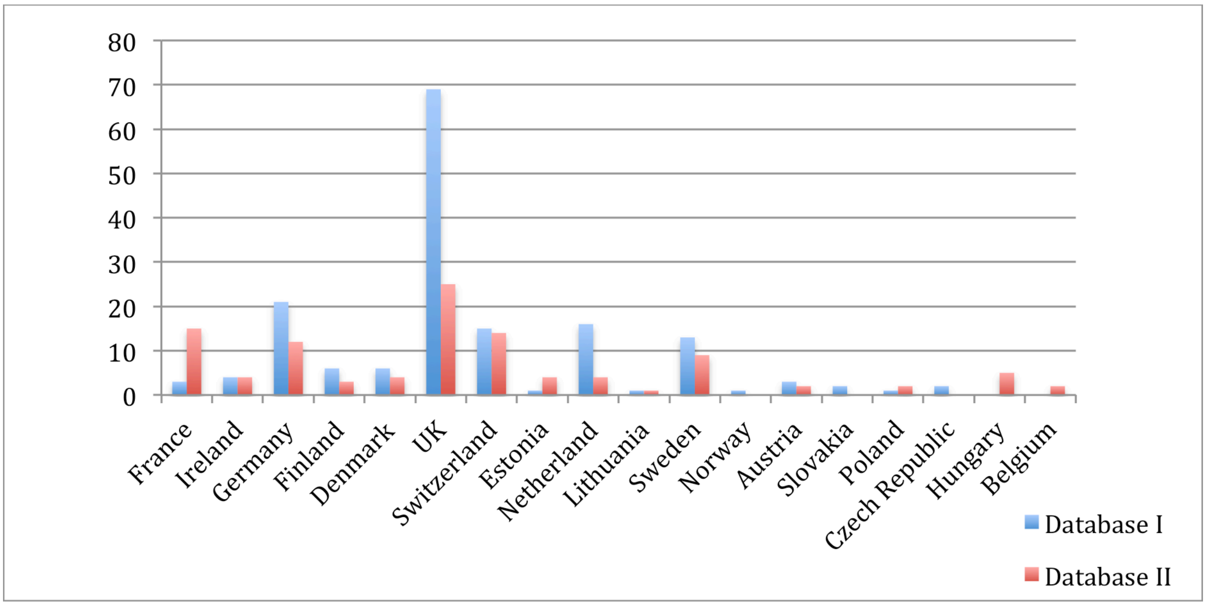

Figure 3.4: *Number of studies per country.*

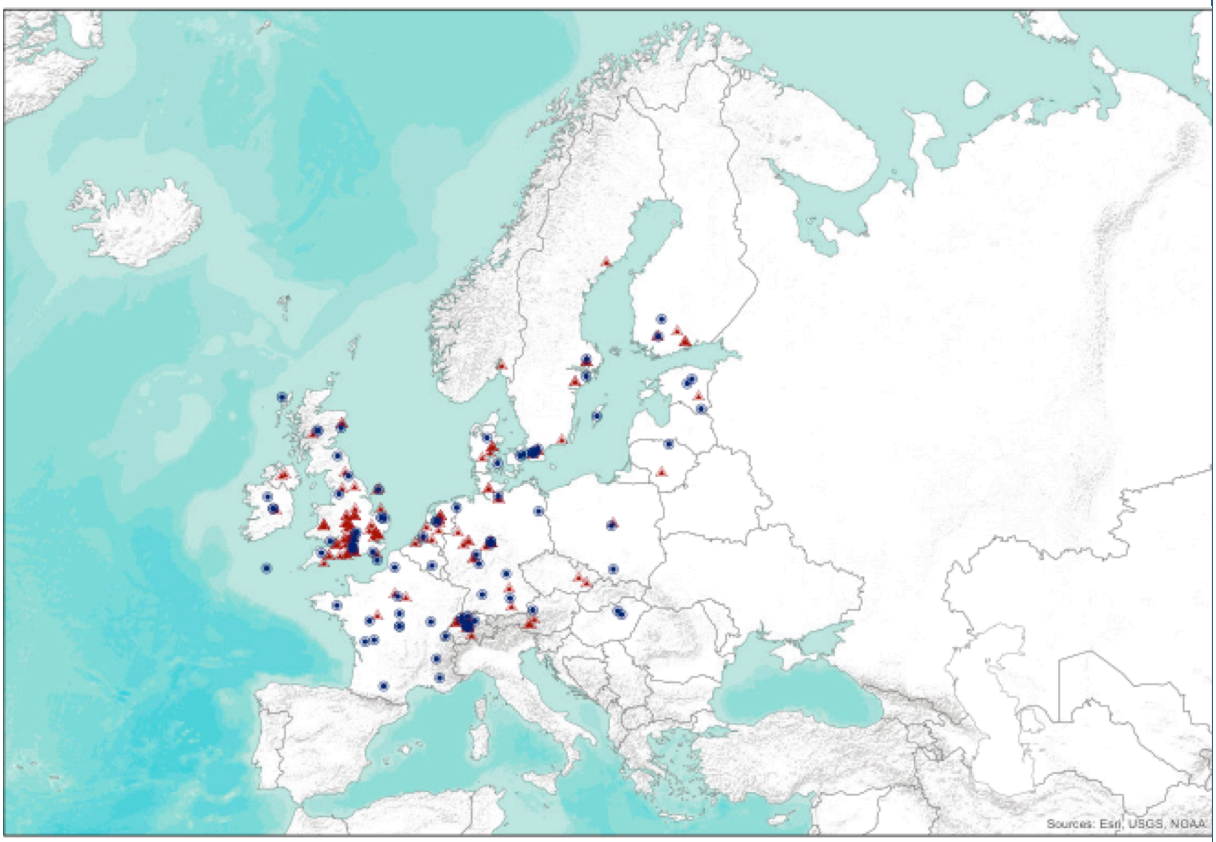

Figure 3.5: *Distribution of articles' study sites, red triangles are articles in the database I and blue dots the articles in the database II. Articles are represented by their site coordinates, 238 articles were plotted into the map, 20 articles were excluded because of insufficient coordinates or because the study was conducted at multiply countries.*

On study length size, studies ranging from 1-3 years are the most common in both databases, 52% of the articles in database I, and 40% of the articles in the database II (only including studies with known lengths). In database II there is also a high number of short-term studies, of less than 1 year. Moreover, in the database I there is a high number of articles with unknown study length, as much as 54 % of the total included articles.

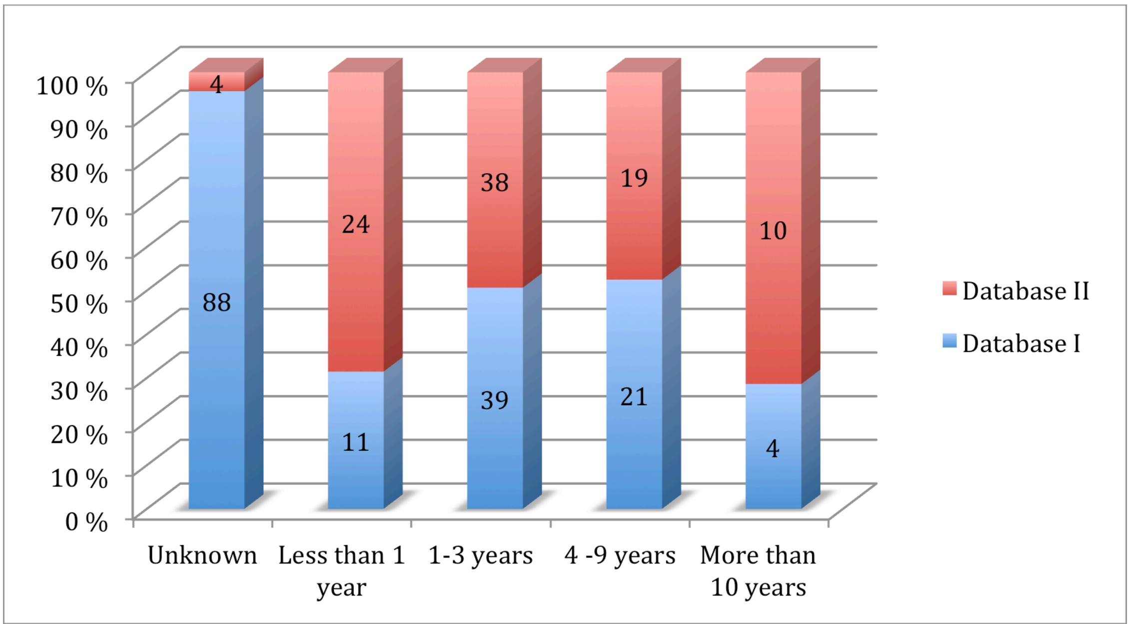

Figure 3.6: *Distribution of study length in reviewed literature. Colours show the proportion of studies from each database in each length category, the absolute number of studies is also indicated in the bars.*

The frequency of ecosystem services sub-categories in reviewed articles is presented in Table 3.1. The majority of studies (132) only referred to regulating services, followed by 57 studies that only referred to cultural services, and provisioning services alone were found in 13 studies. The remaining cases are combinations of regulating services together with provisioning or cultural service.

Table 3.1: Ecosystem services; main and sub categories in reviewed studies.		
NO 3		3
Regulating 132	Biological Control	51
	Biological Control and Pollination	26
	Biological Control and Soil Quality Regulation	11
	Biological Control, Pollination and Soil Quality regulation	1
	Biological Control, Pollination, Soil quality regulation and water regulation	2
	Soil quality regulation	25
	Soil quality regulation and pollination	2
	Soil quality regulation and water regulation	3
	Soil quality regulation, water regulation and climate regulation	1
	Pollination	10
Cultural 57	Heritage, Cultural, Bequest, Inspirational & art	56
	Heritage, Cultural, Bequest, Inspirational& art and Scientific & Educational Services	1
Regulating and Cultural 35	Biological control and Heritage, Cultural Bequest, Inspiration & art	13
	Biological control, pollination and heritage, cultural, bequest, inspiration & art	12
	Pollination, and Heritage, Cultural, Bequest, Inspirational & art	5
	Soil quality regulation and Heritage, Cultural, Bequest, Inspiration & Art	3
	Soil quality regulation, biological control and Heritage, Cultural, Bequest, Inspiration & Art	2
Provisioning 13	Food production	13
Regulating and provisioning 18	Biological control and food production	4
	Biological control, Climate regulation, air quality regulation, water purification and food production	1
	Biological control, Climate regulation, soil quality regulation and food production	1
	Biological control, Soil quality Regulation and food production	1
	Climate regulation and food production	1
	Pollination and food production	1
	Soil quality regulation and Food production	7
	Soil quality regulation, Water regulation, and food production	2
Total 258	**Total sub categories**	**258**

3.2 Motivation for the interventions

Question 1: Which of the motivations: enhanced food production or mitigation of impacts on biodiversity is the primary motivation behind the adoption of agricultural interventions, Organic farming, Integrated farm management and Agri-environmental schemes that can make use of ecological intensification approaches?

As figure 3.1 and 3.2 shows, the articles could be representing more than one agricultural intervention. Table 3.2 shows the aggregated groups used in chi-square testing. Because conventional farming is used as a comparator in studies, including other types of intervention, studies including conventional farming and another type of intervention were classified under that intervention type. Due to the small sample of integrated farming management studies, these were aggregated with organic farming studies. Group 4, comprises studies including AES, organic farming, integrated farming management and/or conventional farming. This group was not considered in the chi-test analysis.

***Table 3.2:** Groups of agricultural interventions*

Group 1: Agri-environmental Schemes		Group 2: Organic/ Integrated farming		Group 3: Conventional farming		Group 4: Other combinations		Total
AES	68	Conventional, Integrated	13	Conventional	16	Organic, AES	6	
Conventional, AES	7	Integrated	4			Organic, conventional, AES	7	
		Organic	16			Organic, Conventional, Integrated, AES	1	
		Organic, conventional	103					
		Organic, conventional, Integrated	9					
		Organic, Integrated	8				14	
Total:	**75**		**153**		**16**			**244**

When analysing all studies, the main motivation for the evaluation of agricultural interventions was to assess their impact on biodiversity (Figure 3.7). Most studies (172) were motivated by the assessment of agriculture impacts on biodiversity, and 86 studies also revealed reasons motivated by food production.

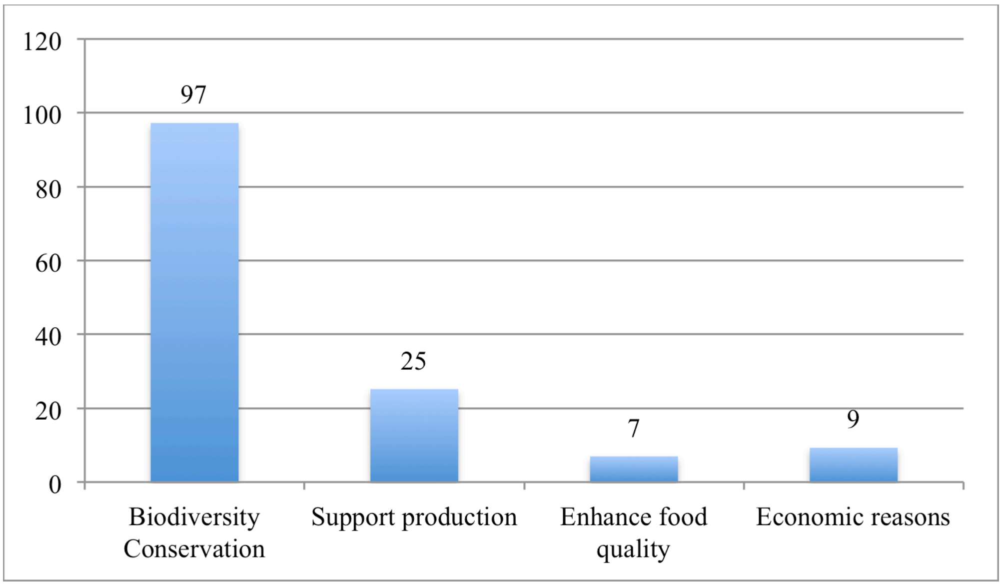

Figure 3.7: *Percentage of studies motivated by biodiversity conservation and by reasons related to food production.*

Among reviewed studies "Biodiversity Conservation" (i.e., mitigation of impact of agricultural practices and/or conservation enhancement) was the most frequent motivation alone (Table 3.3, Figure 3.8). While, only seven studies were motivated by production reasons alone. For chi-square testing, these studies were grouped with studies concerned both with food production and with biodiversity conservation and compared with studies only focusing in biodiversity conservation. Table 3.3 shows the division of studies by main motivation.

Table 3.3: *Groups of main motivations.*

Production & Biodiversity Conservation		**Biodiversity Conservation (only)**		
Support production	2	Biodiversity Conservation	172	
Enhance food quality	2			
Support production & enhance food quality	3			
Biod. Conservation & Support production	43			
Biod. Conservation & Enhance food quality	3			
Biod. Conservation & Economic reasons	16			
Biod. Conservation & Support production & Enhance food quality	9			
Biod. Conservation & Support production & Economic reasons	7			
Biod. Conservation & Support production & Enhance food quality & Economic reasons	1			
Total	**86**		**172**	**258**

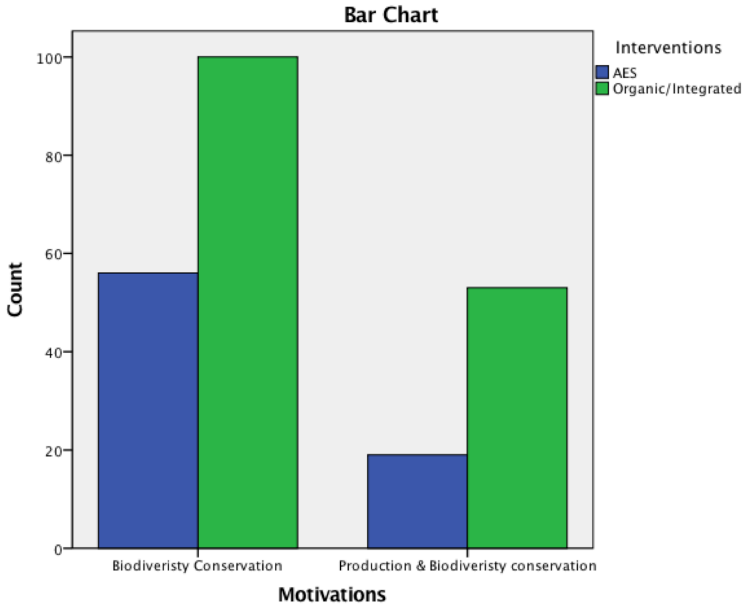

Figure 3.8: *Number of studies per agricultural intervention within the two motivations.*

The chi-square test result (chi-square (1, 228) = 2.018 and p = 0.155; Cramer's V = 0.094), tells there is no association between the main motivation for the use of the intervention and the type of agricultural intervention. The observed and expected counts and residuals for this test are presented in Table 3.4.

Table 3.4: *Observed and expected counts and chi-square test residuals on the association between types of motivation and intervention.*

			Interventions		
			AES	Organic/ Integrated	Total
Motivations	Biodiversity Conservation	Count	56	100	156
		Expected Count	51,3	104,7	156,0
		% within Motivations	35,9%	64,1%	100,0%
		% within Interventions	74,7%	65,4%	68,4%
		% of Total	24,6%	43,9%	68,4%
		Residual	4,7	-4,7	
		Standardized Residual	,7	-,5	
		Adjusted Residual	1,4	-1,4	
	Production & Biodiversity conservation	Count	19	53	72
		Expected Count	23,7	48,3	72,0
		% within Motivations	26,4%	73,6%	100,0%
		% within Interventions	25,3%	34,6%	31,6%
		% of Total	8,3%	23,2%	31,6%
		Residual	-4,7	4,7	
		Standardized Residual	-1,0	,7	
		Adjusted Residual	-1,4	1,4	
Total		Count	75	153	228
		Expected Count	75,0	153,0	228,0
		% within Motivations	32,9%	67,1%	100,0%
		% within Interventions	100,0%	100,0%	100,0%
		% of Total	32,9%	67,1%	100,0%

3.3 Ecological intensification in reviewed studies

Question 2: Does the study include examples of interventions related to ecological intensification?

Only 25% of the reviewed studies included examples of management practices related to ecological intensification (Figure 3.9).

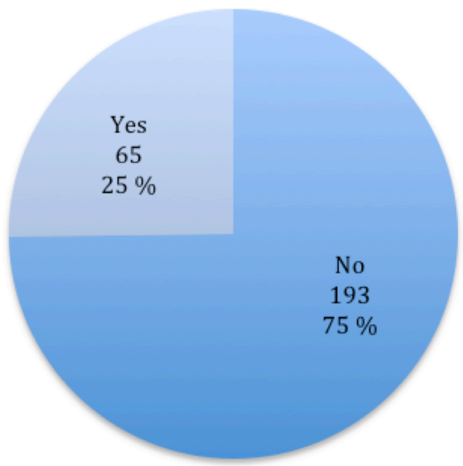

Figure 3.9: *Examples of ecological intensification.*

The frequencies of ecosystem services, interventions and motivation in this group of 65 studies are represented in figure 3.10. Production combined with biodiversity concerns was the most frequent type of motivation, while organic farming / integrated farming management the most represented agricultural intervention and regulating services (only) were the most represented ecosystem services.

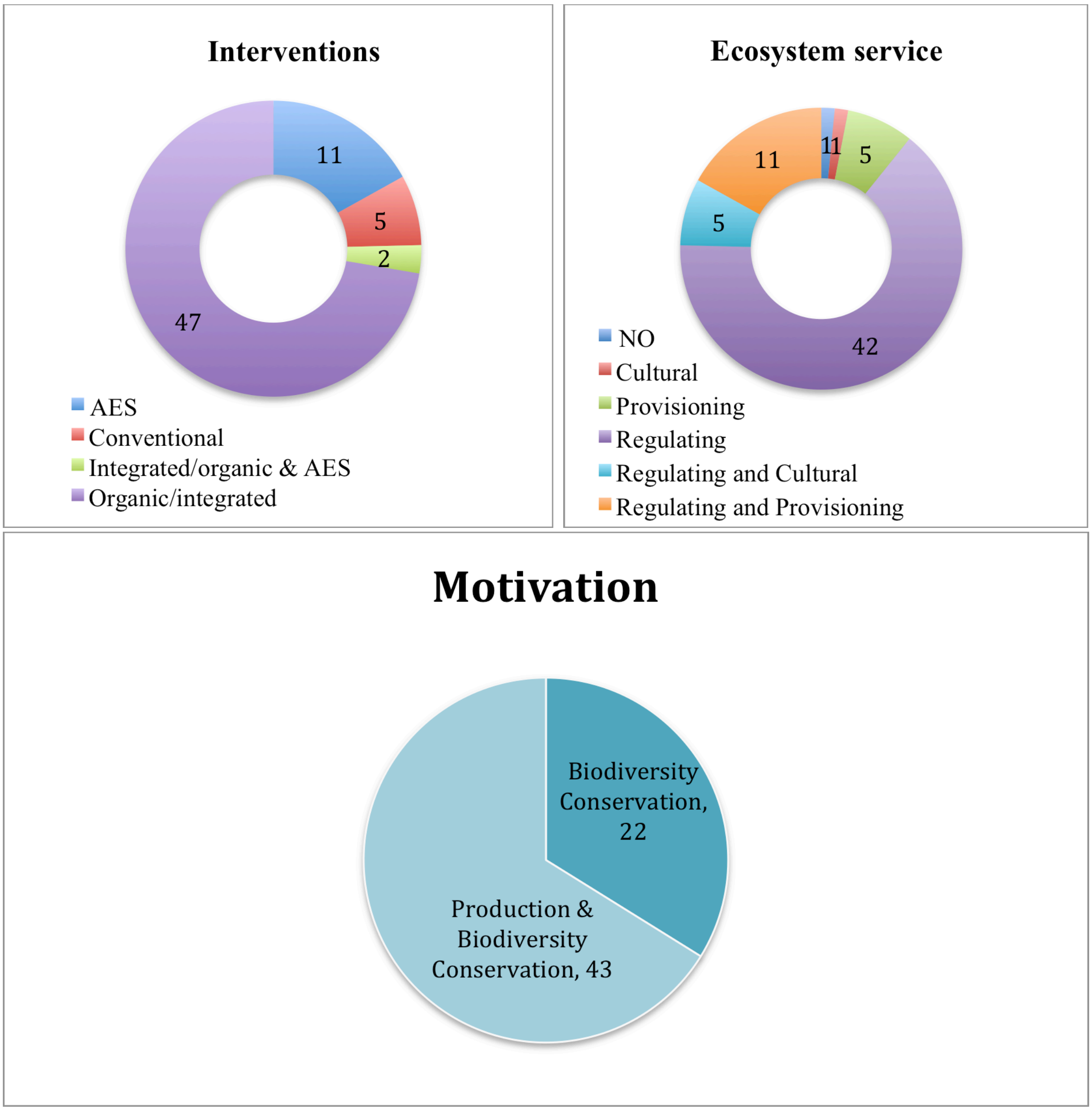

Figure 3.10: *Distribution of agricultural intervention, ecosystem sevices and motivation within articles explicity including ecological intensification practices.*

Among the 172 studies exclusively motivated by biodiversity conservation only 20 studies included examples of ecological intensification, and most of these assessed organic or integrated farming interventions (Figure 3.11). On the other hand, among the 86 studies motivated by both biodiversity conservation and production concerns half included examples of ecological intensification practices, and most of these also assessed organic or integrated farming interventions (Figure 3.11).

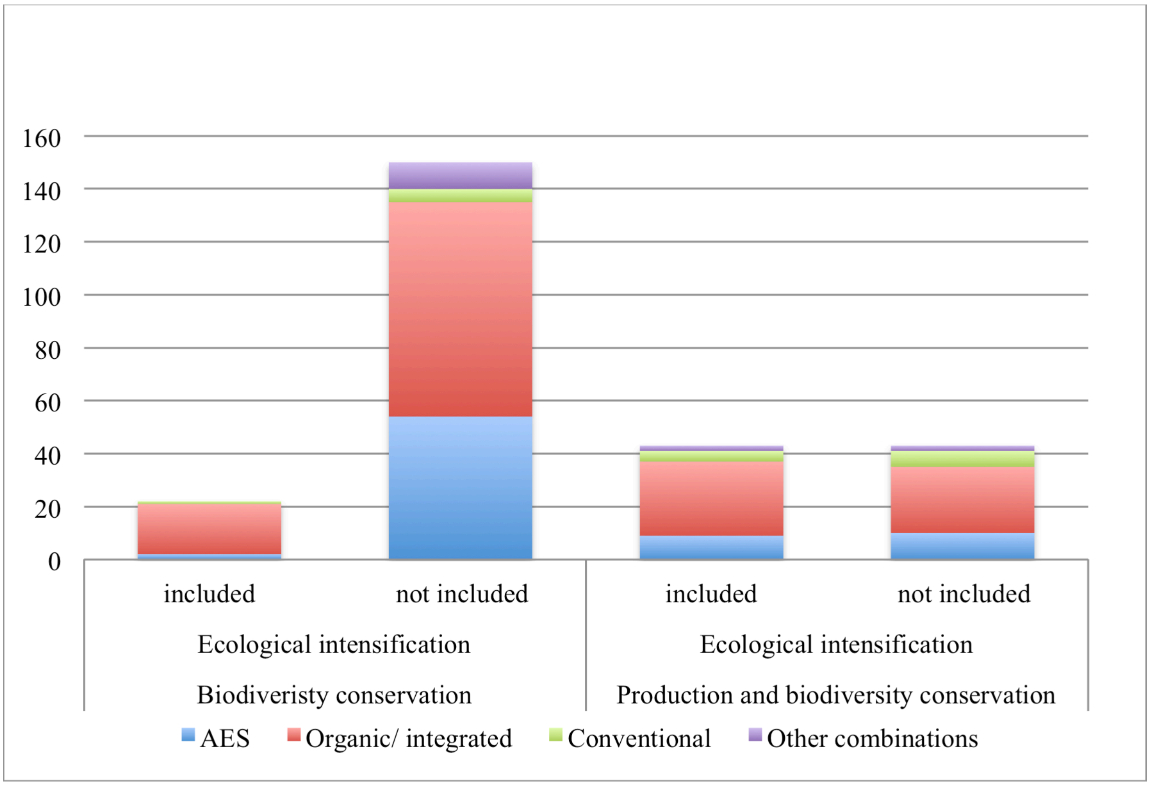

Figure 3. 11: *Relative frequency of agricultural intervention types in groups of studies including, or not, examples of ecological intensification and divided by dominant motivation.*

3.3.1 Association between inclusion of ecological intensification and agricultural interventions

Chi-square test results (chi-square (1, 228) = 6,837 and p = 0.009; Cramer's V = 0.173) indicate a statistically significant association between the explicit description of ecological intensification practices in studies and type of assessed agricultural intervention.

The adjusted residuals in Table 3.5, suggest that the inclusion of ecological intensification is underrepresented in studies assessing agri-environmental schemes and overrepresented in studies assessing organic and integrated farming practices. Opposite results for the articles not including ecological intensification confirm this pattern of association (Table 3.5).

Table 3.5: *Observed and expected counts and chi-square test residuals on the association between ecological intensification and interventions.*

			Interventions		
			AES	Organic/ Integrated	Total
Ecological intensification	Included	Count	11	47	58
		Expected Count	19,1	38,9	58,0
		% within Ecological int.	19,0%	81,0%	100,0%
		% within Interventions	14,7%	30,7%	25,4%
		% of Total	4,8%	20,6%	25,4%
		Residual	-8,1	8,1	
		Standardized Residual	-1,8	1,3	
		Adjusted Residual	**-2,6**	**2,6**	
	Not included	Count	64	106	170
		Expected Count	55,9	114,1	170,0
		% within Ecological int.	37,6%	62,4%	100,0%
		% within Interventions	85,3%	69,3%	74,6%
		% of Total	28,1%	46,5%	74,6%
		Residual	8,1	-8,1	
		Standardized Residual	1,1	-,8	
		Adjusted Residual	**2,6**	**-2,6**	
Total		Count	75	153	228
		Expected Count	75,0	153,0	228,0
		% within Ecological int.	32,9%	67,1%	100,0%
		% within Interventions	100,0%	100,0%	100,0%
		% of Total	32,9%	67,1%	100,0%

Considering the ecological intensification management practices represented in Figure 1.1, Table 3.10 gives examples from reviewed studies that represent these practices within the different agricultural interventions. Organic and integrated farming are also options within the agri-environmental schemes and conventional farming could choose options within the schemes to improve biodiversity, examples in Table 3.10 could be representing more than one intervention. Agri-environmental schemes are mostly represented by methods for the enhancement or restoration of non-crop plant biodiversity, like flowering grasslands, field margins or restoration of hedgerows, which all make an important part of the agricultural landscape. All ecological intensification practices could be linked to organic farming, while integrated farm management, lacked examples of articles within manure and residue addition, set-aside or fallow, increased quantity/quality of semi-natural habitats. This is not a surprise as this type of intervention is more linked to the control of diseases, pests, and weeds.

Table 3.6: *Examples of articles including ecological intensification management distributed within the agricultural interventions.*

	AES	**Organic**	**Integrated**
Integrated Pest Management		“Preserving biodiversity for spatiotemporal insurance for important ecosystem services such as biological control may be critical for coping with environmental changes in the future". Oberg et al. (2007).	”In cereal crops, aphids are one of the most important pests and decrease yield”. Holland et al. (1997).
Conservation Tillage		“It is considered important to find tillage methods, which promote the highest possible productivity while causing minimum damage to the microflora and fauna in the soil”. Petersen, (2002)	”Exploit the natural biotic mechanisms that maintain soil structure, fertility and dranage, and help to regulate and control pest, diseases and weeds”. Hutcheon et al. (2001)
Manure and residue addition		“Organic farming addresses many of these attributes and makes major use of the biological regulation mechanisms to replace external inputs while preserving biodiversity, one of the fundamental principles in ecological intensification”. Doltra et al. (2013).	
Mixed cropping	“Restoration of ecosystem services. Plant and invertebrates functional service affects in agro ecosystems and	“inter and intra-specific crop diversity to increase and stabilize crop yield via e.g improved pest control”. Chateil et al. (2013).	

	production". Pywell et al. (2011)		
Diversified crop rotation and cover crops		"These ecosystem services are important in sustaining soil fertility and stabilizing crop rotation yields especially in low input farming". Moos et al. (2016).	"Pest management that encourage predatory arthropods for ensuring a sufficient level of pest control is achieved by natural enemies." Holland et al. (1998)
Set-aside or fallow	"These agroecosystems and agricultural landscapes provide important soil related ecosystem services, i.e. the maintenance of soil fertility and structural properties, filtering and providing a reservoir for water, nutrient cycling and climate regulation". Tóth et al. (2016).	"Invertebrates provide several important ecosystem services (pollination, biological control) or support them as is the case with chick food". Holland et al. (2014)	
Increasing quantity of seminatural habitats	"Invertebrates are key ecosystem services providers in agro-ecosystems, maintaining soil fertility and providing natural pest control." Blake, (2013)	"A greater emphasis on naturally occurring predators and parasitoids is necessary to reduce reliance on synthetic insecticides." Macfadyen et al. (2009)	
Increasing quality of seminatural habitats	"Bumblebees play a key role within agricultural systems, providing a pollination service that can increase yields of many flowering crops." Lye et al. (2009).	" High proportions of natural, semi natural, or non-crop habitats in agricultural landscapes have been shown to enhance diversity, offspring production and ecosystem services in non-crop habitats and in crop systems at the landscape scale." Holzschuh et al. (2008).	

3.3.2 Association between inclusion of ecological intensification and type of motivation

Among the reviewed literature, there was a majority of studies exclusively motivated by biodiversity conservation and which do not include examples of ecological intensification (Figure 3.11). Chi-square test results (chi-square (1,258) = 42.119 and p = 0.000; Cramer's V = 0.404) indicate a statistically significant association between the explicit description of ecological intensification practices in studies and type of motivation. The adjusted residuals show that studies motivated by biodiversity conservation include less ecological intensification examples than expected by chance. In contrast, studies also motivated by production concerns tend to include more examples of ecological intensification than expected by chance (Table 3.7).

Table 3.7: *Observed and expected counts and chi-square test residuals on the association between types of motivation and ecological intensification.*

			Ecological intensification		
			Included	Not included	Total
Motivation	Biodiversity Conservation	Count	22	150	172
		Expected Count	43,3	128,7	172,0
		% within Motivation	12,8%	87,2%	100,0%
		% within Ecological intensification	33,8%	77,7%	66,7%
		% of Total	8,5%	58,1%	66,7%
		Residual	-21,3	21,3	
		Standardized Residual	-3,2	1,9	
		Adjusted Residual	**-6,5**	**6,5**	
	Production & Biodiversity conservation	Count	43	43	86
		Expected Count	21,7	64,3	86,0
		% within Motivation	50,0%	50,0%	100,0%
		% within Ecological intensification	66,2%	22,3%	33,3%
		% of Total	16,7%	16,7%	33,3%
		Residual	21,3	-21,3	
		Standardized Residual	4,6	-2,7	
		Adjusted Residual	**6,5**	**-6,5**	
Total		Count	65	193	258
		Expected Count	65,0	193,0	258,0
		% within Motivation	25,2%	74,8%	100,0%
		% within Ecological intensification	100,0%	100,0%	100,0%
		% of Total	25,2%	74,8%	100,0%

3.3.3 Association between inclusion of ecological intensification and ecosystem services

The ecosystem services were merged into four groups for testing the association between the inclusion of ecological intensification and the coverage of ecosystem services by reviewed studies. The first group comprises studies that only refer to regulating services, this group includes most of studies. The second group includes studies that only refer cultural services. The third group includes studies that cover both regulating and cultural services. The fourth group includes studies covering provisioning services alone and provisioning and regulating services, these studies were merged into a single group to increase sample size (Figure 3.8).

Table 3.8: *Groups of ecosystem services.*

Group	Ecosystem service	Number of studies
1	Regulating	132
2	Cultural	57
3	Regulating and Cultural	35
4	Provisioning	13
	Regulating and provisioning	18
	Total	**255**

Chi-square test results (chi-square (3, 255) = 33.464 and p= 0.000; Cramer's V = 0.362) indicate a statistically significant association between explicit description of ecological intensification and ecosystem service.

Looking at the relationship between ecosystem services and ecological intensification, studies only covering cultural ecosystem services are less related to ecological intensification practices than expected by chance, and studies covering both regulating and provisioning ecosystem services are more related than expected by chance (table 3.9). Also, among articles not mentioning ecological intensification, cultural ecosystem services are represented more than expected by chance and less represented are regulating and provisioning ecosystem services.

Table 3.9: *Observed and expected counts and chi-square test residuals on the association between ecological intensification and ecosystem services.*

			Ecosystem services				
			Cultural (only)	Regulating (only)	Regulating and Cultural	Regulating and Provisioning	Total
Ecological intensification	Included	Count	1	42	5	16	64
		Expected Count	14,3	33,1	8,8	7,8	64,0
		% within Eco.Int.	1,6%	65,6%	7,8%	25,0%	100,0%
		% within Eco.Ser.	1,8%	31,8%	14,3%	51,6%	25,1%
		% of Total	0,4%	16,5%	2,0%	6,3%	25,1%
		Residual	-13,3	8,9	-3,8	8,2	
		Stand. Res	-3,5	1,5	-1,3	2,9	
		Adj. Res.	**-4,6**	**2,6**	-1,6	**3,6**	
	Not included	Count	56	90	30	15	191
		Expected Count	42,7	98,9	26,2	23,2	191,0
		% within Eco.Int.	29,3%	47,1%	15,7%	7,9%	100,0%
		% within Eco.Ser.	98,2%	68,2%	85,7%	48,4%	74,9%
		% of Tot.	22,0%	35,3%	11,8%	5,9%	74,9%
		Residual	13,3	-8,9	3,8	-8,2	
		Stand. Res	2,0	-,9	,7	-1,7	
		Adj. Res.	**4,6**	**-2,6**	1,6	**-3,6**	
Total		Count	57	132	35	31	255
		Expected Count	57,0	132,0	35,0	31,0	255,0
		% within Eco.Int.	22,4%	51,8%	13,7%	12,2%	100,0%
		% within Eco.Ser.	100,0%	100,0%	100,0%	100,0%	100,0%
		% of Total	22,4%	51,8%	13,7%	12,2%	100,0%

3.4 Differences in studies including/or not including ecological intensification

To take a closer look at the difference between the articles that included ecological intensification and those that did not, the dataset was divided and new tests were performed for the 65 articles including ecological intensification and for the 193 articles not including. As recommended, the categories with small sample size were merged to form bigger groups (Logan, 2010). The following groups were used, for the interventions: AES, organic and integrated farming; for the motivations: biodiversity conservation (only), and production & biodiversity conservation; and for the ecosystem services: regulating services (only), and other combinations (i.e., regulating and other category of services, or - only for studies not including ecological intensification - cultural services alone). Despite data aggregation, some cell counts were still small (i.e., < 5) to be used in chi-square testing, in those cases the recommendation is to use the Fisher's exact test (Logan, 2010). Three articles with no registered ecosystem services were removed from the analyses.

3.4.1 Association between motivation and agricultural intervention in studies including ecological intensification

Fisher's exact test results (Fisher's exact test = 0.296) indicate no association between the main motivation for the use of the intervention and the type of agricultural intervention within articles explicitly mentioning ecological intensification. The observed and expected counts and residuals for this test are presented in Table 3.10.

Table 3.10: *Observed and expected counts and chi-square test residuals on the association between types of motivation and intervention within articles including ecological intensification.*

			Intervention		
			AES	Organic/ Integrated	Total
Motivation	Biodiversity Conservation	Count	2	19	21
		Expected Count	4,0	17,0	21,0
		% within Motivation	9,5%	90,5%	100,0%
		% within Intervention	18,2%	40,4%	36,2%
		% of Total	3,4%	32,8%	36,2%
		Residual	-2,0	2,0	
		Standardized Residual	-1,0	,5	
		Adjusted Residual	-1,4	1,4	
	Production & Biodiversity conservation	Count	9	28	37
		Expected Count	7,0	30,0	37,0
		% within Motivation	24,3%	75,7%	100,0%
		% within Intervention	81,8%	59,6%	63,8%
		% of Total	15,5%	48,3%	63,8%
		Residual	2,0	-2,0	
		Standardized Residual	,7	-,4	
		Adjusted Residual	1,4	-1,4	
Total		Count	11	47	58
		Expected Count	11,0	47,0	58,0
		% within Motivation	19,0%	81,0%	100,0%
		% within Intervention	100,0%	100,0%	100,0%
		% of Total	19,0%	81,0%	100,0%

3.4.2 Association between ecosystem services and agricultural intervention in studies including ecological intensification

Fisher's exact test results (Fisher's exact test = 0.487), indicates no association between the main motivation for the use of the intervention and the type of agricultural intervention. The observed and expected counts and residuals for this test are presented in Table 3.11.

***Table 3.11:** Observed and expected counts and chi-square test residuals on the association between ecosystem services and intervention within articles including ecological intensification.*

			Intervention		
			AES	Organic/ Integrated	Total
Ecosystem Services	Regulating (only)	Count	6	32	38
		Expected Count	7,2	30,8	38,0
		% within Eco.Services	15,8%	84,2%	100,0%
		% within Intervention	54,5%	68,1%	65,5%
		% of Total	10,3%	55,2%	65,5%
		Residual	-1,2	1,2	
		Standardized Residual	-,4	,2	
		Adjusted Residual	-,9	,9	
	Regulating and other	Count	5	15	20
		Expected Count	3,8	16,2	20,0
		% within Eco.Services	25,0%	75,0%	100,0%
		% within Intervention	45,5%	31,9%	34,5%
		% of Total	8,6%	25,9%	34,5%
		Residual	1,2	-1,2	
		Standardized Residual	,6	-,3	
		Adjusted Residual	,9	-,9	
Total		Count	11	47	58
		Expected Count	11,0	47,0	58,0
		% within Eco.Services	19,0%	81,0%	100,0%
		% within Intervention	100,0%	100,0%	100,0%
		% of Total	19,0%	81,0%	100,0%

3.4.3 Association between ecosystem services and motivation in studies including ecological intensification

Fisher's exact test results (Fisher's exact = 0.004; Cramer's V = 0.396) indicate a statistically significant association between motivation and ecosystem service within the articles including ecological intensification.

More specifically, results for adjusted residuals indicate an association between motivation and the ecosystem services covered by the study. Studies only motivated by biodiversity conservation are often limited to regulating services while studies motivated by both biodiversity conservation and production concerns address other ecosystem service categories in addition to regulating services, such as provisioning ecosystem services (Table 3.12).

***Table 3.12:** Observed and expected counts and chi-square test residuals on the association between types of motivation and ecosystem services within articles including ecological intensification.*

			Ecosystem Services		
			Regulating (only)	Regulating and other	Total
Motivation	Biodiversity Conservation	Count	19	2	21
		Expected Count	13,8	7,2	21,0
		% within Motivation	90,5%	9,5%	100,0%
		% within Eco.Services	50,0%	10,0%	36,2%
		% of Total	32,8%	3,4%	36,2%
		Residual	5,2	-5,2	
		Stand.Residual	1,4	-1,9	
		Adjusted Residual	**3,0**	**-3,0**	
	Production & Biodiversity conservation	Count	19	18	37
		Expected Count	24,2	12,8	37,0
		% within Motivation	51,4%	48,6%	100,0%
		% within Eco.Services	50,0%	90,0%	63,8%
		% of Total	32,8%	31,0%	63,8%
		Residual	-5,2	5,2	
		Stand.Residual	-1,1	1,5	
		Adjusted Residual	**-3,0**	**3,0**	
Total		Count	38	20	58
		Expected Count	38,0	20,0	58,0
		% within Motivation	65,5%	34,5%	100,0%
		% within Eco.Services	100,0%	100,0%	100,0%
		% of Total	65,5%	34,5%	100,0%

3.4.4 Association between motivation and agricultural intervention in studies not including ecological intensification

Chi-square test results (chi-square (1, 168) = 1.319 and p = 0.251) indicate that there is no statistically significant association between the main motivation for the use of the intervention and the type of agricultural intervention within articles not including ecological intensification. The observed and expected counts and residuals for this test are presented in Table 3.13.

Table 3.13: *Observed and expected counts and chi-square test residuals on the association between types of motivation and intervention within articles not including ecological intensification.*

			Interventions		
			AES	Organic/ Integrated	Total
Motivation	Biodiversity Conservation	Count	52	81	133
		Expected Count	49,1	83,9	133,0
		% within Motivation	39,1%	60,9%	100,0%
		% within Interventions	83,9%	76,4%	79,2%
		% of Total	31,0%	48,2%	79,2%
		Residual	2,9	-2,9	
		Standardized Residual	,4	-,3	
		Adjusted Residual	1,1	-1,1	
	Production & Biodiversity conservation	Count	10	25	35
		Expected Count	12,9	22,1	35,0
		% within Motivation	28,6%	71,4%	100,0%
		% within Interventions	16,1%	23,6%	20,8%
		% of Total	6,0%	14,9%	20,8%
		Residual	-2,9	2,9	
		Standardized Residual	-,8	,6	
		Adjusted Residual	-1,1	1,1	
Total		Count	62	106	168
		Expected Count	62,0	106,0	168,0
		% within Motivation	36,9%	63,1%	100,0%
		% within Interventions	100,0%	100,0%	100,0%
		% of Total	36,9%	63,1%	100,0%

3.4.5 Association between ecosystem services and agricultural intervention in studies not including ecological intensification

Chi-square test results (chi-square (1, 168) = 8.776 and p = 0.003; Cramer's V = 0.229) indicate a statistically significant association between ecosystem services and agricultural interventions within those articles not including ecological intensification.

To detect the nature of the association indicated above, the adjusted residuals were used. Among the studies not including ecological intensification examples, the studies about AES tend to cover other ecosystem services, in particular, cultural services (table 3.14). In contrast, organic and integrated farming studies tend to focus exclusively on regulating services.

Table 3.14: *Observed and expected counts and chi-square test residuals on the association between ecosystem services and intervention within articles not including ecological intensification.*

			Interventions		
			AES	Organic/ Integrated	Total
Ecosystem service	Regulating (only)	Count	21	61	82
		Expected Count	30,3	51,7	82,0
		% within Ecosystem service	25,6%	74,4%	100,0%
		% within Interventions	33,9%	57,5%	48,8%
		% of Total	12,5%	36,3%	48,8%
		Residual	-9,3	9,3	
		Standardized Residual	-1,7	1,3	
		Adjusted Residual	**-3,0**	**3,0**	
	Regulating and other	Count	41	45	86
		Expected Count	31,7	54,3	86,0
		% within Ecosystem service	47,7%	52,3%	100,0%
		% within Interventions	66,1%	42,5%	51,2%
		% of Total	24,4%	26,8%	51,2%
		Residual	9,3	-9,3	
		Standardized Residual	1,6	-1,3	
		Adjusted Residual	**3,0**	**-3,0**	
Total		Count	62	106	168
		Expected Count	62,0	106,0	168,0
		% within Ecosystem service	36,9%	63,1%	100,0%
		% within Interventions	100,0%	100,0%	100,0%
		% of Total	36,9%	63,1%	100,0%

A further look into the data, explaining the association of Agri-environmental schemes and regulating and other ecosystem services, revealed that out of the 62 included studies, cultural service alone are represented 29 times, 12 are a combination of cultural and regulating ecosystem service, 21 are regulating ecosystem service alone, provisioning service are not apparent.

3.4.6 Assocuation between ecosystem services and motivation in studies not including ecological intensification

Chi-square test results (chi-square (1, 168) = 0.531 and p = 0.466), indicate no association between the main motivation and addressed ecosystem services within those articles not including ecological intensification. The observed and expected counts and residuals for this test are represented in Table 3.15.

Table 3.15: *Observed and expected counts and chi-square test residuals on the association between types of motivation and ecosystem services within articles not including ecological intensification.*

			Ecosystem service		
			Regulating (only)	Regulating and other	Total
Motivation	Biodiversity Conservation	Count	63	70	133
		Expected Count	64,9	68,1	133,0
		% within Motivation	47,4%	52,6%	100,0%
		% within Eco.service	76,8%	81,4%	79,2%
		% of Total	37,5%	41,7%	79,2%
		Residual	-1,9	1,9	
		Stand.Residual	-,2	,2	
		Adjusted Residual	-,7	,7	
	Production & Biodiversity conservation	Count	19	16	35
		Expected Count	17,1	17,9	35,0
		% within Motivation	54,3%	45,7%	100,0%
		% within Eco.service	23,2%	18,6%	20,8%
		% of Total	11,3%	9,5%	20,8%
		Residual	1,9	-1,9	
		Stand. Residual	,5	-,5	
		Adjusted Residual	,7	-,7	
Total		Count	82	86	168
		Expected Count	82,0	86,0	168,0
		% within Motivation	48,8%	51,2%	100,0%
		% within Eco.service	100,0%	100,0%	100,0%
		% of Total	48,8%	51,2%	100,0%

3.5 Ecosystem services in reviewed studies

Question 3: Which ecosystem services are being associated with agricultural production?

Regulating ecosystem services were the most frequent category in reviewed literature. Moreover, most studies address exclusively regulating ecosystem services. When coupled with other service categories, regulating and cultural services were more frequent in studies motivated only by biodiversity conservation, while the combination of regulating and provisioning was only found for studies motivated by both production and biodiversity concerns. Similarly, the single focus on cultural services was only detected in studies motivated by biodiversity conservation alone.

Chi-square test results (chi-square (3, 255) = 87.970 and p = 0.000; Cramer's V = 0.587) indicate a statistically significant association between motivation and ecosystem services.

Results from the residuals analysis show that studies exclusively motivated by biodiversity conservation concerns are more associated to cultural services and less to regulating and provisioning services as expected by chance. Studies also concerned with production show the opposite pattern, being more associated to regulating and provisioning services (Table 3.16).

Table 3.16: *Observed and expected counts and chi-square test residuals on the association between types of motivation and ecosystem services.*

			Ecosystem services				
			Cultural	Regulating	Regulating & Cultural	Regulating & Provisioning	Total
Motivation	Biod. Conser.	Count	56	89	25	0	170
		Expected Count	38,0	88,0	23,3	20,7	170,0
		% within Motiv.	32,9%	52,4%	14,7%	0,0%	100,0%
		% within Eco.Ser.	98,2%	67,4%	71,4%	0,0%	66,7%
		% of Total	22,0%	34,9%	9,8%	0,0%	66,7%
		Residual	18,0	1,0	1,7	-20,7	
		Stand. Residual	**2,9**	0,1	0,3	**-4,5**	
	Prod. & Biod. Conser.	Count	1	43	10	31	85
		Expected Count	19,0	44,0	11,7	10,3	85,0
		% within Motiv.	1,2%	50,6%	11,8%	36,5%	100,0%
		% within Eco.Ser.	1,8%	32,6%	28,6%	100,0%	33,3%
		% of Total	0,4%	16,9%	3,9%	12,2%	33,3%
		Residual	-18,0	-1,0	-1,7	20,7	
		Stand. Residual	**-4,1**	-0,2	-0,5	**6,4**	
Total		Count	57	132	35	31	255
		Expected Count	57,0	132,0	35,0	31,0	255,0
		% within Motiv.	22,4%	51,8%	13,7%	12,2%	100,0%
		% within Eco.Ser.	100,0%	100,0%	100,0%	100,0%	100,0%
		% of Total	22,4%	51,8%	13,7%	12,2%	100,0%

The coexistence of ecosystem services are represented in table 3.17, shows that studies with the focus on the cultural ecosystem service in most cases just consider this service or together with the regulating service pollination and biological control. Studies related to food production did not consider cultural services, but did rather include regulating services, particularly soil quality regulation. Biological control was the single focus of 48 studies, but these services also appeared in combination with pollination and soil quality regulation. Pollination was often considered in combination with biological control. Soil quality regulation was the single focus of 25 studies, but also considered in combination with biological control and water regulation. Water regulation, climate regulation, and soil retention were never considered alone and soil retention only in combination with soil quality regulation (Table 3.17).

Table 3.17: *Co-occurrence of ecosystem services in reviewed studies. The number of studies for each pair, or for the service alone (diagonals), is indicated in each cell.*

	Cultural	Food Prod.	Pollination	Bio. Control	Soil Quality	Soil Ret.	Water Reg.	Climate Reg.
Cultural	***53***	0						
Food Production	0	***13***						
Pollination	14	1	***9***	40	4	0	2	0
Biological Control	26	6	40	***48***	17	0	3	1
Soil Quality	5	11	4	17	***25***	3	9	5
Soil Retention	0	3	0	0	3	***0***	0	0
Water Regulation	0	3	2	3	9	0	***0***	2
Climate Regulation	0	2	0	1	5	0	2	***0***

Cereals are the most frequent crop in reviewed studies, being found in 20 studies; half of these studies address biological control services. In addition, biological control is the ecosystem service most referred (Table 3.18).

Table 3.18 *Association between crop systems and ecosystem services in the studies mentioning ecological intensification.*

	Grass	Crop	Cereal	Crop and cereal	Grass and cereal	Grass and crop	Grass, crop and cereal	Total
Food Production	1		1			1	2	**5**
Pollination	1		3			1		**5**
Biological Control	2	4	10	2	1	1	2	**22**
Soil Quality regulation			1	2	1	1	3	**8**
Soil Retention								
Water Regulation								
Climate Regulation								
Biological control and heritage, cultural, bequest, inspiration & art		1	1	1			1	**4**
Biological Control and Soil quality regulation			2					**2**
Biological control, water regulation, Climate regulation, soil quality regulation and food production			1				1	**2**
Soil quality regulation, Water regulation, and food production			1			1		**2**
Biological control and food production		1				1		**2**
Soil quality regulation, water regulation and climate regulation							1	**1**
Soil quality regulation and food production		1				1		**2**
Soil quality regulation, soil retention and Food production		1		1			1	**3**
Biological control and Pollination				1	1	1		**3**
Heritage, Cultural, Bequest, Inspiration & art	1							**1**
Pollination and Heritage, Cultural, Bequest, Inspiration & art	1							**1**
Soil quality regulation, water regulation, biological control and Pollination	1							**1**
No ecosystem service		1						**1**
Total	**7**	**9**	**20**	**7**	**3**	**8**	**11**	**65**

4 Discussion

This thesis emanates from a need for change in the way food is being produced. To ensure sustainable practices and long-term food security, the link between environment and production needs to be improved. Ecological intensification can contribute towards that end, through the smart use of ecosystem services for supporting or increasing food production. The aim was to discover and systemize the amount of literature including practices of ecological intensification and the motivation for their use in agriculture, that is, for the increase or support of food production, or for biodiversity conservation (or a combination), but also assess their association to agricultural interventions, and to categories of ecosystem services. A systematic review was used to map and review the current nature of the field and to derive recommendations.

First the association between dominant motivation and agricultural intervention was not significant. Results show that the relative frequency of the tested motivations is similar across the agricultural interventions, with biodiversity conservation alone being, by far, the most frequent motivation for studies addressing biodiversity and agriculture together. Nevertheless, because all search strings included "biodiversity" (to better target ecological intensification studies), the reviewed literature included few studies only focused on production issues. A new search for studies only focusing on production could reveal other approaches to ecological intensification and different motivational patterns. On the other hand, the reviewed literature suggests that the conciliation of agriculture and biodiversity is still biased towards the mitigation of impacts, while the use and importance of biodiversity to support food production receives less attention (Figure 3.9).
As just referred, biodiversity conservation alone was the most frequent motivation among the retrieved literature (172), with only 7 articles motivated by production alone, and the remaining showing mixed motivation (Table 3.3). The inclusion of ecological intensification practices was more associated to studies motivated by both biodiversity and production, and was underrepresented in studies only concerned with biodiversity conservation. The single focus on biodiversity conservation was associated in particular to studies assessing agri-environmental schemes, which, in general, also lacked links to ecological intensification (Figure 3.11). On the other hand, organic and integrating farm management are found to be associated to ecological intensification practices, indicating that these agricultural interventions do take into consideration or valorise the synergies between biodiversity and

food production. Since organic farming is also part of agri-environmental schemes (CAP, 2005), it would be reasonable to give increased support to this measure for strengthening these synergies. The primary aim for agri-environmental schemes is environmental impacts, and the payment for compensational yield reduction covers the negative effect the measures have on production (CAP, 2005). Therefore, there is an opportunity for the improvement of agri-environmental schemes, namely to address and promote the synergies between biodiversity conservation and food production. Biodiversity conservation and increased production have been addressed as contradictory, with justifications that conservation is better directed to uncultivated or marginal agricultural areas, and that a decrease in management intensity goes hand in hand with increased ecosystem-service provision (EU, 2017).

In agreement with the findings discussed above, studies including ecological intensification practices tend to focus on regulating and provisioning ecosystem services, showing less concern for the maintenance or enhancement of cultural ecosystem services. While this pattern makes sense because the main purpose of ecological intensifications is to make smart use of the regulating ecosystem services to provide food, it also reveals the current divide between the management of production and cultural goods (Table 3.17).

To further inspect the association between variables, new tests were done for the articles including and not including ecological intensification (Table 3.19). Studies including ecological intensification revealed a significant association between motivation and assessed ecosystem services. Namely, an association between the single focus on biodiversity conservation and regulating ecosystem services, and between a shared focus on production and biodiversity conservation and regulating and other ecosystem services (provisioning and cultural) (Table 3.12). In particular, studies focusing on biodiversity conservation alone and regulating services were concerned about the enhancement of non-crop land like headland, flower strips and meadows, for the richness and abundance of plant species, and for the maintenance of invertebrates to support pollination and biological control services. Within articles not including ecological intensification, organic and integrated farming studies tend to focus only on regulating ecosystem service, while studies on agri-environmental schemes tend to focus on cultural services, which in this case mostly refer to the conservation of natural heritage or diversity (i.e., species conservation) (Table 3.14 & Table 4.1)

Table 4.1: *Summary of variables association in studies mentioning or not ecological intensification*		
Tested association	**Ecological Intensification**	**No Ecological Intensification**
Motivation and Intervention	Not significant	Not significant
Motivation and Ecosystem services	Significant: studies exclusively motivated by biodiversity conservation concerns restrict their analysis to regulating services; studies motivated by both production and biodiversity conservation concerns address other category(ies) of ecosystem services in addition to regulating services, namely provisioning ecosystem services (table 3.12).	Not significant
Intervention and Ecosystem services	Not significant	Significant: Studies assessing the performance of organic and integrated farming tend to focus only on regulating ecosystem service, while studies assessing the performance of agri-environmental schemes tend to focus on cultural services (i.e. natural heritage or diversity) (table 3.14).

A more detailed analysis on the coverage of ecosystem services by the reviewed studies revealed that most articles, 51 % (n = 132), presented a single focus on regulating services, followed by 22% (n = 57) that assessed cultural services alone (i.e., biodiversity values), while 5% (n = 13) only measured variables related to provisioning services (food production), the remaining 22% focused in a mix of categories, either regulating and cultural or regulating and provisioning ecosystem services. Moreover, considering all studies, chi-square tests also revealed an association between motivation and ecosystem services. Biodiversity conservation motivation alone is more related to cultural ecosystem services. Studies also motivated by production are associated with regulating and provisioning ecosystem services. The sub-categorization revealed that the provisioning ecosystem service, food production is being considered together with the regulating services, in particularly soil quality regulation and biological control. Within regulating ecosystem service, biological control was the single focus of 48 articles, but could also be seen in combination with pollination and soil quality regulation. The single focus of 25 articles was soil quality regulation, but was also seen in combination with biological control and water regulation. This shows that ecosystem services important for obtaining the ecological intensification are under focus, but the linkage between increased ecosystem service functions and increased support and production of food is still understudied (but see for instance, Garibaldi et al. 2014, 2016).

The examples given in Table 3.6 of ecological intensification methods represented within agricultural intensification, show that agri-environmental schemes are mostly represented by methods for the enhancement or restoration of non-crop plant biodiversity, like flowering grasslands, field margins or restoration of hedgerows, which are an important part of the agricultural landscape, but are more related to cultural ecosystem services, in restoring the aesthetics of the historical landscape. These management practices are also linked to enhance or attract natural enemies and/or wild pollinators to crops, which could contribute for the support of food production (Kremen & Miles, 2012).

Effect of ecological intensification practices on biodiversity and production

Among the reviewed studies the ones including ecological intensification mostly present data on the positive effects on biodiversity, however, even when not mentioned these effects may also support food production. Here I synthetize the main findings, collected in the reviewed literature, on the effects of practices on biodiversity and production.

Field margins/set-aside/flower strips

Field margins under organic farm managements have increased plant biodiversity leading to increased abundance of invertebrates in fields (Asteraki et al. 2004, Framton, 2002). Higher diversity and density of arthropods and butterflies were found in the field margins than in field centres, when compared to conventional farming (Gabriel et al. 2010, Oberg, 2007, Oberg et al. 2007, Schmidt et al. 2005). Permanent field margins are suggested to enhance diversity, capture nutrients and sooth as recreational areas (Weibull et al. 2003). Set-aside management is effective in ensuring higher species richness and support the regeneration of biological resources (Tóth et al. 2016).

Planting species rich wild-flower communities, increases flower densities and plant species richness that supports abundance and richness of wild bees and hoverflies, which are important for ecosystem service provision (Grass et al. 2016, Holzschuh et al. 2008). Compared to conventional farming, organic fields had higher bee diversity, flower cover and flower diversity. In addition, organic farming is more effective in improving biodiversity condition when added to intensive homogeneous landscapes (Holzschuh et al. 2007).

Enhancement of non-crop habitats in farmland promotes abundance of predators, which are beneficial to agricultural production in controlling pests, and increase the abundance of pollinators (Blake et al. 2013). Below and above ground arthropods, which are important contributors to support ecosystem services are improved by increased non-crop vegetation and diversity, but since the challenge is also to sustain yields, integrated crop management should be developed (Norris et al. 2016). Species-rich wildflower strips are an option under agri-environmental schemes, delivering positive effects on insect pollinators and natural pest control agents, which are important for the enhancement of food production, and contribute to reduce the need for insecticides (Tschumi et al. 2016). Sown flower strips in the centre of big fields would increase the benefit from natural pest control (Woodcock et al. 2016). The reinvasion of fields by beneficial invertebrates from unsprayed buffer zones could be promoted by the protection of field margins (Holland et al. 2000). For obtaining ecological intensification of mountain grasslands the ratio of permanent grasslands and sown grassland are important, the maintenance of high diversity, and the timing of grazing and mowing, these managements could improve the positive link between agriculture and environment (Loucougaray et al. 2015).

Practices for weed and pest management

Booij & Norlander (1992) found the abundance and composition of predators to be more related to crop (Wheat, pea, sugar beet, potato, onion and carrot) than to farming system, Clough et al. (2007) also reported higher predator activity-density in organic field, but within conventional fields the predator activity-density showed to significantly increase with yield production. High abundance of problematic weeds, which compete with crops for nutrients, was only apparent in conventional farming and not in integrated or organic plots (Frieben, 2005). Abundance of ground beetles population does not differ between integrated and conventional farming management, and the population only declines for a short time after pesticide application before it regenerates (Huusela-Veistola, 1996). With the use of appropriate ecological restoration, positive shifts in abundance and diversity of important functional groups of plants and invertebrates could be achieved in productive land, largest positive shifts were obtained by creation of diverse vegetation (Pywell et al. 2011). Diversified cropping practices between fields could reduce the need of agrochemicals and enhance landscape biodiversity (Hawes et al. 2010). Increased crop genetic diversity shows a positive impact on below ground collembolan and above ground arthropods diversity (Chateil et al. 2013). A greater level of parasitoids diversity at the whole-farm level was found at organic farms, but this did not translate into greater levels of pest control, as the study shows no increased cereal aphid mortality (Macfadyen et al. 2009).

At both landscape and local scale, organic farming has the potential for controlling arable weeds, but the impact of this intervention is higher in landscape dominated by conventional fields. In these cases, the option for organic farming could contribute to biodiversity conservation and food production (win-win), because not only invertebrates, such as carabid beetles, and plant diversity are enhanced but the farmers could have directly economic benefit from reduced weed infestation (Diekötter et al. 2016).

Farmers decisions are related to agronomic and economic constraints, so the whole farm strategy has to be accounted for when changing practices, but flexible strategies exist to enhance natural enemies (Puech et al. 2014), such as the change in weed management. Starting with reducing herbicide application, opens the possibilities for ecological intensification to be achieved (Petit et al. 2015), namely through alternative weed management, such as mixed cropping, conservation tillage, crop rotation and cover crops, integrated pest management or conservation tillage enhances the supporting services such as pollination and biological pest control (Bommarco et al. 2013).

Soil management practices

Mechanical soil loosening has negative effect on abundance and biomass of earthworms (Lees et al 2016). Polosi et al. 2009, on the other hand, concluded that earthworm populations does not have positive effect from organic system (without organic manure, no pesticides), compared with conventional, this is suggested to be because of the lover yield, leaving less available trophic resources.

Natural enemies and microbial biomass are favoured by shallow ploughing (Sun et al. 2016) while pests are promoted by deep ploughing (Gallo & Pekar, 2001). The reduction of tillage intensity in organic farming could cause an increase in soil organisms, but because tillage is also an important tool to control weeds in organic farming it may attenuate the effects of this agricultural intervention for soil organisms (Metzke et al. 2007). Moreover, organic farming using non-inversion tillage had higher plant-available water in surface soil, aggregated soil stability and soil organic matter, soil carbon and abundance of earthworms (Crittenden & Goede, 2016).

Yield/crop

In what regards the effects on yield, the outcomes differ in the literature. Williams & Hedlund et al. (2013) do not report a positive effect of organic farming in yield, with conventional farming having significantly higher values. A reduction of 20% in in organic crop yield was found to be caused by a negative nutrient balance, despite positive effects from the fertilization with organic matter, which included reduced soil acidification, improved soil structure and reduced risk of erosion, phosphorous and potassium remained low (Fliessbach, 2000). In order to keep yield reduction within acceptable levels the selection of the crop species is important, while pest and diseases control, and improvement of nutrient management could be done by intensive use of fertility building legumes (Thorup-Kristensen et al. 2012). For instance growing catch crops gave increased wheat grain yields in organic farming rotations, being more effective with the soil and rotation type, which requires an increased knowledge on nitrogen cycling (Doltra & Olesen, 2013). The use of inorganic nitrogen fertilisers is able to compensate for the reduction in regulating services but is unable to completely compensate for the supporting services loss (Albizua et al. 2015). Improved ecosystem services which help ensure a sustainable future, integration of genetically variety crops and cross populations aims to be at least as productive as the current yield, are considered important for the maintenance of biodiversity (Döring et al. 2015). The high organic matter application maximizes the provisioning services in organic cereal crops can lead to trade-offs with other ecosystem services (Fan et al. 2016). Compared with conventional farming, organic farming has the ability to sustain greater diversity of arbuscular mycorrhizal fungi, which have potential benefits by increasing phosphorous uptake, and grain production (Manoharan et al. 2017).

To increase farmers' acceptance of agri-environmental schemes the functional groups such as pollinators should get more focus as having major impact on effectiveness (Kohler et al. 2007). Those farms that achieved sustainable intensification, increased food production and enhanced environmental quality, have been driven by financial benefits; reduced inputs costs, leading to a reduction in pollution and wastes, and the incentive to enhance biodiversity comes from the income gained from agri-environmental schemes (Firbank et al. 2013). Intensive land use leads to declined plant species richness, this decline is more pronounced if the land use changes in extensive managed agricultural areas than in intensive managed areas. Because biodiversity and ecosystem services are naturally higher under extensive land use, the costs of conservation actions in intensive farming could be more costly (Kleijn et al. 2009).

5 Conclusion

This thesis was introduced by the paradigm shift, towards ecological intensification, as a promising solution for future food production taking into account the importance of biodiversity conservation (UN, 2013). So the question, is ecological intensification offering the needed solution? Ecological and intensification are terms with contradictions; intensification cannot keep on forever in a closed world with limits. The ecological intensification of current agriculture with smart use of ecosystem service functionalities, lack a strategy for how to maintain food production in the long run. Increased numbers and improved internal loop in agro ecosystems with landscape design could reduce land cost, but will still involve additional use of limited resources such as land and fresh water in order to increase agricultural production, which means that the ecological intensification could not be expanded indefinitely due to land limitations (Gonzáles de Molina & Casado, 2017).

Most of the reviewed articles where ecological intensification is explicitly mentioned are representing organic or integrated farming practices, while agri- environmental schemes are represented less than expected. This finding suggests that there is space for the improvement of the schemes, namely be addressing the potential for synergies between food production and biodiversity conservation. The schemes which target “out of production areas” shows to be more effective in enhancing species richness those schemes that are placed within production areas (Bàtary et al. 2015), this enhanced biodiversity could be beneficial to production even when it is not the focus of the practice, but with better targeting of the schemes to also focus on the production the synergies could be improved and production increased.

Ecological intensification, as expected, was found to be associated with both provisioning and regulating services, and motivated by both production and biodiversity conservation. In these studies, outcomes for production from the use of ecological intensification were also frequently linked to positive outcomes for biodiversity, which reveals the linkage of increased biodiversity and enhanced production. The fact that organic and integrated farming managements are the agricultural interventions related more to ecological intensification than agri-environmental schemes are surprisingly, since so much economic resources are directed to these schemes to reverse the decline of farmland biodiversity (Ekroos et al. 2014, Bàtary et al. 2015). Agri- environmental schemes were found to be more associated with cultural ecosystem services alone or in combination with regulating services, which indicates that their goal is more focused on the maintenance and restoration of cultural landscapes and associated species, than on improvements to production, which is in agreement with the finding of Bátary et al. 2015.

As discussed in a point above, the effectiveness of interventions will also depend on the composition of the landscape. Ecological intensification approaches would make a larger difference (positive impact) in areas dominated by intensive agriculture (because in extensive areas ecological functions are already at high levels), but on the other hand the effectiveness will also depend on the level of pressure. If there is high pressure associated to the neighbouring landscape the improvement from ecological intensification in small areas may not be enough to respond to that change. In the end, the balance between ecological intensification vs. conventional will be important for the outcome. Too few areas of ecological intensification may not be enough to make a significant difference, while the changes will only be detectable if implemented in areas that require improvement.

The agri-environmental schemes are a powerful tool in reversing agricultural impact on farmland biodiversity, but to reduce the intensity of farming, does not fit with a world of need for increased food production, so the measures that improve the ecosystem service functionalities such as water quality, soil quality, biological control and pollination, should be used with the purpose to increase production (Ekroos et al. 2014) (CAP, 2005). It would be of high value to have concrete options for how to obtain the desired support from clearly defined ecosystem services, based on economic opportunities and consequences. The lack of evidence of agri-environmental schemes effectiveness in extensive agricultural lands encourages more research, because it has been indicated that the current schemes are rather ineffective in these areas (Bàtary e al. 2015). The principles guiding ecological intensification are promising, even though they do not take into consideration resources limits in an infinite world (Gonzáles de Molina & Casado, 2017), therefore it will be necessary to combine ecological intensification with other solutions, such as decrease consumption and food waste and change diets (Seppelt et al. 2016).

6 References

Albizua, A., Williams, A., Hedlund, K., & Pascual, U. (2015). Crop rotations including ley and manure can promote ecosystem services in conventional farming systems. *Applied Soil Ecology*, 95, 54–61.

Albrecht, H. & Mattheis, A. (1998). The effects of organic and integrated management farming on rare arable weeds on the Forschungsverbund Agrarokosysteme Munchen (FAM) research station in southern Bavaria. *Biological Conservation*, 86, 347-356.

Alvarez, T., Frampton, G. K. & Goulson, D. (2001). Epigeic Collembola in winter wheat under organic, integrated and conventional farm management regimes. *Agriculture, Ecosystems & Environment*, 83(1/2), 95-110.

Aschwanden, J., Holzgang, O. & Jenni, L. (2007). Importance of ecological compensation areas for small mammals in intensively farmed areas. *Wildlife Biology*, 13(2), 150-158.

Asteraki, E. J., Hart, B. J., Ings, T. C. & Manley, W. J. (2004). Factors influencing the plant and invertebrate diversity of arable field margins. *Agriculture, Ecosystems & Environment,* 102(2), 219-231.

Batáry, P., Dicks, L. V., Kleijn D. & Sutherland, W. J. (2015). The role of agri-environmental schemes in conservation and environmental management. *Conservation Biology,* 00 (0), 1-11

Beddington. J. R., Asaduzzaman, M., Clark, M.E., Bremauntz, A. Fernández., Guillou, M. D., Howlett, D. J.B… Wakhungu, J. (2012). What next for agriculture after Durban? *Science*, 335, 289–290.

Birge, T., Toivonen, M., Kaljonen, M. & Herzon, I. (2017). Probing the grounds: Developing a payment-by-results agri-environment scheme in Finland. *Land Use Policy*, *61*, 302-315.

Blake, R. J., Woodcock, B. A., Westbury, D. B., Sutton, P. & Potts, S. G. (2013). Novel management to enhance spider biodiversity in existing grass buffer strips. *Agricultural and Forest Entomology*, *15*(1), 77–85.

Boerema A., Rebelo A. J., Bodi M. B., Esler K. J. & Meire P. (2017). Are ecosystem services adequately quantified? *Journal of Applied Ecology*, 54, 358-370.

Boland A, Emma Cherry M & Dickson R. (2014). *Doing a Systematic Review A Student's Guide*. London, UK: SAGE.

Bommarco, Riccardo. & Kleijn, David., & Potts, Simon G. (2013). Ecological intensification: harnessing ecosystems services for food security. *Trends in Ecology and Evolution*, 28(4), 230-238

Booij, C. & Noorlander, J. (1992). Farming systems and insect predators. *Agriculture, Ecosystems and Environment*, 40(1-4), 125-135.

Bugalho, Miguel N., Caldeira, Maria C., Pereira, João S., Aronson, James. &Pausas, Juli G., (2011) Mediterranean cork oak savannas require human use to sustain biodiversity and ecosystem services. *Frontiers in Ecology and the Environment*. 9(5), 278-286

Bullock, James M., Aronson, James., Newton, Adrian C., Pywell, Richard F., & Rey-Benayas, Jose M. (2011) Restoration of ecosystem services and biodiversity: conflicts and opportunities. *Trends in Ecology and Evolution*. 26(10), 541-549

Centre for Agriculture and Biosciences International (CABI). (n.d.). Integrated crop management. Available at: http://www.cabi.org/about-cabi/cabi-centres/switzerland/integrated-crop-management/ (Retrieved: 27.02.17)

Chateil, C., Goldringer, I., Tarallo, L., Kerbiriou, C., Le Viol, I., Ponge, J. F., … Porcher, E. (2013). Crop genetic diversity benefits farmland biodiversity in cultivated fields. *Agriculture, Ecosystems and Environment*, *171*, 25–32.

Collaboration for Environmental Evidence (CEE). (2013). Guidelines for Systematic Review and Evidence Synthesis in Environmental Management. Version 4.2. Environmental Evidence. Available at: www.environmentalevidence.org/Documents/Guidelines/Guidelines4.2.pdf (Retrieved: 05.03.17)

Convention on Biological Diversity (1992). Article 2. Use of terms. UN. Available at: https://www.cbd.int/doc/legal/cbd-en.pdf (Retrieved: 15.09.17)

Convention on Biological Diversity (2010) Decision X/2: The strategic plan for biodiversity 2011-2020 and the Aichi Biodiversity Targets. UNEP Available at: https://www.cbd.int/doc/decisions/cop-10/cop-10-dec-02-en.pdf (Retrieved: 15.09.17)

Convention on Biological Diversity (CBD). (n.d) History of the Convention. Available at: https://www.cbd.int/history/ (Retrieved: 02.03.17)

Clough, Y., Kruess, A. & Tscharntke, T. (2007). Organic versus conventional arable farming systems: functional grouping helps understand staphylinid response. *Agriculture, Ecosystems & Environment,* 118(1/4), 285-290

Crittenden, S. J., & de Goede, R. G. M. (2016). Original article: Integrating soil physical and biological properties in contrasting tillage systems in organic and conventional farming. *European Journal of Soil Biology*, 77, 26–33.

Diekötter, T., Wamser, S., Dörner, T., Wolters, V., & Birkhofer, K. (2016). Organic farming affects the potential of a granivorous carabid beetle to control arable weeds at local and landscape scales. *Agricultural & Forest Entomology*, *18*(2), 167-173

Doltra, J., & Olesen, J. E. (2013). The role of catch crops in the ecological intensification of spring cereals in organic farming under Nordic climate. *European Journal of Agronomy*, 44, 98–108.

Doré, T., Makowski D., Malézieux, E., Munier-Jolain, N., Tchamitchian M. & Tittonell P. (2011). Facing up to the paradigm of ecological intensification in agronomy: revisiting methods, concepts and knowledge. *European Journal of Agronomy*, 34, 197-210.

Döring, T. F., Annicchiarico, P., Clarke, S., Haigh, Z., Jones, H. E., Pearce, H., … Wolfe, M. S. (2015). Comparative analysis of performance and stability among composite cross populations, variety mixtures and pure lines of winter wheat in organic and conventional cropping systems. *Field Crops Research*, 183, 235–245.

Ekroos, J., Olsson, O., Rundlöf, M., Wätzold, F. & Smith, H.G. (2014) Optimizing agri-environment schemes for biodiversity, ecosystem services or both? *Biological Conservation*.172, 65–71.

Environmental Evidence Journal. Systematic Reviews. BioMed Central- The Open Access Publisher. Available at: http://environmentalevidence.org/wp-content/uploads/2014/05/EE_InstructionsforAuthors_SYSTREVIEWS.pdf (Retrieved: 05.03.17)

European Union. (2017). Science for Environment Policy - *Agri-environmental schemes: how to enhance the agriculture-environment relationship.* Thematic Issue 57. Issue produced for the European Commission DG Environment by the Science Communication Unit, UWE, Bristol. Available at: http://ec.europa.eu/science-environment-policy (Retrieved: 21.07.17)

European Commission. (2011). Our life insurance, our natural capital: an EU biodiversity strategy to 2020. Communication from the Commission to the European parliament, the council, the economic and social committee and the committee of the regions. Brussel: European Commission. Available at: http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52011DC0244&from=EN (Retrieved: 05.06.17)

European Commission (2013a). Overview of the CAP Reform 2014-2020. Agricultural Policy Perspective Brief Nr. 5. European Union. Available at: http://ec.europa.eu/agriculture/sites/agriculture/files/policy-perspectives/policy-briefs/05_en.pdf (Retrieved: 01.03.17)

European Commission. (2013b). The reform of the CAP towards 2020. Consultation document for impact assessment. Available at: http://ec.europa.eu/agriculture/sites/agriculture/files/cap-post-2013/consultation/consultation-document_en.pdf (Retrieved: 01.03.17)

European Commission (2015). EU agriculture and climate change. Available at: https://ec.europa.eu/agriculture/sites/agriculture/files/climate-change/factsheet_en.pdf (Retrieved: 01.03.17)

European Commission. (2017a). What is Organic farming?. Organic farming. Agriculture and rural development. Available at: https://ec.europa.eu/agriculture/organic/organic-farming/what-is-organic-farming_en (Retrieved: 10.02.17)

European Commission. (2017b). EU law on Organic production: an overview. Agriculture and rural development. Available at: https://ec.europa.eu/agriculture/organic/eu-policy/eu-legislation/brief-overview_en (Retrieved: 10.02.17)

European Commission. (2017c). Agri-environment measures. Agriculture and rural development. Available at: https://ec.europa.eu/agriculture/envir/measures_en (Retrieved: 10.02.17)

European Union (EU). (2007). Council regulation (EC) No 834/2007 of 28 June 2007 on organic production and labelling of organic products and repealing regulation (EEC) No 2092/91. Official Journal of the European Union. Vol. 189. Nr.1 Available at: http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2007:189:0001:0023:EN:PDF (Retrieved: 06.06.17)

Fan, F., Henriksen, C. B., & Porter, J. (2016). Valuation of ecosystem services in organic cereal crop production systems with different management practices in relation to organic matter input. *Ecosystem Services*, 22(April), 117–127.

FAO (2017). The future of food and agriculture- Trends and challenges. Rome. Available at: www.fao.org/3/a-i6583e.pdf (Retrieved: 01.03.17)

FAO. (2013a). Our priorities- The FAO Strategic Objectives. Available at: http://www.fao.org/docrep/018/mi317e/mi317e.pdf (Retrieved 05.06.17)

FAO. (2013b). Comparative table: Eco-functional, sustainable and ecological intensification., Seventh framework programme theme KBBE 2012.1.2-02, Managing semi-natural habitats and on-farm biodiversity to optimise ecological services, Collaborative project., Libertation, prepared by FAO, November 2013 Available at: http://agrobiodiversityplatform.org/liberation/wp-content/uploads/2014/05/Comparative-table-intensification.pdf (Retrieved:05.06.17)

Ficher, Joern., Abson, David, J., Bergsten, Arvid., Collier, Neil French., Dorresteijn, Ine., Hanspach, Jan., … Senbeta, Feyera. (2017) Reframing the Food-Biodiversity Challenge. *Trends in Ecology & Evolution*, 32(5), 335- 345.

Firbank, L. G., Elliott, J., Drake, B., Cao, Y., & Gooday, R. (2013). Evidence of sustainable intensification among British farms. *Agriculture, Ecosystems and Environment*, *173*, 58–65.

Fliessbach, A., Mäder, P., Dubois, D. & Gunst, L. (2000). Results from a 21 year old field trial. Organic farming enhances soil fertility and biodiversity. *FIBL Dossier* (1), 15 pp.

Food and Agriculture Organization of the United Nations (FAO). (1999). Organic agriculture. Item 8 of the Provisional Agenda. Committee on agriculture. Fifteenth Session. Rome. Available at: http://www.fao.org/docrep/meeting/X0075e.htm (Retrieved: 06.06.17)

Frampton, G. K. (2002). Long-term impacts of an organophosphate-based regime of pesticides on field and field-edge Collembola communities. *Pest Management Science,* 58(10), 991-1001.

Frieben, B. (2005). *Potential of weeds attractive to beneficial insects in organic fields - their consideration in research programs.* Bonn, International Society of Organic Agricultural Research (ISOFAR), 456-459.

Gabriel, D., Sait, S. M., Hodgson, J. A., Schmutz, U., Kunin, W. E. & Benton, T. G. (2010). Scale matters: the impact of organic farming on biodiversity at different spatial scales. *Ecology Letters,* 13, 858-869.

Gallo, J. & Pekar, S. (2001). Effect of ploughing and previous crop on winter wheat pests and their natural enemies under integrated farming system in Slovakia. *Anzeiger fur Schadlingskunde* 74(3): 60-65.

Garibaldi, Lucas A., Carvalheiro, Luísa G., Vaissière, Bernard E., Gemmill-Herren, Barbara., Hipólito, Juliana., … Zhang, Hong. (2016) Mutually beneficial pollinator diversity and crop yield outcomes in small and large farms. *Science*, 351(6271), 388-391.

Garibaldi, Lucas A., Carvalheiro, Luísa G., Leonhardt, Sara D., Aizen, Marcelo A., Blaauw, Brett R.,Isaacs, Rufus., … Winfree, Rachael. (2014). From research to action: enhancing crop yield through wild pollinators. *Frontiers in Ecology and the Environment,* 12(8), 439-447

Glamann, Josefine., Hanspach, Jan., Abson David J., Collier Neil. & Fischer, Joern (2017) The intersection of food security and biodiversity conservation: a review. *Regional Environmental* *change, 17(5), 1303-1313.*

Gonzáles de Molina, Manuel. & Guzman Casado, Gloria I,. (2017) Agroecology and Ecological Intensification. A Discussion from a metabolic Point of View. *Sustainability,* 9(86), 1-19.

Grass, I., Albrecht, J., Jauker, F., Diekötter, T., Warzecha, D., Wolters, V., & Farwig, N. (2016). Much more than bees-Wildflower plantings support highly diverse flower-visitor communities from complex to structurally simple agricultural landscapes. *Agriculture, Ecosystems and Environment*, 225, 45–53.

Haines-Young, Roy. & Potschin, Marion. (2010) *Ecosystem Ecology: A New Synthesis*. Chapter 6, *The links between biodiversity, ecosystem services and human well-being*. Cambridge University Press.

Haines-Young, Roy. & Potschin, Marion.. (2013). Classifying Ecosystem Services. University of Nottingham. Available at: http://openness.hugin.com/example/cices (Retrieved: 02.03.17)

Hawes, C., Squire, G. R., Hallett, P. D., Watson, C. A. & Young, M. (2010) Arable plant communities as indicators of farming practice. *Agriculture, Ecosystems & Environment*, 138 (1-2), 17-26.

Holland, J. M., Winder, L. & Perry, J. N. (2000). The impact of dimethoate on the spatial distribution of beneficial arthropods in winter wheat. *Annals of Applied Biology*, 136(2), 93-105.

Holzschuh, A., Steffan-Dewenter, I. & Tscharntke, T. (2008). Agricultural landscapes with organic crops support higher pollinator diversity. Oikos, 117(3), 354-361.

Holzschuh, A., Steffan-Dewenter, I., Kleijn, D. & Tscharntke, T.(2007). Diversity of flower-visiting bees in cereal fields: effects of farming system, landscape composition and regional context. *Journal of Applied Ecology,* 44(1), 41-49.

Huusela-Veistola, E. (1996). Effects of pesticide use and cultivation techniques on ground beetles (Col, Carabidae) in cereal fields. *Annales Zoologici Fennici,* 33(1), 197-205.

IFOAM Organics International. Principles of organic agriculture-preamble. Available at: http://www.ifoam.bio/sites/default/files/poa_english_web.pdf (Retrieved: 17.02.17)

Kleijn, D., Kohler, F., Baldi, A., Batary, P., Concepcion, E. D., Clough, Y., … Verhulst, J. (2009). On the relationship between farmland biodiversity and land-use intensity in Europe. *Proceedings of the Royal Society. B*, 276, 903–909

Kleijn, D., Baquero, R.A., Clough, Y., Diaz, M., Esteban, J., Fernadez, F… Yela, J.L. (2006) Mixed biodiversity benefits of agri-environment schemes in five European countries. *Ecology Letters,* 9(3), 243–254.

Kleijn, D. & Sutherland, WJ. (2003) How effective are European agri-environment schemes in conserving and promoting biodiversity? *Journal of Applied Ecology,* 40, 947–969.

Kohler, F., Verhulst, J., Knop, E., Herzog, F. & Kleijn, D. (2007). Indirect effects of grassland extensification schemes on pollinators in two contrasting European countries. *Biological Conservation,* 135(2), 302-307.

Kremen, C. (2015). Reframing the land-sparing/land-sharing debate for biodiversity conservation. *Annals of the New York Academy of Sciences*, 1355(1), 52-76.

Kremen, C. & Miles, A. (2012). Ecosystem services in biologically diversified versus conventional farming systems: benefits, externalities, and trade-offs. *Ecology and Society,*17(4), 40.

Laerd statistics. (n.d). Retrieved from: https://statistics.laerd.com/spss-tutorials/chi-square-test-for-association-using-spss-statistics.php (Retrieved: 11.09.2017)

LEAF- linking environment and farming. What is LEAF's Integrated Farm Management (IFM)? (n.d). Available at: http://www.leafuk.org/leaf/farmers/LEAFs_IFM/Whatisifm.eb (Retrieved: 16.02.17)

Lees, K. J., McKenzie, A. J., Newell Price, J. P., Critchley, C. N., Rhymer, C. M., Chambers, B. J., & Whittingham, M. J. (2016). The effects of soil compaction mitigation on below-ground fauna: How earthworms respond to mechanical loosening and power harrow cultivation. *Agriculture, Ecosystems and Environment*, 232, 273–282.

Logan, M. (2010). *Biostatistical Design and Analysis Using R- A Practical Guide.* West Sussex, UK: Wiley-Blackwell.

Loucougaray, G., Dobremez, L., Gos, P., Pauthenet, Y., Nettier, B., & Lavorel, S. (2015). Assessing the Effects of Grassland Management on Forage Production and Environmental Quality to Identify Paths to Ecological Intensification in Mountain Grasslands. *Environmental Management*, *56*(5), 1039–1052.

Lin BB. (2011). Resilience in agriculture through crop diversification: adaptive management for environmental change. *Bioscience* , 61(3), 183-193.

Macfadyen, S., Gibson, R., Raso, L., Sint, D., Traugott, M. & Memmott, J. (2009). Parasitoid control of aphids in organic and conventional farming systems. *Agriculture, Ecosystems & Environment,* 133(1/2), 14-18.

Manoharan, L., Rosenstock, N. P., Williams, A., & Hedlund, K. (2017). Agricultural management practices influence AMF diversity and community composition with cascading effects on plant productivity. *Applied Soil Ecology*, 115, 53–59.

Metzke, M., Potthoff, M., Quintern, M., Hess, J. & Joergensen, R. G.. (2007). *Effect of reduced tillage systems on earthworm communities in a 6-year organic rotation.* 43(Suppl.1), S209-S215.

Millennium Ecosystem Assessment (MEA). (2005). *Ecosystems and Human Well-being: Synthesis*. Washington, DC: Island Press. Available at: http://www.millenniumassessment.org/documents/document.356.aspx.pdf (Retrieved: 01.03.17)

Norris, S. L., Blackshaw, R. P., Dunn, R. M., Critchley, N. R., Smith, K. E., Williams, J. R., … Murray, P. J. (2016). Improving above and below-ground arthropod biodiversity in maize cultivation systems. *Applied Soil Ecology*, *108*, 25–46.

Oberg, S. (2007). Diversity of spiders after spring sowing - influence of farming system and habitat type. *Journal of Applied Entomology*, 131(8), 524-531.

Oberg, S., Ekbom, B. & Bommarco, R. (2007). Influence of habitat type and surrounding landscape on spider diversity in Swedish agroecosystems. *Agriculture Ecosystems & Environment*, 122(2), 211-219

Pelosi, C., Bertrand, M. & Roger-Estrade, J. (2009). Earthworm community in conventional, organic and direct seeding with living mulch cropping systems. *Agronomy for Sustainable Development* 29(2): 287-295.

Petit, S., Munier-Jolain, N., Bretagnolle, V., Bockstaller, C., Gaba, S., Cordeau, S., … Colbach, N. (2015). Ecological Intensification Through Pesticide Reduction: Weed Control, Weed Biodiversity and Sustainability in Arable Farming. *Environmental Management*, *56*(5), 1078–1090.

Pretty, J., Sutherland, WJ., Ashby, J., Auburn, J., Baulcombe, … McNeely, J. (2010). The top 100 questions of importance to the future of global agriculture. *International Journal of Agricultural Sustainability*, 8(4), 219–236.

Pretty, JN., Toulmin, C. & Williams, S. (2011). Sustainable intensification in African agriculture. *International Journal of Agricultural Sustainability*, 9(1), 5-24.

Puech, C., Baudry, J., Joannon, A., Poggi, S., & Aviron, S. (2014). Organic vs. conventional farming dichotomy: Does it make sense for natural enemies? *Agriculture, Ecosystems and Environment*, *194*, 48–57.

Pywell, R. F., Meek, W. R., Loxton, R. G., Nowakowski, M., Carvell, C., & Woodcock, B. A. (2011). Ecological restoration on farmland can drive beneficial functional responses in plant and invertebrate communities. *Agriculture, Ecosystems and Environment*, *140*(1–2), 62–67.

Randall, N. P. & James, K. (2012). The effectiveness of integrated farm management, organic farming and agri-environment schemes for conserving biodiversity in temperate Europe - A systematic map. *Environmental Evidence,* 1(4), 1-21.

Reed, J., Deakin, Liz., & Sunderland, T. (2014). What are 'Integrated Landscape Approaches' and how effectively have they been implemented in the tropics: a systematic map protocol. *Environmental Evidence*, 4(2), 1-7.

Reed, Mark S., Andrew Moxey, Katrin Prager, Nick Hanley, James Skates, Aletta Bonn, Chris D. Evans, Klaus Glenk, and Ken Thomson. (2014). Improving the link between payments and the provision of ecosystem services in agri-environment schemes. *Ecosystem Services,* 9, 44-53.

Saufert, V. & Ramankutty, N. (2017). Many shades of gray – The context-dependent performance of organic agriculture. *Science Advances*, 3(e1602638), 1-14.

Schmidt, M. H., Roschewitz, I., Thies, C. & Tscharntke, T. (2005). Differential effects of landscape and management on diversity and density of ground-dwelling farmland spiders. *Journal of Applied Ecology,* 42(2), 281-287.

Seppelt, Ralf., Beckmann, Michael., Ceausu, Silva., Cord, Anna F., Gerstner, Katharina., Gurevitch, Jessica., Kambach, Stephan., Klotz, Stefan., Mendenhall, Chase., Phillips, Helen R. P., Powell, Kristin., Verburg, Peter H., Verhagen, Willem., Winter, Marten. & Newbold, Tim. (2016). Harmonizing Biodiversity Conservation and Productivity in the Context of Increasing Demands on Landscapes. *Bioscience,* Advanced publication, 1-7

SPSS Tutorials (2016a). Cramér's V – What and Why? Retrieved from: https://www.spss tutorials.com/cramers-v-what-and-why/ (Retrieved: 22.10.17)

SPSS Tutorials (2016b). Z-Scores- What and Why? Retrieved from: https://www.spss-tutorials.com/z-scores-what-and-why/ (Retrieved: 10.10.17)

SPSS Tutorials (2017). SPSS Chi-Square Independent Test. Retrieved from https://www.spss-tutorials.com/spss-chi-square-independence-test/ (Retrieved: 10.10.17)

Sun, H., Koal, P., Liu, D., Gerl, G., Schroll, R., Gattinger, A., … Munch, J. C. (2016). Soil microbial community and microbial residues respond positively to minimum tillage under organic farming in Southern Germany. *Applied Soil Ecology*, 108, 16–24.

The James Hutton Institute. Integrated Farm Management. Available at: http://www.hutton.ac.uk/learning/leaf/ifm (Retrieved: 16.02.17)

Thorup-Kristensen, K., Dresbøll, D. B., & Kristensen, H. L. (2012). Crop yield, root growth, and nutrient dynamics in a conventional and three organic cropping systems with different levels of external inputs and N re-cycling through fertility building crops, *37*(1 *OP-In European Journal of Agronomy,* 37(1), 66-82.

Tittonell, Pablo. (2014). Ecological Intensification of agriculture – sustainable in nature. *Current Opinion in Environmental Sustainability , 8, 53*-61.

Tóth, Z., Hornung, E., Báldi, A., & Kovács-Hostyánszki, A. (2016). Effects of set-aside management on soil macrodecomposers in Hungary. *Applied Soil Ecology*, 99, 89–97.

Tscharntke, T., Klein, A.M., Kruess, A., Steffan-Dewenter, I. & Thies, C. (2005). Landscape perspectives on agricultural intensification and biodiversity: ecosystem service management. *Ecological Letter,* 8, 857-874.

Tschumi, M., Albrecht, M., Bärtschi, C., Collatz, J., Entling, M. H., & Jacot, K. (2016). Perennial, species-rich wildflower strips enhance pest control and crop yield. *Agriculture, Ecosystems and Environment*, *220*, 97–103.

United Nations (2012). The future we want. The General Assembly. 66/288. Available at: http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/66/288&Lang=E (Retrieved 05.06.17)

United Nations (2015). Transforming our world: the 2030 Agenda for Sustainable Development. The General Assembly. 70/1. Available at: http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E (Retrieved 05.06.17) (a: Goal 2; b: Goal 12; c: Goal 13; d: Goal 15)

United Nations (UN). (2013). Trade and Environment Review 2013- Wake up before it is too late: Make agriculture truly sustainable now for food security in a changing climate UNCTAD/DITC/TED/2012/3; United Nations Publication; ISSN 1810-5432 (a: Cap. 1, Com. IV; b: Cap 1, Com. IV, B; c: Cap. 5, Com. I; d: Lead article, Cap 1; e: Cap. 5, Com. I, F).

Weibull, A. C., Ostman, O. & Granqvist, A. (2003). Species richness in agroecosystems: the effect of landscape, habitat and farm management. *Biodiversity and Conservation*, 12(7), 1335-1355.

Williams, A., & Hedlund, K. (2013). Indicators of soil ecosystem services in conventional and organic arable fields along a gradient of landscape heterogeneity in southern Sweden, *65 OP-I*, 1.

Woodcock, B. A., Bullock, J. M., McCracken, M., Chapman, R. E., Ball, S. L., Edwards, M. E., … Pywell, R. F. (2016). Spill-over of pest control and pollination services into arable crops. *Agriculture, Ecosystems and Environment*, 231, 15–23.

7 Appendix

A. Chi-square test statistics and symmetric measures

B. The master table; both databases (with only the data used)

A: Chi-Square Test statistics and Symmetric measures.

Section 3.2: Testing association between motivation and agricultural interventions.

Chi-Square Tests of association between motivation and agricultural interventions.

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	2,018[a]	1	,155		
Continuity Correction[b]	1,610	1	,204		
Likelihood Ratio	2,062	1	,151		
Fisher's Exact Test				,174	,101
N of Valid Cases	228				

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 23,68.

b. Computed only for a 2x2 table

Symmetric Measures, shows the strength of the association between motivation and agricultural interventions.

		Value	Approximate Significance
Nominal by Nominal	Phi	,094	,155
	Cramer's V	,094	,155
N of Valid Cases		228	

Section 3.3.1: Testing association between ecological intensification and agricultural interventions.

Chi-Square Tests of association between ecological intensification and agricultural interventions.

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	6,837[a]	1	,009		
Continuity Correction[b]	6,017	1	,014		
Likelihood Ratio	7,315	1	,007		
Fisher's Exact Test				,010	,006
N of Valid Cases	228				

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 19,08.

b. Computed only for a 2x2 table

Symmetric Measures, show the strength of the association between ecological intensification and agricultural interventions.

		Value	Approximate Significance
Nominal by Nominal	Phi	-,173	,009
	Cramer's V	,173	,009
N of Valid Cases		228	

Section 3.3.2: Testing association between motivation and ecological intensification.

Chi-Square Tests of association between ecological intensification and motivation.

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	42,119[a]	1	,000		
Continuity Correction[b]	40,168	1	,000		
Likelihood Ratio	40,495	1	,000		
Fisher's Exact Test				,000	,000
N of Valid Cases	258				

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 21,67.
b. Computed only for a 2x2 table

Symmetric Measures show the strength of the association between ecological intensification and motivation.

		Value	Approximate Significance
Nominal by Nominal	Phi	-,404	,000
	Cramer's V	,404	,000
N of Valid Cases		258	

Section 3.3.3: Testing association between ecological intensification and ecosystem services.

Chi-Square Tests of association between ecological intensification and ecosystem services.

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	33,464[a]	3	,000
Likelihood Ratio	40,490	3	,000
N of Valid Cases	255		

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 7,78.

Symmetric Measures, show the strength of the association between ecological intensification and ecosystem services.

		Value	Approximate Significance
Nominal by Nominal	Phi	,362	,000
	Cramer's V	,362	,000
N of Valid Cases		255	

Section 3.4.1: Testing association between motivation and agricultural interventions within articles including ecological intensification.

Chi-Square Tests of association between interventions and motivations within articles including ecological intensification.

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1,909[a]	1	,167		
Continuity Correction[b]	1,068	1	,301		
Likelihood Ratio	2,081	1	,149		
Fisher's Exact Test				,296	,151
N of Valid Cases	58				

a. 1 cells (25,0%) have expected count less than 5. The minimum expected count is 3,98.

b. Computed only for a 2x2 table

Symmetric Measures, show the strength of the association between interventions and motivations within articles including ecological intensification.

		Value	Approximate Significance
Nominal by Nominal	Phi	-,181	,167
	Cramer's V	,181	,167
N of Valid Cases		58	

Section 3.4.2: Testing association between agricultural interventions and ecosystem services within articles including ecological intensification.

Chi-Square Tests of association between interventions and ecosystem services within articles including ecological intensification.

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	,723[a]	1	,395		
Continuity Correction[b]	,248	1	,618		
Likelihood Ratio	,702	1	,402		
Fisher's Exact Test				,487	,304
N of Valid Cases	58				

a. 1 cells (25,0%) have expected count less than 5. The minimum expected count is 3,79.

b. Computed only for a 2x2 table

Symmetric Measures, show the strength of the association between interventions and ecosystem services within articles including ecological intensification.

		Value	Approximate Significance
Nominal by Nominal	Phi	-,112	,395
	Cramer's V	,112	,395
N of Valid Cases		58	

Section 3.4.3: Testing association between motivation and ecosystem services within articles including ecological intensification.

Chi-Square Tests of association between types of motivations and ecosystem services within articles including ecological intensification.					
	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	9,077[a]	1	,003		
Continuity Correction[b]	7,428	1	,006		
Likelihood Ratio	10,251	1	,001		
Fisher's Exact Test				,004	,002
N of Valid Cases	58				

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 7,24.
b. Computed only for a 2x2 table

Symmetric Measures, show the strength of the association between ecosystem services and motivations within articles including ecological intensification.			
		Value	Approximate Significance
Nominal by Nominal	Phi	,396	,003
	Cramer's V	,396	,003
N of Valid Cases		58	

Section 3.4.4: Testing association between motivation and agricultural interventions within articles not including ecological intensification.

Chi-Square Tests of association between interventions and motivations within articles not including ecological intensification.					
	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	1,319[a]	1	,251		
Continuity Correction[b]	,905	1	,341		
Likelihood Ratio	1,357	1	,244		
Fisher's Exact Test				,326	,171
N of Valid Cases	168				

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 12,92.
b. Computed only for a 2x2 table

Symmetric Measures, show the strength of the association between interventions and motivations within articles not including ecological intensification.			
		Value	Approximate Significance
Nominal by Nominal	Phi	,089	,251
	Cramer's V	,089	,251
N of Valid Cases		168	

Section 3.4.5: Testing association between motivation and agricultural interventions within articles not including ecological intensification.

Chi-Square Tests of association between interventions and ecosystem services within articles not including ecological intensification.

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	8,776[a]	1	,003		
Continuity Correction[b]	7,854	1	,005		
Likelihood Ratio	8,898	1	,003		
Fisher's Exact Test				,004	,002
N of Valid Cases	168				

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 30,26.
b. Computed only for a 2x2 table

Symmetric Measures, show the strength of the association between interventions and ecosystem services within articles not including ecological intensification.

		Value	Approximate Significance
Nominal by Nominal	Phi	-,229	,003
	Cramer's V	,229	,003
N of Valid Cases		168	

Section 3.4.6: Testing association between motivation and ecosystem services within articles not including ecological intensification.

Chi-Square Tests of association between motivation and ecosystem services within articles not including ecological intensification.

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	,531[a]	1	,466		
Continuity Correction[b]	,290	1	,590		
Likelihood Ratio	,531	1	,466		
Fisher's Exact Test				,569	,295
N of Valid Cases	168				

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 17,08.
b. Computed only for a 2x2 table

Symmetric Measures, show the strength of the association between motivations and ecosystem services within articles not including ecological intensification.

		Value	Approximate Significance
Nominal by Nominal	Phi	-,056	,466
	Cramer's V	,056	,466
N of Valid Cases		168	

Section 3.5: Testing association between motivation and ecosystem services

Chi-Square Tests of association between types of motivations and ecosystem services.

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	87,970[a]	3	,000
Likelihood Ratio	106,056	3	,000
N of Valid Cases	255		

a. 0 cells (0,0%) have expected count less than 5. The minimum expected count is 10,33.

Symmetric Measures, show the strength of the association between types of motivations and ecosystem services.

		Value	Approximate Significance
Nominal by Nominal	Phi	,587	,000
	Cramer's V	,587	,000
N of Valid Cases		255	

Database	Reference	Study lenght	Country of study	Intervention	Motivation	Ecological intensification	Measured variable	Type of system	Ecosystem service	Ecosystem sevrices sub-categories
Database I	Alvarez, T., Frampton, G. K. & Goulson, D. (2001). "Epigeic Collembola in winter wheat under organic, integrated and conventional farm management regimes." Agriculture, Ecosystems & Environment 83(1/2): 95-110.	Unknown	UK	Organic, conventional, Integrated	Biodiveristy Conservation	Not included	Arthrophods	Cereal	Regulating	Soil quality regulation
Database I	Andersen, A. & Eltun, R. (2000). "Long-term developments in the carabid and staphylinid (Col., Carabidae and Staphylinidae) fauna during conversion from conventional to biological farming." Journal of Applied Entomology-Zeitschrift Fur Angewandte Entomolo	3 to 10 years	Norway	Organic, conventional	Biodiveristy Conservation	Not included	Arthrophods	Grassland, cropland and cereal	Regulating	Biological Control
Database I	Aschwanden, J., Holzgang, O. & Jenni, L. (2007). "Importance of ecological compensation areas for small mammals in intensively farmed areas." Wildlife Biology 13(2): 150-158.	less than 1 year	Switzerland	Conventional	Biodiveristy Conservation	Not included	Mammals	Cereal and grassland	Regulating	Biological Control
Database I	Asteraki, E. J., Hart, B. J., Ings, T. C. & Manley, W. J.(2004). "Factors influencing the plant and invertebrate diversity of arable field margins." Agriculture, Ecosystems & Environment 102(2): 219-231.	less than 1 year	UK	Organic, conventional	Biodiveristy Conservation	Included	Plant and above ground Invertebrats	Grassland	Regulating	Biological Control
Database I	Aude, E., Tybirk, K. & Pedersen, M. B. (2003). "Vegetation diversity of conventional and organic hedgerows in Denmark." Agriculture, Ecosystems & Environment 99(1/3): 135-147.	less than 1 year	UK	Organic, conventional	Biodiveristy Conservation	Not included	Plant and bryophytes	Non-crop	Regulating	Biological Control
Database I	Aude, E., Tybirk, K., Michelsen, A., Ejrnaes, R., Hald, A. B. & Mark, S. (2004). "Conservation value of the herbaceous vegetation in hedgerows - does organic farming make a difference?" Biological Conservation 118(4): 467-478.	Unknown	Denmark	Organic, conventional	Biodiveristy Conservation	Not included	Plant	Non-crop	Regulating	Biological Control
Database I	Bates, F. S. and Harris, S. (2009). "Does hedgerow management on organic farms benefit small mammal populations?" Agriculture, Ecosystems & Environment 129(1/3): 124-130.	Unknown	UK	Organic, conventional	Biodiveristy Conservation	Not included	Mammals	Non-crop	Regulating	Biological Control
Database I	Belfrage, K., Bjorklund, J. & Salomonsson, L. (2005) The effects of farm size and organic farming on diversity of birds, pollinators and plants in Swedish landscapes. Ambio 34(8) 582-588	Unknown	UK	Organic, conventional	Biodiveristy Conservation	Not included	Birds, Pollinators a	Cereal and cropland	Regulating	Biological control and Pollination
Database I	Birkhofer, K., Fliessbach, A., Wise, D. H. & Scheu, S. (2008). "Generalist predators in organically and conventionally managed grass-clover fields: implications for conservation biological control." Annals of Applied Biology 153(2): 271-280.	Unknown	Switzerland	Organic, conventional	Biodiveristy Conservation	Included	Above ground invertebrats	Grassland	Regulating	Biological Control
Database I	Birrer, S., Spiess, M., Herzog, F., Jenny, M., Kohli, L. & Lugrin, B. (2007). "The Swiss agri-environment scheme promotes farmland birds: but only moderately." Journal of Ornithology 148: 295-303.	1 to 3 years	Switzerland	AES	Biodiveristy Conservation	Not included	Birds	Non-crop	cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database I	Blackburn, J. and Wallace, A. (2001). "Comparative abundance of centipedes on organic and conventional farms, and its possible relation to declines in farmland bird populations." Basic and Applied Ecology 2(4): 373 381.	Unknown	UK	Organic, conventional	Biodiveristy Conservation	Not included	Arthrophods	Cereal and cropland	Regulating	Biological Control and Soil quality regulation
Database I	Aavik, T. and Liira J. "Quantifying the effect of organic farming, field boundary type and landscape structure on the vegetation of field boundaries." Agriculture, Ecosystems & Environment 135(3): 178-186.	Unknown	Estonia	Organic, conventional	Biodiveristy Conservation	Not included	Plant	Non-crop	Regulating	Biological Control
Database I	Albrecht, H. and Mattheis, A. (1998). "The effects of organic and integrated farming on rare arable weeds on the Forschungsverbund Agrarokosysteme Munchen (FAM) research station in southern Bavaria." Biological Conservation 86: 347-356.	3 to 10 years	Germany	Organic, Integrated	Biodiveristy Conservation	Not included	Plant	Cropland	Regulating	Biological Control
Database I	Booij, C. & Noorlander, J. (1992). "Farming systems and insect predators." Agriculture, Ecosystems and Environment 40(1-4): 125-135.	3 to 10 years	Netherlands	Organic, conventional, Integrated	Biodiveristy Conservation	Included	Above ground invertebrats	Cereal and cropland	Regulating	Biological Control
Database I	Bradbury, R. B., Kyrkos, A., Morris, A. J., Clark, S. C., Perkins, A. J. & Wilson, J. D. (2000). "Habitat associations and breeding success of yellowhammers on lowland farmland." Journal of Applied Ecology 37: 789-805.	Unknown	UK	Organic, conventional	Biodiveristy Conservation	Not included	Birds	Grassland and non-crop	cultural	Heritage, Cultural, Bequest, Inspirationa l& art

Database I	Bradbury, R. B., Bailey, C. M., Wright, D. & Evans, A. D. (2008). "Wintering Cirl Buntings Emberiza cirlus in southwest England select cereal stubbles that follow a low-input herbicide regime: birds selected stubbles preceded by crops with reduced pestici	less than 1 year	UK	Organic, Integrated	Biodiveristy Conservation	Not included	Birds	Cereal and grassland	cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database I	Bradbury, R. B., Browne, S. J., Stevens, D. K. & Aebischer, N. J. (2004). "Five-year evaluation of the impact of the Arable Stewardship Pilot Scheme on birds." 146(Suppl.2): 171-180.	3 to 10 years	UK	AES	Biodiveristy Conservation	Not included	Birds	Grassland	cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database I	Breeuwer, A., Berendse, F., Willems, F., Foppen, R., Teunissen, W., Schekkerman, H. & Goedhart, P. (2009). "	More than 10 years	Netherlands	AES	Biodiveristy Conservation	Not included	Birds	Non-crop	cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database I	Browne S. J. & Aebischer, N. J. Arable Stewardship: Impact of the Pilot Scheme on Grey Partridge and Brown Hare after Five Years. Final report.	3 to 10 years	UK	AES	Biodiveristy Conservation	Not included	Mammals	Cereal	cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database I	Chamberlain, D. E. & Wilson, J. D. (2000). The contribution of hedgerow structure to the value of organic farms to birds. Ecology and Conservation of Lowland Farmland Birds. N. J. Aebischer, A. D. Evans, P. V. Grice and J. A. Vickery. Tring, British Ornit	Unknown	UK	Organic, conventional	Biodiveristy Conservation	Not included	Birds	Cereal and grassland	cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database I	Chamberlain, D. E., Joys, A., Johnson, P. J., Norton, L., Feber, R. E. & Fuller, R. J. (2010) "Does organic farming benefit farmland birds in winter?" Biology Letters 6(1): 82-84.	1 to 3 years	UK	Organic, conventional	Biodiveristy Conservation	Not included	Birds	Cereal, cropland and non-crop	cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database I	Chamberlain, D. E., Wilson, J. D. & Fuller, R. J. (1999). "A comparison of bird populations on organic and conventional farm systems in southern Britain." Biological Conservation 88(3): 307-320.	Unknown	UK	Organic, conventional	Biodiveristy Conservation	Not included	Birds	Cereal and non-crop	cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database I	Cilgi, T. & Frampton, G. K. (1994). "Arthropod populations under current and reduced-input pesticide regimes: results from the first four treatment years of the MAFF "SCARAB" British Crop Protection Council, BCPC Publicationsproject." 2: 653-660.	3 to 10 years	UK	Conventional, Integrated	Production & Biodiveristy conservation	Not included	Arthrophods	Cereal and cropland	Regulating	Soil quality regulation
Database I	Clough, Y., Holzschuh, A., Gabriel, D., Purtauf, T., Kleijn, D., Kruess, A., Steffan-Dewenter, I. & Tscharntke, T. (2007). "Alpha and beta diversity of arthropods and plants in organically and conventionally managed wheat fields." Journal of Applied Ecolo	Unknown	Germany	Organic, conventional	Biodiveristy Conservation	Not included	Plant and Arthropod	Cereal	Regulating	Soil quality regulation and Pollination
Database I	Clough, Y., Kruess, A. & Tscharntke, T. (2007). "Organic versus conventional arable farming systems: functional grouping helps understand staphylinid response." Agriculture, Ecosystems & Environment 118(1/4): 285-290.	Unknown	Germany	Organic, conventional	Biodiveristy Conservation	Included	Above ground invertebrats	Cereal	Regulating	Biological Control and Soil quality regulation
Database I	Clough, Y., Kruess, A., Kleijn, D. & Tscharntke, T. (2005). "Spider diversity in cereal fields: comparing factors at local, landscape and regional scales." Journal of Biogeography 32(11): 2007-2014.	less than 1 year	Germany	Organic, conventional	Biodiveristy Conservation	Not included	Arthrophods	Cereal	Regulating	Biological Control

Database I	Critchley, C. N. R., Fowbert, J. A., Sherwood, A. J. & Pywell, R. F. (2006). "Vegetation development of sown grass margins in arable fields under a countrywide agri-environment scheme." Biological Conservation 132(1): 1-11.	Unknown	UK	AES	Biodiveristy Conservation	Not included	Plant	Non-crop	Regulating	Soil quality regulation and Pollination
Database I	Critchley, C., Allen, D. S., Fowbert, J. A., Mole, A. C. & Gundrey, A. L. (2004). "Habitat establishment on arable land: assessment of an agri-environment scheme in England, UK." Biological Conservation 119(4): 429 442.	Unknown	UK	AES	Biodiveristy Conservation	Not included	Plant and fauna	Cereal and cropland	Regulating and c	Biological control, Pollination and Heritage, Cultural, Bequest, Inspirational & art
Database I	Dauber, J., Purtauf, T., Allspach, A., Frisch, J., Voigtlander, K. & Wolters, V. (2005). "Local vs. landscape controls on diversity: a test using surface-dwelling soil macroinvertebrates of differing mobility." Global Ecology and Biogeography 14(3): 213-2	Unknown	Germany	Integrated	Biodiveristy Conservation	Not included	Invertebrats	Cropland and grassland	Regulating	Biological Control and Soil quality regulation
Database I	De Snoo, G. R. (1997). "Arable flora in sprayed and unsprayed crop edges." Agriculture, Ecosystems and Environment 66: 223-230.	3 to 10 years	Netherlands	Conventional	Production & Biodiveristy conservation	Not included	Plant	Cereal and cropland	Regulating and Cultural	Pollination and Heritage, Cultural, Bequest, Inspirational& art
Database I	Döring, T. F., Hiller, A., Wehke, S., Schulte, G. & Broll, G. (2003). "Biotic indicators of carabid species richness on organically and conventionally managed arable fields." Agriculture, Ecosystems & Environment 98(1/3): 133-139.	less than 1 year	Germany	Organic, conventional	Biodiveristy Conservation	Not included	Arthrophods	Cereal and cropland	Regulating	Soil quality regulation
Database I	Ekroos, J., Piha, M. & Tiainen, J. (2008). "Role of organic and conventional field boundaries on boreal bumblebees and butterflies." Agriculture, Ecosystems & Environment 124(3-4): 155-159.	Unknown	Finland	Organic, conventional	Production & Biodiveristy conservation	Not included	Arthrophods	Cereal	Regulating	Biological control and Pollination
Database I	Ekroos, J., Hyvonen, T., Tiainen, J. & Tiira, M. (2010) "Responses in plant and carabid communities to farming practises in boreal landscapes." Agriculture Ecosystems & Environment 135(4): 288-293.	Unknown	Finland	Organic, conventional	Biodiveristy Conservation	Not included	Plant and Arthropod	Cereal	Regulating	Biological Control and Soil quality regulation
Database I	Eyre, M. D., Sanderson, R. A., Shotton, P. N. & Leifert, C. (2009). "Investigating the effects of crop type, fertility management and crop protection on the activity of beneficial invertebrates in an extensive farm management comparison trial." Annals of	1 to 3 years	UK	Organic, conventional	Production & Biodiveristy conservation	Included	Above ground invertebrats	Grassland, cropland and cereal	Regulating	Biological Control
Database I	Feber, R. E., Bell, J., Johnson, P. J., Firbank, L. G. & Macdonald, D. W. (1998). "The effects of organic farming on surface-active spider (Araneae) assemblages in wheat in southern England, UK." Journal of Arachnology 26(2): 190-202.	Unknown	UK	Organic, conventional	Biodiveristy Conservation	Not included	Arthrophods	Cereal	Regulating	Biological Control
Database I	Feber, R. E., Johnson, P.J., Firbank, L.G., Hopkins, A. & Macdonald, D.W. (2007). "A comparison of butterfly populations on organically and conventionally managed farmland." Journal of Zoology 273(1): 30-39.	1 to 3 years	UK	Organic, conventional	Biodiveristy Conservation	Not included	Arthrophods	Cropland and grassland	Regulating	Biological control and Pollination
Database I	Feber, R., Firbank, L. G., Johnson, P. J. & Macdonald, DW (1997). "The effects of organic farming on pest and non-pest butterfly abundance." Agriculture, Ecosystems & Environment 64(2): 133-139.	1 to 3 years	UK	Organic, conventional	Production & Biodiveristy conservation	Not included	Arthrophods	Cropland and non-crop	Regulating	Biological control and Pollination
Database I	Feehan, J., Gillmor, D. A. & Culleton, N. E. (2005). "Effects of an agri-environment scheme on farmland biodiversity in Ireland." Agriculture, Ecosystems & Environment 107(2-3): 275-286.	Unknown	Ireland	AES	Biodiveristy Conservation	Not included	Plant and Arthropod	Non-crop	Regulating	Biological Control and Soil quality regulation
Database I	Field, R. G. & Mason, C. F. (2005). "The utilization of two-metre Countryside Stewardship Scheme grass margins by the gatekeeper Pyronia tithonus (L.)." Journal of Natural History 39(18): 1533-1538.	3 to 10 years	UK	AES	Biodiveristy Conservation	Not included	Arthrophods	Non-crop	Regulating	Biological control and Pollination

Database I	Field, R. G., Gardiner, T., Mason, C. F. & Hill, J. (2005). "Agri-environment schemes and butterflies: the utilisation of 6 m grass margins." Biodiversity and Conservation 14(8): 1969-1976.	3 to 10 years	UK	AES	Biodiveristy Conservation	Not included	Arthrophods	Cereal	Regulating	Biological control and Pollination
Database I	Field, R. G., Gardiner, T., Mason, C. F. & Hill, J. (2006). "Countryside Stewardship Scheme and butterflies: a study of plant and butterfly species richness." Biodiversity and Conservation 15(1): 443-452.	3 to 10 years	UK	AES	Biodiveristy Conservation	Not included	Plant and Arthropod	Non-crop	Regulating	Biological control and Pollination
Database I	Field, R. G., Gardiner, T., Mason, C. F. & Hill, J. (2007). "Agri-environment schemes and butterflies: the utilisation of two metre arable field margins." Biodiversity and Conservation 16(2): 465-474.	3 to 10 years	UK	AES	Biodiveristy Conservation	Not included	Arthrophods	Cereal	Regulating	Biological control and Pollination
Database I	Fliessbach, A., Mäder, P., Dubois, D. & Gunst, L. (2000). "Results from a 21 year old field trial. Organic farming enhances soil fertility and biodiversity." FIBL Dossier(no.1): 15 pp.	More than 10 years	Switzerland	Organic, conventional	Production & Biodiveristy conservation	Included	Soil invertebratsand production	Cereal and cropland	Regulating and Provisioning	Soil quality regulation, soil retention and Food production
Database I	Frampton, G. K. (2002). "Long-term impacts of an organophosphate-based regime of pesticides on field and field-edge Collembola communities." Pest Management Science 58(10): 991-1001.	3 to 10 years	UK	Conventional, Integrated	Production & Biodiveristy conservation	Included	Soil invertebrats	Cereal and grassland	Regulating	Soil quality regulation
Database I	Frampton, G. K. (1997). "The potential of Collembola as indicators of pesticide usage: Evidence and methods from the UK arable ecosystem." Pedobiologia 41(1-3): 179-184.	3 to 10 years	UK	Conventional, Integrated	Biodiveristy Conservation	Not included	Arthrophods	Grassland, cropland and cereal	Regulating	Soil quality regulation
Database I	Frampton, G. K., Cilgi, T. & Wratten, S. D. (1994). "The MAFF 'SCARAB' project: long-term consequences for farmland arthropods of pesticide use in the UK." Integrated control in cereals, Le Rheu (France), 30 Nov - 2 Dec 1992, Bulletin OLIB SROP. 17(4): 2	Unknown	UK	Conventional, Integrated	Biodiveristy Conservation	Not included	Arthrophods	Grassland, cropland and cereal	Regulating	Soil quality regulation
Database I	Frieben, B. (2005). Potential of weeds attractive to beneficial insects in organic fields - their consideration in research programs. Bonn, International Society of Organic Agricultural Research (ISOFAR): 456-459.	Unknown	Germany	Organic, conventional	Biodiveristy Conservation	Included	Plant	Cereal and cropland	Regulating	Biological control and Pollination
Database I	Frydrych, J., Bartak, M., Losak, M., Cagas, B., Rotrekl, J. & Kolarik, P. (2009). "Arthropod biodiversity in a landscape with grass and leguminous vegetation cover." "Alternative functions of grassland. Proceedings of the 15th European Grassland Federatio	Unknown	Czech	Organic, conventional	Production & Biodiveristy conservation	Not included	Arthrophods	Cropland and grassland	Regulating	Soil quality regulation
Database I	Fuller, R. J., Norton, L. R., Feber, R. E., Johnson, P. J., Chamberlain, D. E., Joys, A. C., Mathews, F., Stuart, R. C., Townsend, M. C., Manley, W. J., Wolfe, M. S., Macdonald, D. W. & Firbank, L. G. (2005). "Benefits of organic farming to biodiversity v	Unknown	UK	Organic, conventional	Biodiveristy Conservation	Not included	plants, arthropods, invertebrats and birds	Cereal	Regulating	Biological Control and Soil quality regulation
Database I	Gabriel, D., Sait, S. M., Hodgson, J. A., Schmutz, U., Kunin, W. E. & Benton, T. G. (2010). "Scale matters: the impact of organic farming on biodiversity at different spatial scales. ." Ecology Letters 13: 858-869.	Unknown	UK	Organic, conventional	Production & Biodiveristy conservation	Included	Plant and birds	Cereal and grassland	Regulating	Pollination and biological control
Database I	Gabriel, D. & Tscharntke, T. (2007). "Insect pollinated plants benefit from organic farming." Agriculture, Ecosystems & Environment 118(1/4): 43-48.	Unknown	Germany	Organic, conventional	Biodiveristy Conservation	Not included	Plant	Cereal	Regulating	Biological control and Pollination
Database I	Gabriel, D., Roschewitz, I., Tscharntke, T. & Thies, C. (2006). "Beta diversity at different spatial scales: plant communities in organic and conventional agriculture." Ecological Applications 16(5): 2011-2021.	Unknown	Germany	Organic, conventional	Biodiveristy Conservation	Not included	Plant	Cereal	Regulating	Biological control and Pollination
Database I	Gallo, J. & Pekar, S. (1999). "Winter wheat pests and their natural enemies under organic farming system in Slovakia: Effect of ploughing and previous crop." Anzeiger Fur Schadlingskunde-Journal of Pest Science 72(2): 31-36.	1 to 3 years	Slovakia	Organic	Biodiveristy Conservation	Not included	Pest	Cereal	Regulating	Biological Control
Database I	Gallo, J. & Pekar, S. (2001). "Effect of ploughing and previous crop on winter wheat pests and their natural enemies under integrated farming system in Slovakia." Anzeiger fur Schadlingskunde 74(3): 60-65.	Unknown	Slovakia	Integrated	Production & Biodiveristy conservation	Included	Pest	Cereal	Regulating	Biological Control

Database I	Garbutt, R. A. & Sparks, T. H. (2002). "Changes in the botanical diversity of a species rich ancient hedgerow between two surveys (1971-1998)." Biological Conservation 106(2): 273-278.	Unknown	UK	Conventional	Biodiveristy Conservation	Not included	Plant	Non-crop	Regulating and cultural	Biological control, Pollination and Heritage, Cultural, Bequest, Inspirational & art
Database I	Gardiner, T. & Hill, J. (2005). "A study of grasshopper populations in Countryside Stewardship Scheme field margins in Essex." British Journal of Entomology and Natural History 18(2): 73-80.	1 to 3 years	UK	AES	Biodiveristy Conservation	Not included	Arthrophods	cereal	Regulating	Biological Control
Database I	Gibson, R. H., Pearce, S., Morris, R. J., Symondson, W. O. C. & Memmott, J. (2007). "Plant diversity and land use under organic and conventional agriculture: a whole-farm approach." Journal of Applied Ecology 44: 792-803.	Unknown	UK	Organic, conventional	Biodiveristy Conservation	Not included	Plant	Non-crop	Regulating	Biological control and Pollination
Database I	Goulson, D., Hughes, W. O. H., Derwent, L. C. & Stout, J. C. (2002). "Colony growth of the bumblebee, Bombus terrestris, in improved and conventional agricultural and suburban habitats." Oecologia 130(2): 267-273.	less than 1 year	UK	Conventional, AES	Production & Biodiveristy conservation	Included	Arthrophods	Cereal	Regulating	Pollination
Database I	Green, R. E., Osborne, P. E. & Sears, E. J. (1994). "The Distribution of Passerine Birds in Hedgerows During the Breeding-Season in Relation to Characteristics of the Hedgerow and Adjacent Farmland." Journal of Applied Ecology 31(4): 677-692.	Unknown	UK	Conventional, Integrated	Biodiveristy Conservation	Not included	Birds	Cereal	cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database I	Hald, A. B. (1999). "Weed vegetation (wild flora) of long established organic versus conventional cereal fields in Denmark." Annals of Applied Biology 134(3): 307-314.	1 to 3 years	Denmark	Organic, conventional	Biodiveristy Conservation	Not included	Plant	Cereal	Regulating	Biological control and Pollination
Database I	Hart, J. D., Milsom, T. P., Fisher, G., Wilkins, V., Moreby, S. J., Murray, A. W. A. & Robertson, P. A. (2006). "The relationship between yellowhammer breeding performance, arthropod abundance and insecticide applications on arable farmland." Journal of A	1 to 3 years	UK	Conventional	Biodiveristy Conservation	Not included	Birds	Cropland, grassland and non-crop	Regulating and cultural	Soil quality regulation and Herritage, Cultural, Bequest, Inspiration & Art
Database I	Hasken, K. H. & Poehling, H. M. (1995). "EFFECTS OF DIFFERENT INTENSITIES OF FERTILIZERS AND PESTICIDES ON APHIDS AND APHID PREDATORS IN WINTER-WHEAT." Agriculture Ecosystems & Environment 52(1): 45-50.	less than 1 year	Germany	Organic, conventional, Integrated	Biodiveristy Conservation	Included	Arthrophod and predators	Cereal	Regulating	Biological Control
Database I	Hawes, C., Squire, G. R., Hallett, P. D., Watson, C. A. & Young, M. (2010) "Arable plant communities as indicators of farming practice." Agriculture, Ecosystems & Environment. 138 (1-2):17-26.	Unknown	UK	Organic, conventional, Integrated	Production & Biodiveristy conservation	Included	Plant	Cereal and cropland	Regulating	Biological Control
Database I	Henderson, I. G., Ravenscroft, N., Smith, G. & Holloway, S.(2009). "Effects of crop diversification and low pesticide inputs on bird populations on arable land." Agriculture, Ecosystems & Environment 129(1/3): 149-156.	3 to 10 years	UK	Integrated	Biodiveristy Conservation	Not included	Birds	Cropland	Cultural	Heritage, Cultural, Bequest, Inspirational& art and Sientific &Educational Services

Database I	Herzog, F., Dreier, S., Hofer, G., Marfurt, C., Schüpbach, B., Spiess, M. & Walter, T (2005). "Effect of ecological compensation areas on floristic and breeding bird diversity in Swiss agricultural landscapes." Agriculture, Ecosystems & Environment 108(3)	Unknown	Switzerland	AES	Biodiveristy Conservation	Not included	Birds	Non-crop	Regulating and cultural	Biological control, Pollination and Heritage, Cultural, Bequest, Inspirational & art
Database I	Holland, J. M. & Thomas, S. R. (1996). Phacelia tanacetifolia flower strips: Their effect on beneficial invertebrates and gamebird chick food in an integrated farming system. Arthropod Natural Enemies in Arable Land Ii - Survival, Reproduction and Enhance	Unknown	UK	Conventional, Integrated	Biodiveristy Conservation	Not included	Birds, arthropods and parasitoids	Cropland and grassland	Regulating	Biological Control
Database I	Holland, J. M. & Thomas, S. R. (1997). "Assessing the role of beneficial invertebrates in conventional and integrated farming systems during an outbreak of Sitobion avenae." Biological Agriculture & Horticulture 15(1-4): 73-82.	less than 1 year	UK	Conventional, Integrated	Biodiveristy Conservation	Included	Arthrophods	Cereal	Regulating	Biological Control
Database I	Holland, J. M., Winder, L. & Perry, J. N. (2000). "The impact of dimethoate on the spatial distribution of beneficial arthropods in winter wheat." Annals of Applied Biology 136(2): 93-105.	Unknown	UK	Conventional	Biodiveristy Conservation	Included	Arthrophods	Cereal	Regulating	Biological Control
Database I	Holland, J. M., Cook, S. K., Drysdale, A. D., Hewitt, M. V., Spink, J. & Turley, D. B.(1998). "The impact on non-target arthropods of integrated compared to conventional farming: results from the LINK Integrated Farming Systems project." In: 1998 Brighton	Unknown	UK	Conventional, Integrated	Biodiveristy Conservation	Included	Arthrophods	Cereal and cropland	Regulating	Soil quality regulation
Database I	Holzschuh, A., Steffan-Dewenter, I., Kleijn, D. & Tscharntke, T.(2007). "Diversity of flower-visiting bees in cereal fields: effects of farming system, landscape composition and regional context." Journal of Applied Ecology 44(1): 41-49.	Unknown	Germany	Organic, conventional	Biodiveristy Conservation	Included	Arthrophods	Cereal	Regulating	Pollination
Database I	Holzschuh, A., Steffan-Dewenter, I. & Tscharntke, T. (2008). "Agricultural landscapes with organic crops support higher pollinator diversity." Oikos 117(3): 354-361.	Unknown	Germany	Organic	Biodiveristy Conservation	Included	Arthrophods	Cereal	Regulating	Pollination
Database I	Hopkins, A., Pywell, R.F., Peel, S., Johnson, R.H & Bowling, P.J. (1999). "Enhancement of botanical diversity of permanent grassland and impact on hay production in Environmentally Sensitive Areas in the UK." Grass & Forage Science 54: 163-173.	1 to 3 years	UK	AES	Biodiveristy Conservation	Not included	Plant	Grassland	Regulating	Biological Control
Database I	Hutcheon, J. A., Iles, D. R. & Kendall, D. A. (2001). "Earthworm populations in conventional and integrated farming systems in the LIFE Project (SW England) in 1990-2000." Annals of Applied Biology 139(3): 361-372.	More than 10 years	UK	Conventional, Integrated	Biodiveristy Conservation	Included	Earthworms	Grassland, cropland and cereal	Regulating	Soil quality regulation
Database I	Huusela-Veistola, E. (1998). "Effects of perennial grass strips on spiders (Araneae) in cereal fields and impact on pesticide side-effects." Journal of Applied Entomology 122(9/10): 575-583.	1 to 3 years	Finland	Conventional, Integrated	Biodiveristy Conservation	Not included	Arthrophods	Cereal and grassland	Regulating	Biological Control
Database I	Huusela-Veistola, E. (1996). "Effects of pesticide use and cultivation techniques on ground beetles (Col, Carabidae) in cereal fields." Annales Zoologici Fennici 33(1): 197-205.	1 to 3 years	Finland	Conventional, Integrated	Production & Biodiveristy conservation	Included	Arthrophods	Cereal	Regulating	Biological Control
Database I	Hyvonen, T., Ketoja, E., Salonen, J., Jalli, H. & Tiainen, J. (2003). "Weed species diversity and community composition in organic and conventional cropping of spring cereals." Agriculture, Ecosystems & Environment 97(1/3): 131-149.	1 to 3 years	Finland	Organic, conventional	Biodiveristy Conservation	Not included	Plant	Cereal	Regulating	Biological control and Pollination
Database I	Irmler, U. (2010) "Changes in earthworm populations during conversion from conventional to organic farming." Agriculture, Ecosystems & Environment 135(3): 194-198.	3 to 10 years	Germany	Organic, conventional	Biodiveristy Conservation	Not included	Earthworms	Grassland, cropland and cereal	Regulating	Soil quality regulation and water regulation
Database I	Irmler, U. (2003). "The spatial and temporal pattern of carabid beetles on arable fields in northern Germany (Schleswig-Holstein) and their value as ecological indicators." Agriculture, Ecosystems & Environment 98(1/3): 141-151.	1 to 3 years	Germany	Organic, conventional	Biodiveristy Conservation	Not included	Arthrophods	Cereal	Regulating	Biological Control
Database I	Jeanneret, P., Aviron, S., Herzog, F., Luka, H., Pozzi, S. & Walter, T. (2005). Temporal trends of arthropod diversity in conventional and low-input meadows. Grassland Science in Europe Volume 10. Tartu, Estonian Grassland Society: 344-347.	3 to 10 years	Switzerland	AES	Biodiveristy Conservation	Not included	Arthrophods	Cropland and grassland	Regulating	Biological Control and Soil quality regulation

Database I	Kaar, B. & Freyer, B. (2008). Weed species diversity and cover-abundance in organic and conventional winter cereal fields and 15 years ago. Bonn, International Society of Organic Agricultural Research (ISOFAR): 686-689.	1 to 3 years	Austria	Organic, conventional	Biodiveristy Conservation	Not included	Plant	Cereal	Regulating	Biological control and Pollination
Database I	Kampmann, D.,Herzog, F., Jeanneret, P., Konold, W., Peter, M., Walter, T., Wildi, O. & Lascher, A. (2008). "Mountain grassland biodiversity: impact of site conditions versus management type." Journal for Nature Conservation 16(1): 12-25.	Unknown	Switzerland	AES	Biodiveristy Conservation	Not included	Plant and Arthropod	Grassland	cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database I	Kleijn, D. & van Zuijlen, G. J. C. (2004). "The conservation effects of meadow bird agreements on farmland in Zeeland, The Netherlands, in the period 1989-1995." Biological Conservation 117(4): 443-451.	1 to 3 years	Netherlands	AES	Biodiveristy Conservation	Not included	Birds	Non-crop	cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database I	Kleijn, D.,Berendse, F., Smit, R. & Gilissen, N. (2001). "Agri-environment schemes do not effectively protect biodiversity in Dutch agricultural landscapes." Nature 413(6857): 723-725.	Unknown	Netherlands	AES	Biodiveristy Conservation	Not included	Plant, birds and pollinators	Grassland	Regulating and cultural	Biological control, Pollination and Heritage, Cultural, Bequest, Inspirational & art
Database I	Kleijn, D., Kohler, F., Baldi, A., Batary, P., Concepcion, E. D., Clough, Y., Diaz, M., Gabriel, D., Holzschuh, A., Knop, E., Kovacs, A., Marshall, E. J. P., Tscharntke, T. & Verhulst, J. (2009). "On the relationship between farmland biodiversity and land	Unknown	Netherlands	AES	Production & Biodiveristy conservation	Included	Plant	Cropland and grassland	Regulating	Biological Control
Database I	Knop, E., Kleijn, D., Herzog, F. & Schmid, B. (2006). "Effectiveness of the Swiss agri-environment scheme in promoting biodiversity." Journal of Applied Ecology 43(1): 120-127.	Unknown	Switzerland	AES	Biodiveristy Conservation	Not included	Plant and Arthropod	Non-crop	Regulating	Biological control and Pollination
Database I	Kohler, F., Verhulst, J., Knop, E., Herzog, F. & Kleijn, D. (2007). "Indirect effects of grassland extensification schemes on pollinators in two contrasting European countries." Biological Conservation 135(2): 302-307.	Unknown	Multiply countries	AES	Production & Biodiveristy conservation	Included	Arthrophods	Grassland	Regulating	Pollination
Database I	Kragten, S. & Snoo, G. R. d. (2008). "Field-breeding birds on organic and conventional arable farms in the Netherlands." Agriculture, Ecosystems & Environment 126(3/4): 270-274.	1 to 3 years	Netherlands	Organic, conventional	Biodiveristy Conservation	Not included	Birds	Cereal and cropland	cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database I	Kragten, S. & Snoo, G. R. d. (2007). "Nest success of Lapwings Vanellus vanellus on organic and conventional arable farms in the Netherlands." Ibis 149: 742-749.	Unknown	Netherlands	Organic, conventional	Biodiveristy Conservation	Not included	Birds	Cereal and cropland	cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database I	Kragten, S., Reinstra, E. & Gertenaar, E. (2009). "Breeding Barn Swallows Hirundo rustica on organic and conventional arable farms in the Netherlands." Journal of Ornithology 150(2): 515-518.	Unknown	Netherlands	Organic, conventional	Biodiveristy Conservation	Not included	Birds	Cereal and cropland	cultural	Heritage, Cultural, Bequest, Inspirationa l& art

Database I	Kragten, S., K. B. Trimbos & Snoo, G. R. d.(2008). "Breeding skylarks (Alauda arvensis) on organic and conventional arable farms in The Netherlands." Agriculture, Ecosystems & Environment 126(3-4): 163-167.	Unknown	Netherlands	Organic, conventional	Biodiveristy Conservation	Not included	Birds	Cereal and cropland	cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database I	Lubbe, S. K. & Snoo, G. R. d. (2007). "Effect of dairy farm management on Swallow Hirundo rustica abundance in The Netherlands: dairy farm management methods have no influence on numbers of Swallow breeding pairs." Bird Study 54(2): 176-181.	Unknown	Netherlands	Organic, conventional	Biodiveristy Conservation	Included	Birds	Grassland	cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database I	Lye, G. C., Park, K., Osborne, J., Holland, J. & Goulson, D.. (2009). "Assessing the value of Rural Stewardship schemes for providing foraging resources and nesting habitat for bumblebee queens (Hymenoptera: Apidae)." Biological Conservation 142(10): 2023	Unknown	UK	AES	Production & Biodiveristy conservation	Included	Arthrophods	Cropland and grassland	Regulating	Pollination
Database I	Macfadyen, S., Gibson, R., Polaszek, A., Morris, R. J., Craze, P. G., Planque, R., Symondson, W. O. C. & Memmott, J. (2009). "Do differences in food web structure between organic and conventional farms affect the ecosystem service of pest control?" Ecolog	Unknown	UK	Organic, conventional	Production & Biodiveristy conservation	Not included	Plant and pest	Cropland and grassland	Provisioning	Food production
Database I	Macfadyen, S., Gibson, R., Raso, L., Sint, D., Traugott, M. & Memmott, J. (2009). "Parasitoid control of aphids in organic and conventional farming systems." Agriculture, Ecosystems & Environment 133(1/2): 14-18.	Unknown	UK	Organic, conventional	Production & Biodiveristy conservation	Included	Pest	Cereal	Regulating	Biological Control
Database I	Manhoudt, A. G. E., Visser, A. J. & Snoo, G. R. d. (2007). "Management regimes and farming practices enhancing plant species richness on ditch banks." Agriculture, Ecosystems & Environment 119(3-4): 353-358.	Unknown	Netherlands	Organic, conventional	Biodiveristy Conservation	Not included	Plant	Non-crop	Regulating	Biological control and Pollination
Database I	Marshall, E. J. P., West, T. M. & Kleijn, D. (2006). "Impacts of an agri-environment field margin prescription on the flora and fauna of arable farmland in different landscapes." Agriculture, Ecosystems & Environment 113(1/4): 36-44.	less than 1 year	UK	AES	Biodiveristy Conservation	Not included	Plant, birds and pollinators	Non-crop	Regulating and cultural	Biological control, Pollination and Heritage, Cultural, Bequest, Inspirational & art
Database I	Mayer, F., Heinz, S. & Kuhn, G. (2008). "Effects of agri-environment schemes on plant diversity in Bavarian grasslands." Community Ecology 9(2): 229-236.	Unknown	Germany	Organic, conventional, AES	Biodiveristy Conservation	Not included	Plant	Grassland	Regulating	Biological control and Pollination
Database I	McEvoy, P. M., Flexen, M. & McAdam, J. H.(2006). "The Environmentally Sensitive Area (ESA) scheme in northern Ireland: ten years of agri-environment monitoring." Biology and Environment: Proceedings of the Royal Irish Academy, Section B 106B(3): 413-423.	More than 10 years	Ireland	AES	Biodiveristy Conservation	Not included	Plant	Grassland	Regulating	Biological control and Pollination
Database I	Merckx, T., Feber, R. E., Riordan, P., Townsend, M. C., Bourn, N. A. D., Parsons, M. S. & Macdonald, D. W. (2009). "Optimizing the biodiversity gain from agri-environment schemes." Agriculture, Ecosystems and Environment 130(3-4): 177-182.	Unknown	UK	AES	Biodiveristy Conservation	Not included	Arthrophods	Non-crop	Regulating	Biological control and Pollination
Database I	Metzke, M., Potthoff, M., Quintern, M., Hess, J. & Joergensen, R. G.. (2007). "Effect of reduced tillage systems on earthworm communities in a 6-year organic rotation." 43(Suppl.1): S209-S215.	1 to 3 years	Germany	Organic	Biodiveristy Conservation	Included	Earthworms	Grassland, cropland and cereal	Regulating	Soil quality regulation, water regulation and climate regulation
Database I	Moorcroft, D., Whittingham, M. J., Bradbury, R. B. & Wilson, J. D. (2002). "The selection of stubble fields by wintering granivorous birds reflects vegetation cover and food abundance." Journal of Applied Ecology 39(3): 535-547.	Unknown	UK	Organic, conventional	Biodiveristy Conservation	Not included	Birds	Grassland, cropland and cereal	cultural	Heritage, Cultural, Bequest, Inspirationa l& art

Database I	Moreby, S. J. (1996). "The effects of organic and conventional farming methods on plant bug densities (Hemiptera: Heteroptera) within winter wheat fields." Annals of Applied Biology 128(3): 415-421.	1 to 3 years	UK	Organic, conventional	Biodiveristy Conservation	Not included	pest	Cereal	Regulating and cultural	Biological control and heritage, cultural, bequest, inspiration & art
Database I	Moreby, S. J. & Sotherton, N. W. (1997). "A comparison of some important chick-food insect groups found in organic and conventionaly-grown winter wheat fields in southern England." Biological Agriculture & Horticulture 15(1-4): 51-60.	1 to 3 years	UK	Organic, conventional	Biodiveristy Conservation	Not included	Plant and Arthropod	Cereal	Regulating	Biological Control
Database I	Moreby, S. J.& Southway, S.E. (1999). "Influence of autumn applied herbicides on summer and autumn food available to birds in winter wheat fields in southern England." Agriculture, Ecosystems & Environment 72(3): 285-297.	1 to 3 years	UK	Conventional	Biodiveristy Conservation	Not included	Plant and Invertebrats	Cereal	Regulating	Biological Control
Database I	Morris, A. J., Wilson, J. D., Whittingham, M. J. & Bradbury, R. B. (2005). "Indirect effects of pesticides on breeding yellowhammer (Emberiza citrinella)." Agriculture, Ecosystems & Environment 106(1): 1-16.	Unknown	UK	Conventional	Biodiveristy Conservation	Not included	Birds	Cereal and grassland	cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database I	Neumann, H., Loges, R. & Taube, F (2008). Comparative analysis of conventional and organic farming systems: diversity and abundance of farmland birds. Bonn, International Society of Organic Agricultural Research (ISOFAR): 644-647.	1 to 3 years	Germany	Organic, conventional	Biodiveristy Conservation	Not included	Birds	Cropland	cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database I	Norton, L. R., Fuller, R. J., Feber, R. E., Johnson, P. J., Chamberlain, D. E., Joys, A. C., Mathews, F., Stuart, R. C., Townsend, M. C., Manley, W. J., Wolfe, M. S., MacDonald, D. W. & Firbank, L. G.(2006). "The benefits of organic farming for biodiversi	Unknown	UK	Organic, conventional	Biodiveristy Conservation	Not included	Plant and Arthropod	Cereal	Regulating	Biological Control
Database I	Oberg, S. (2007). "Diversity of spiders after spring sowing - influence of farming system and habitat type." Journal of Applied Entomology 131(8): 524-531.	Unknown	Sweden	Organic, conventional	Production & Biodiveristy conservation	Included	Arthrophods	Cereal	Regulating	Biological Control
Database I	Öberg, S. (2009). "Influence of landscape structure and farming practice on body condition and fecundity of wolf spiders." Basic and Applied Ecology 10(7): 614-621.	Unknown	Sweden	Organic, conventional	Production & Biodiveristy conservation	Included	Arthrophods	Cereal	Regulating	Biological Control and Soil quality regulation
Database I	Oberg, S., Ekbom, B. & Bommarco, R. (2007). "Influence of habitat type and surrounding landscape on spider diversity in Swedish agroecosystems." Agriculture Ecosystems & Environment 122(2): 211-219.	1 to 3 years	Sweden	Organic	Biodiveristy Conservation	Included	Arthrophods	Cereal	Regulating	Biological Control
Database I	Ondine, F. C., Jean, C. & Romain, J.(2009). "Effects of organic and soil conservation management on specialist bird species." Agriculture, Ecosystems & Environment 129(1/3): 140-143.	Unknown	France	Organic, conventional	Biodiveristy Conservation	Not included	Birds	Cereal	Cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database I	Pacha, M. J. & Petit, S. (2008). "The effect of landscape structure and habitat quality on the occurrence of Geranium sylvaticum in fragmented hay meadows." Agriculture, Ecosystems & Environment 123(1/3): 81-87.	Unknown	UK	AES	Biodiveristy Conservation	Not included	Plant	Non-crop	Regulating and cultural	Soil quality regulation and Herritage, Cultural, Bequest, Inspiration & Art
Database I	Peigne, J., Cannavaciuolo, M., Gautronneau, Y., Aveline, A., Giteau, J. L. & Cluzeau, D. (2009). "Earthworm populations under different tillage systems in organic farming." Soil & Tillage Research 104(2): 207-214.	1 to 3 years	France	Organic	Biodiveristy Conservation	Not included	Earthworms	Cropland	Regulating	Soil quality regulation

Database I	Pelosi, C., Bertrand, M. & Roger-Estrade, J. (2009). "Earthworm community in conventional, organic and direct seeding with living mulch cropping systems." Agronomy for Sustainable Development 29(2): 287-295.	1 to 3 years	France	Organic, conventional	Biodiveristy Conservation	Included	Earthworms	Cereal and cropland	Regulating	Soil quality regulation
Database I	Perkins, A. J., Maggs, H. E. & Wilson, J. D. (2008). "Winter bird use of seed-rich habitats in agri-environment schemes." Agriculture, Ecosystems & Environment 126(3/4): 189-194.	1 to 3 years	UK	AES	Biodiveristy Conservation	Not included	Birds	Grassland, cropland and cereal	Cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database I	Petersen, H. (2002). "Effects of non-inverting deep tillage vs. conventional ploughing on collembolan populations in an organic wheat field." European Journal of Soil Biology 38(2): 177-180.	less than 1 year	Denmark	Organic	Biodiveristy Conservation	Included	Arthrophods	Cereal	Regulating	Soil quality regulation
Database I	Petersen, S., Axelsen, J. A., Tybirk, K., Aude, E. & Vestergaard, P. (2006). "Effects of organic farming on field boundary vegetation in Denmark." Agriculture, Ecosystems & Environment 113(1-4): 302-306.	Unknown	Denmark	Organic, conventional	Biodiveristy Conservation	Not included	plant	Grassland, cropland and cereal	Regulating and cultural	Soil quality regulation, biological control and Herritage, Cultural, Bequest, Inspiration & Art
Database I	Pfiffner, L. & Luka, H. (2000). "Overwintering of arthropods in soils of arable fields and adjacent semi-natural habitats." Agriculture, Ecosystems & Environment 78(3): 215-222.	less than 1 year	Switzerland	Organic, Integrated	Biodiveristy Conservation	Not included	Arthrophods	Non-crop	Regulating	Soil quality regulation
Database I	Pfiffner, L. & Luka, H. (2003). "Effects of low-input farming systems on carabids and epigeal spiders - a paired farm approach." Basic and Applied Ecology 4(2): 117-127.	1 to 3 years	Switzerland	Organic, Integrated	Biodiveristy Conservation	Not included	Arthrophods	Cereal	Regulating	Biological Control
Database I	Pfiffner, L. & Luka, H. (2007). "Earthworm populations in two low-input cereal farming systems." Applied Soil Ecology 37(3): 184-191.	1 to 3 years	Switzerland	Organic, Integrated	Biodiveristy Conservation	Not included	Earthworms	Cereal	Regulating	Soil quality regulation and water regulation
Database I	Pfiffner, L. & Niggli, U. (1996). "Effects of bio-dynamic, organic and conventional farming on ground beetles (Col Carabidae) and other epigaeic arthropods in winter wheat." Biological Agriculture & Horticulture 12(4): 353-364.	1 to 3 years	Switzerland	Organic, conventional	Biodiveristy Conservation	Not included	Arthrophods	Cereal	Regulating	Biological Control and Soil quality regulation
Database I	Piha, M., Tiainen, J., Holopainen, J. & Vepsalainen, V. (2007). "Effects of land-use and landscape characteristics on avian diversity and abundance in a boreal agricultural landscape with organic and conventional farms." Biological Conservation 140(1-2):	Unknown	Finland	Organic, conventional	Biodiveristy Conservation	Not included	Birds	Cereal and grassland	Cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database I	Pocock, M. J. O. & Jennings, N. (2008). "Testing biotic indicator taxa: the sensitivity of insectivorous mammals and their prey to the intensification of lowland agriculture." Journal of Applied Ecology 45(1): 151-160.	Unknown	UK	Organic, conventional	Biodiveristy Conservation	Not included	Mammals and arthropods	Cereal	Regulating	Biological Control
Database I	Poetsch, E. M.,Blaschka, A. & Resch, R. (2005). Impact of different management systems and location parameters on floristic diversity of mountainous grassland.	Unknown	Austria	Organic	Biodiveristy Conservation	Not included	Plant	Grassland	Cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database I	Purtauf, T., Roschewitz, I., Dauber, J., Thies, C., Tscharntke, T. & Wolters, V. (2005). "Landscape context of organic and conventional farms: influences on carabid beetle diversity." Agriculture, Ecosystems & Environment 108(2): 165-174.	Unknown	Germany	Organic, conventional	Biodiveristy Conservation	Not included	Arthrophods	Cereal	Regulating	Biological Control and Soil quality regulation

Database I	Rahmann, G., Paulsen, H., Hötker, H., Jeromin, K., Schrader, S., Haneklaus, S. & Schnug, E. (2006). Contribution of organic farming to conserving and improving biodiversity in Germany, (Aves) fauna as an example. Aspects of Applied Biology 79: 187-190.	1 to 3 years	Germany	Organic, conventional	Biodiveristy Conservation	Not included	Birds	Cropland	Cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database I	Reddersen, J. (1997). "The arthropod fauna of organic versus conventional cereal fields in Denmark." Biol. Agric. &. Hortic 15(1-4): 61-71.	1 to 3 years	Denmark	Organic, conventional	Biodiveristy Conservation	Not included	Arthrophods	Cereal	Regulating	Biological Control
Database I	Reid, N., McDonald, R. A. & Montgomery, W. I. (2007). "Mammals and agri-environment schemes: hare haven or pest paradise?" Journal of Applied Ecology 44(6): 1200-1208.	Unknown	Ireland	AES	Biodiveristy Conservation	Not included	Mammals	Grassland	Regulating and cultural	Biological control and heritage, cultural, bequest, inspiration & art
Database I	Roth, T., Amrhein, V., Peter, B. & Weber, D. (2008). "A Swiss agri-environment scheme effectively enhances species richness for some taxa over time." Agriculture, Ecosystems & Environment 125(1/4): 167-172.	3 to 10 years	Switzerland	AES	Biodiveristy Conservation	Not included	plants, arthropods, invertebrats and birds	Grassland	Regulating and cultural	Biological control, Pollination and Heritage, Cultural, Bequest, Inspirational & art
Database I	Rundolf, M. & Smith, H. G. (2006). "The effect of organic farming on butterfly diversity depends on landscape context." Journal of Applied Ecology 43(6): 1121-1127.	Unknown	Sweden	Organic, conventional	Biodiveristy Conservation	Not included	Arthrophods	Cereal	Regulating	Biological control and Pollination
Database I	Rundlöf, M., Nilsson, H. & Smith, H. G. (2008). "Interacting effects of farming practice and landscape context on bumble bees." Biological Conservation 141(2): 417-426.	Unknown	Sweden	Organic, conventional	Biodiveristy Conservation	Not included	Arthrophods	Cereal	Regulating	Biological control and Pollination
Database I	Rundlof, M., Bengtsson, J. & Smith, H. G. (2008) "Local and landscape effects of organic farming on butterfly species richness and abundance." Journal of Applied Ecology 45 (3): 813-820	Unknown	Sweden	Organic, conventional	Biodiveristy Conservation	Not included	Arthrophods	Cereal	Regulating	Biological control and Pollination
Database I	Rundlöf, M., Mathilda E. & Henrik, G. S. (2010). "Organic farming at local and landscape scales benefits plant diversity." Ecography 33 (3): 514-522	Unknown	Sweden	Organic, conventional	Biodiveristy Conservation	Not included	Plant	Cereal	Regulating and cultural	Biological control, Pollination and Heritage, Cultural, Bequest, Inspirational & art
Database I	Sarapatka, B. & Vesely, M. (2005). Carabid beetles (Carabidae) in agroecosystems - case study on the effects of conversion to organic farming and land structure. Bonn, International Society of Organic Agricultural Research (ISOFAR): 563-566.	3 to 10 years	Czech	Organic, conventional	Biodiveristy Conservation	Not included	Arthrophods	Cropland	Regulating	Biological Control
Database I	Schekkerman, H., Teunissen, W. & Oosterveld, E. (2008). "The effect of 'mosaic management' on the demography of black-tailed godwit Limosa limosa on farmland." Journal of Applied Ecology 45(4): 1067-1075.	Unknown	Netherlands	AES	Biodiveristy Conservation	Not included	Birds	Grassland, cropland and cereal	Cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database I	Schmidt, M. H., Roschewitz, I., Thies, C. & Tscharntke, T. (2005). "Differential effects of landscape and management on diversity and density of ground-dwelling farmland spiders." Journal of Applied Ecology 42(2): 281-287.	Unknown	Germany	Organic, conventional	Biodiveristy Conservation	Included	Arthrophods	Cereal	Regulating	Biological Control

Database I	Schmidt, O., Curry, J. P., Purvis, G. & Clements, R. O. (2001). "Earthworm communities in conventional wheat monocropping and low-input wheat-clover intercropping systems." Annals of Applied Biology 138: 377 388.	1 to 3 years	Multiple countries	Conventional, Integrated	Biodiveristy Conservation	Not included	Earthworms	Cereal and grassland	Regulating	Soil quality regulation
Database I	Schrader, S., Kiehne, J., Anderson, T. H., Paulsen, H. M. & Rahmann, G. (2006). "Development of collembolans after conversion towards organic farming." Aspects of Applied Biology (79): 181-185.	1 to 3 years	Germany	Organic, conventional	Production & Biodiveristy conservation	Not included	Arthrophods	Grassland, cropland and cereal	Regulating	Biological Control
Database I	Scullion, J., Neale, S. & Philipps, L. (2002). "Comparisons of earthworm populations and cast properties in conventional and organic arable rotations." Soil Use and Management 18: 293-300.	1 to 3 years	UK	Organic, conventional	Production & Biodiveristy conservation	Not included	Earthworms	Grassland, cropland and cereal	Regulating and Provisioning	Soil quality regulation and Food production
Database I	Scullion, J., Neale, S. & Philipps, L. (2007). "Earthworm casting and burrowing activity in conventional and organic grass-arable rotations." European Journal of Soil Biology 43(Suppl.1): S216-S221.	Unknown	UK	Organic, conventional	Production & Biodiveristy conservation	Not included	Earthworms	Grassland, cropland and cereal	Regulating	Soil quality regulation and water regulation
Database I	Sepp, K., Ivask, M., Kaasik, A., Mikk, M. & Peepson, A. (2005). "Soil biota indicators for monitoring the Estonian agri-environmental programme." Agriculture Ecosystems & Environment 108(3): 264-273.	1 to 3 years	Estonia	AES	Biodiveristy Conservation	Not included	Soil quality	Cereal and cropland	Regulating	Soil quality regulation
Database I	Sheldon, R. D., Chaney, K. & Tyler, G. A. (2007) Factors affecting nest survival of northern Lapwings Vanellus vanellus in arable farmland: an agri-environment scheme prescription can enhance nest survival: Capsule A spring/summer fallow agri-environment	1 to 3 years	UK	AES	Biodiveristy Conservation	Not included	Birds	Cereal and non-crop	Cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database I	Smith, H. G., Danhardt, J., Lindstrom, A. & Rundlof, M. (2010). "Consequences of organic farming and landscape heterogeneity for species richness and abundance of farmland birds." Oecologia 162(4): 1071-1079.	Unknown	Sweden	Organic, conventional	Biodiveristy Conservation	Not included	Birds	Grassland, cropland and cereal	Cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database I	Stevens, D. K. & Bradbury, R. B. (2006). "Effects of the Arable Stewardship Pilot Scheme on breeding birds at field and farm-scales." Agriculture, Ecosystems & Environment 112(4): 283-290.	3 to 10 years	UK	AES	Biodiveristy Conservation	Not included	Birds	Grassland, cropland and cereal	Cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database I	Tamutis, V., Monseviaius, V. & Pekarskas, J. (2004). "Ground and rove beetles (Coleoptera: Carabidae, Staphylinidae) in ecological and conventional winter wheat fields." Baltic Journal of Coleopterology 4(1): 31-40.	Unknown	Lithuania	Organic, conventional	Biodiveristy Conservation	Included	Arthrophods	Cereal	Regulating	Biological Control
Database I	Tarrant K.A., Field S.A., Langton S.D.& Hart A.D.M. (1997) Effects on earthworm populations of reducing pesticide use in arable crop rotations. Soil Biology & Biochemistry 29: 657-661.	3 to 10 years	UK	Organic, conventional, Integrated	Biodiveristy Conservation	Not included	Earthworms	Cropland	Regulating	Soil quality regulation
Database I	Taylor, M. E. & Morecroft, M. D. (2009). "Effects of agri-environment schemes in a long-term ecological time series." Agriculture, Ecosystems & Environment 130(1-2): 9-15.	Unknown	UK	Organic, AES	Biodiveristy Conservation	Not included	Plant, Arthropod and Mammals	Grassland	Regulating	Biological Control
Database I	Verhulst, J. (2007). Meadow bird ecology at different spatial scales: responses to environmental conditions and implications for management: 136 pp.	Unknown	Netherlands	AES	Biodiveristy Conservation	Not included	Birds	Non-crop	Cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database I	Verhulst, J., Kleijn, D. & Berendse, F. (2007). "Direct and indirect effects of the most widely implemented Dutch agri-environment schemes on breeding waders." Journal of Applied Ecology 44(1): 70-80.	Unknown	Netherlands	AES	Biodiveristy Conservation	Not included	Birds	Grassland	Cultural	Heritage, Cultural, Bequest, Inspirationa l& art

Database I	Wakeham-Dawson, A. & Aebischer, N. J. (1998). "Factors determining winter densities of birds on environmentally sensitive area arable reversion grassland in southern England, with special reference to skylarks (Alauda arvensis)." Agriculture, Ecosystems &	1 to 3 years	UK	AES	Biodiveristy Conservation	Not included	Birds	Cereal and grassland	Cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database I	Wakeham-Dawson, A., Szoszkiewicz, K., Stern, K. & Aebischer, N. J. (1998). "Breeding skylarks Alauda arvensis on Environmentally Sensitive Area arable reversion grass in southern England: survey-based and experimental determination of density." Journal of	1 to 3 years	UK	AES	Biodiveristy Conservation	Not included	Birds	Cereal and grassland	Cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database I	Walter, T., Herzog, F., Birrer, S., Dreier, S., Hunziker, M., Jeanneret, P., Lascher, A., Peter, B., Pfiffner, L. & Spiess, M. (2004). Effects of ecological compensation areas on species diversity in the Swiss grassland - an overview. Grassland Science in	Unknown	Switzerland	AES	Biodiveristy Conservation	Not included	Plant and Arthropod	Grassland	Regulating and cultural	Biological control and heritage, cultural, bequest, inspiration & art
Database I	Weibull, A. & Ostman, O. (2003). "Species composition in agroecosystems: the effect of landscape, habitat, and farm management." Basic and Applied Ecology 4(4): 349-361.	Unknown	Sweden	Organic, conventional	Biodiveristy Conservation	Not included	Plant and Arthropod	Cereal and grassland	Regulating and cultural	Biological control, Pollination and Heritage, Cultural, Bequest, Inspirational & art
Database I	Weibull, A. C. (2002). "Higher biodiversity in heterogeneous landscapes." Entomologisk Tidskrift 123(4): 163-165.	Unknown	Sweden	Organic	Biodiveristy Conservation	Not included	Plant and Arthropod	Grassland	Regulating and cultural	Biological control, Pollination and Heritage, Cultural, Bequest, Inspirational & art
Database I	Weibull, A. C., Ostman, O. & Granqvist, A. (2003). "Species richness in agroecosystems: the effect of landscape, habitat and farm management." Biodiversity and Conservation 12(7): 1335-1355.	Unknown	Sweden	Organic, conventional	Production & Biodiveristy conservation	Included	Plant and Arthropod	Cereal and cropland	Regulating and cultural	Biological control and heritage, cultural, bequest, inspiration & art
Database I	Weibull, A.-C., Bengtsson, J. & Nohlgren, E. (2000). "Diversity of butterflies in the agricultural landscape: the role of farming system and landscape heterogeneity." Ecography 23(6): 743-750.	1 to 3 years	Sweden	Organic, conventional	Biodiveristy Conservation	Not included	Arthrophods	Grassland, cropland and cereal	Regulating and cultural	Biological control, Pollination and Heritage, Cultural, Bequest, Inspirational & art

Database I	Wickramasinghe, L. P. (2003) A study of the activity and species richness of British bats and their insect prey on organic and conventional farms using acoustic survey methods. Bristol. Ph.D.	Unknown	UK	Organic, conventional	Biodiveristy Conservation	Not included	Mammals	Grassland, cropland and cereal	Regulating and cultural	Biological control, Pollination and Heritage, Cultural, Bequest, Inspirational & art
Database I	Wickramasinghe, L. P., Harris, S., Jones, G. & Jennings, N. V. (2004). "Abundance and species richness of nocturnal insects on organic and conventional farms: effects of agricultural intensification on bat foraging." Conservation Biology 18(5): 1283-1292.	Unknown	UK	Organic, conventional	Biodiveristy Conservation	Not included	Arthrophods	Cropland and grassland	Regulating and cultural	Biological control, Pollination and Heritage, Cultural, Bequest, Inspirational & art
Database I	Wickramasinghe, L. P., Harris, S., Jones, G. & Vaughan, N. (2003). "Bat activity and species richness on organic and conventional farms: impact of agricultural intensification." Journal of Applied Ecology 40(6): 984-993.	Unknown	UK	Organic, conventional	Biodiveristy Conservation	Not included	Mammals	Grassland	Cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database I	Wilson, A., Vickery, J. & Pendlebury, C. (2007). "Agri-environment schemes as a tool for reversing declining populations of grassland waders: mixed benefits from Environmentally Sensitive Areas in England." Biological Conservation 136(1): 128-135.	Unknown	UK	AES	Biodiveristy Conservation	Not included	Birds	Grassland	Cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database I	Wilson, J. D., Evans, J., Browne, S. J. & King, J. R. (1997). "Territory distribution and breeding success of skylarks Alauda arvensis on organic and intensive farmland in southern England." Journal of Applied Ecology 34(6): 1462-1478.	Unknown	UK	Organic, conventional	Biodiveristy Conservation	Not included	Birds	Grassland, cropland and cereal	Cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database I	Wolnicki, K., Lesiński, G. & Rembiałkowska, E. (2009). "Birds inhabiting organic and conventional farms in Central Poland." Acta Zoologica Cracoviensia - Series A: Vertebrata 52: 1-10.	Unknown	Poland	Organic, conventional	Biodiveristy Conservation	Not included	Birds	Cereal	Cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database I	Wrbka, T., Schindler, S., Pollheimer, M., Schmitzberger, I. & Peterseil, J. (2008). "Impact of the Austrian agri-environmental scheme on diversity of landscapes, plants and birds." Community Ecology 9(2): 217-227.	3 to 10 years	Austria	AES	Biodiveristy Conservation	Not included	Birds and Plant	Grassland	Cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database II	Albizua, A., Williams, A., Hedlund, K., & Pascual, U. (2015). Crop rotations including ley and manure can promote ecosystem services in conventional farming systems. *Applied Soil Ecology*, *95*, 54–61. Retrieved from http://10.0.3.248/j.apsoil.2015.06.003	More than 10 years	Sweden	Conventional	Production & Biodiveristy conservation	Included	soil quality and production	Grassland, cropland and cereal	Regulating and Provisioning	Soil quality regulation, soil retention and Food production
Database II	Andersson, G. K. S., Ekroos, J., Stjernman, M., Rundlöf, M., & Smith, H. G. (2014). Effects of farming intensity, crop rotation and landscape heterogeneity on field bean pollination. *Agriculture, Ecosystems and Environment*, *184*, 145–148. https://doi.org/10.1016/j.agee.2013.12.002	less than 1 year	Sweden	Organic, conventional	Production & Biodiveristy conservation	Not included	Production	Cropland and grassland	Regulating and Provisioning	pollination and food production

Database II	Artru, S., Garré, S., Dupraz, C., Hiel, M. P., Blitz-Frayret, C., & Lassois, L. (2017). Impact of spatio-temporal shade dynamics on wheat growth and yield, perspectives for temperate agroforestry. *European Journal of Agronomy*, *82*, 60–70. https://doi.org/10.1016/j.eja.2016.10.004	1 to 3 years	Belgium	Conventional	Production & Biodiveristy conservation	Not included	production	Cropland	Provisioning	Food production
Database II	Batáry, P., Báldi, A., Sárospataki, M., Kohler, F., Verhulst, J., Knop, E., … Kleijn, D. (2010). Effect of conservation management on bees and insect-pollinated grassland plant communities in three European countries. *Agriculture, Ecosystems and Environment*, *136*(1–2), 35–39. https://doi.org/10.1016/j.agee.2009.11.004	less than 1 year	Hungary, Switzerland and Netherlands	AES	Production & Biodiveristy conservation	Not included	Arthrophods	Grassland	Regulating	Pollination
Database II	Batáry, P., Holzschuh, A., Orci, K. M., Samu, F., & Tscharntke, T. (2012). Responses of plant, insect and spider biodiversity to local and landscape scale management intensity in cereal crops and grasslands. *Agriculture, Ecosystems and Environment*, *146*(1), 130–136. https://doi.org/10.1016/j.agee.2011.10.018	less than 1 year	Germany	Organic, conventional	Biodiveristy Conservation	Not included	Plant and Arthropod	Cropland	Regulating and cultural	Biological control and heritage, cultural, bequest, inspiration & art
Database II	Bertholdsson, N. O., Weedon, O., Brumlop, S., & Finckh, M. R. (2016). Evolutionary changes of weed competitive traits in winter wheat composite cross populations in organic and conventional farming systems. *European Journal of Agronomy*, *79*, 23–30. Retrieved from http://10.0.3.248/j.eja.2016.05.004	3 to 10 years	UK and Germany	Organic, conventional	Production & Biodiveristy conservation	Not included	Production	Cropland	Provisioning	Food production
Database II	Besnard, A. G., & Secondi, J. (2014). Hedgerows diminish the value of meadows for grassland birds: Potential conflicts for agri-environment schemes. *Agriculture, Ecosystems and Environment*, *189*, 21–27. https://doi.org/10.1016/j.agee.2014.03.014	less than 1 year	France	AES	Production & Biodiveristy conservation	Not included	Birds	Grassland and non-crop	Cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database II	Bilsborrow, P., Cooper, J., Tétard-Jones, C., Średnicka-Tober, D., Barański, M., Eyre, M., … Wilcockson, S. (2013). The effect of organic and conventional management on the yield and quality of wheat grown in a long-term field trial, *51 OP-I*, 71. https://doi.org/10.1016/j.eja.2013.06.003	3 to 10 years	UK	Organic, conventional	Production & Biodiveristy conservation	Not included	Production	Cropland	Provisioning	Food production
Database II	Birrer, S., Zellweger-Fischer, J., Stoeckli, S., Korner-Nievergelt, F., Balmer, O., Jenny, M., & Pfiffner, L. (2014). Biodiversity at the farm scale: A novel credit point system. *Agriculture, Ecosystems and Environment*, *197*, 195–203. https://doi.org/10.1016/j.agee.2014.08.008	less than 1 year	Switzerland	Organic, conventional, Integrated	Biodiveristy Conservation	Not included	Plant, birds and arthropods	Cropland and grassland	Regulating and cultural	Biological control and heritage, cultural, bequest, inspiration & art
Database II	Bisang, I., Bergamini, A., & Lienhard, L. (2009). Environmental-friendly farming in Switzerland is not hornwort-friendly. *Biological Conservation*, *142*(10), 2104–2113. https://doi.org/10.1016/j.biocon.2009.04.006	1 to 3 years	Switzerland	AES	Biodiveristy Conservation	Not included	Plant	Grassland, cropland and cereal	Cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database II	Blake, R. J., Woodcock, B. A., Westbury, D. B., Sutton, P., & Potts, S. G. (2013). Novel management to enhance spider biodiversity in existing grass buffer strips. *Agricultural and Forest Entomology*, *15*(1), 77–85. https://doi.org/10.1111/j.1461-9563.2012.00593.x	1 to 3 years	UK	AES	Biodiveristy Conservation	Included	Arthrophods	Cropland	Regulating	Biological control
Database II	Blanchet, G., Gavazov, K., Bragazza, L., & Sinaj, S. (2016). Responses of soil properties and crop yields to different inorganic and organic amendments in a Swiss conventional farming system. *Agriculture, Ecosystems & Environment*, *230*, 116–126. https://doi.org/10.1016/j.agee.2016.05.032	More than 10 years	Switzerland	Conventional	Production & Biodiveristy conservation	Not included	Soil quality	Cropland	Regulating	Soil quality regulation
Database II	Botías, C., David, A., Hill, E. M., & Goulson, D. (2016). Contamination of wild plants near neonicotinoid seed-treated crops, and implications for non-target insects. *Science of the Total Environment*, *566–567*, 269–278. https://doi.org/10.1016/j.scitotenv.2016.05.065	less than 1 year	UK	Conventional	Production & Biodiveristy conservation	Included	Pesticides	Cropland	NO	NO

Database II	Broughton, R. K., Shore, R. F., Heard, M. S., Amy, S. R., Meek, W. R., Redhead, J. W., … Pywell, R. F. (2014). Agri-environment scheme enhances small mammal diversity and abundance at the farm-scale. *Agriculture, Ecosystems and Environment*, *192*, 122–129. https://doi.org/10.1016/j.agee.2014.04.009	3 to 10 years	UK	Conventional, AES	Biodiveristy Conservation	Not included	Mammals	Grassland, cropland and cereal	Regulating and cultural	Biological control and heritage, cultural, bequest, inspiration & art
Database II	Bruppacher, L., Pellet, J., Arlettaz, R., & Humbert, J. Y. (2016). Simple modifications of mowing regime promote butterflies in extensively managed meadows: Evidence from field-scale experiments. *Biological Conservation*, *196*, 196–202. https://doi.org/10.1016/j.biocon.2016.02.018	less than 1 year	Switzerland	AES	Biodiveristy Conservation	Not included	Arthrophods	Grassland	Regulating	Biological control and Pollination
Database II	Caro, G., Marrec, R., Gauffre, B., Roncoroni, M., Augiron, S., & Bretagnolle, V. (2016). Multi-scale effects of agri-environment schemes on carabid beetles in intensive farmland. *Agriculture, Ecosystems and Environment*, *229*, 48–56. https://doi.org/10.1016/j.agee.2016.05.009	1 to 3 years	France	Organic, conventional, AES	Biodiveristy Conservation	Not included	Arthrophods	Grassland, cropland and cereal	Regulating	Biological control
Database II	Chateil, C., Goldringer, I., Tarallo, L., Kerbiriou, C., Le Viol, I., Ponge, J. F., … Porcher, E. (2013). Crop genetic diversity benefits farmland biodiversity in cultivated fields. *Agriculture, Ecosystems and Environment*, *171*, 25–32. https://doi.org/10.1016/j.agee.2013.03.004	1 to 3 years	France	Organic	Production & Biodiveristy conservation	Included	Plant and Arthropod	Cereal	Regulating and cultural	Biological control and heritage, cultural, bequest, inspiration & art
Database II	Crittenden, S. J., & de Goede, R. G. M. (2016). Original article: Integrating soil physical and biological properties in contrasting tillage systems in organic and conventional farming. *European Journal of Soil Biology*, *77*, 26–33. Retrieved from http://10.0.3.248/j.ejsobi.2016.09.003	1 to 3 years	Netherlands	Organic, conventional	Production & Biodiveristy conservation	Included	Earthworms	Cropland and grassland	Regulating and Provisioning	Soil quality regulation and food production
Database II	Crittenden, S. J., Poot, N., Heinen, M., van Balen, D. J. M., & Pulleman, M. M. (2015). Soil physical quality in contrasting tillage systems in organic and conventional farming. *Soil & Tillage Research*, *154*, 136–144. Retrieved from http://10.0.3.248/j.still.2015.06.018	1 to 3 years	Netherlands	Organic, conventional	Production & Biodiveristy conservation	Not included	soil quality and production	Cropland	Regulating and Provisioning	Soil quality regulation and food production
Database II	Dedeurwaerdere, T., Polard, A., & Melindi-Ghidi, P. (2015). Analysis: The role of network bridging organisations in compensation payments for agri-environmental services under the EU Common Agricultural Policy. *Ecological Economics*, *119*, 24–38. Retrieved from http://10.0.3.248/j.ecolecon.2015.07.025	3 to 10 years	Belgium	Conventional, AES	Biodiveristy Conservation	Not included	NO	Cereal and grassland	NO	NO
Database II	Diekötter, T., Wamser, S., Dörner, T., Wolters, V., & Birkhofer, K. (2016). Organic farming affects the potential of a granivorous carabid beetle to control arable weeds at local and landscape scales. *Agricultural & Forest Entomology*, *18*(2), 167-173. doi:10.1111/afe.12150	less than 1 year	Germany	Organic, conventional	Production & Biodiveristy conservation	Included	Arthrophods	Cropland	Regulating	Biological control
Database II	Doltra, J., & Olesen, J. E. (2013). The role of catch crops in the ecological intensification of spring cereals in organic farming under Nordic climate. *European Journal of Agronomy*, *44*, 98–108. Retrieved from http://10.0.3.248/j.eja.2012.03.006	More than 10 years	Denmark	Organic	Production & Biodiveristy conservation	Included	Production	Grassland, cropland and cereal	Provisioning	Food production
Database II	Döring, T. F., Annicchiarico, P., Clarke, S., Haigh, Z., Jones, H. E., Pearce, H., … Wolfe, M. S. (2015). Comparative analysis of performance and stability among composite cross populations, variety mixtures and pure lines of winter wheat in organic and conventional cropping systems. *Field Crops Research*, *183*, 235–245. https://doi.org/10.1016/j.fcr.2015.08.009	1 to 3 years	UK	Organic, conventional	Production & Biodiveristy conservation	Included	Production	Cereal	Provisioning	Food production
Database II	Elts, J., & Lõhmus, A. (2012). What do we lack in agri-environment schemes? The case of farmland birds in Estonia. *Agriculture, Ecosystems and Environment*, *156*, 89–93. https://doi.org/10.1016/j.agee.2012.04.023	3 to 10 years	Estonia	Organic, conventional, AES	Biodiveristy Conservation	Not included	Birds	Cereal and grassland	Cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database II	Eyre, M. D., Luff, M. L., & Leifert, C. (2013). Crop, field boundary, productivity and disturbance influences on ground beetles (Coleoptera, Carabidae) in the agroecosystem. *Agriculture, Ecosystems and Environment*, *165*, 60–67. https://doi.org/10.1016/j.agee.2012.12.009	3 to 10 years	UK	Organic, conventional	Production & Biodiveristy conservation	Included	Arthrophods	Grassland, cropland and cereal	Regulating	Biological control

Database II	Fan, F., Henriksen, C. B., & Porter, J. (2016). Valuation of ecosystem services in organic cereal crop production systems with different management practices in relation to organic matter input. *Ecosystem Services*, *22*(April), 117–127. https://doi.org/10.1016/j.ecoser.2016.10.007	More than 10 years	Denmark	Organic	Production & Biodiveristy conservation	Included	Ecosystem services	Cereal	Regulating and Provisioning	Biological control, water regulation, Climate regulation, soil quality regulation and food production
Database II	Firbank, L. G., Elliott, J., Drake, B., Cao, Y., & Gooday, R. (2013). Evidence of sustainable intensification among British farms. *Agriculture, Ecosystems and Environment*, *173*, 58–65. https://doi.org/10.1016/j.agee.2013.04.010	3 to 10 years	UK	Organic, AES	Production & Biodiveristy conservation	Included	Ecosystem services	Grassland, cropland and cereal	Regulating and Provisioning	Biological control, Climate regulation, air quality regulation, water purification and food production
Database II	Fischer, C., & Wagner, C. (2016). Can agri-environmental schemes enhance non-target species? Effects of sown wildflower fields on the common hamster (Cricetus cricetus) at local and landscape scales. *Biological Conservation*, *194*, 168–175. https://doi.org/10.1016/j.biocon.2015.12.021	less than 1 year	Germany	AES	Biodiveristy Conservation	Included	Mammals	Grassland, cropland and cereal	Regulating and cultural	Biological control and heritage, cultural, bequest, inspiration & art
Database II	Fischer, C., Thies, C., & Tscharntke, T. (2011). Mixed effects of landscape complexity and farming practice on weed seed removal. *Perspectives in Plant Ecology, Evolution and Systematics*, *13*(4), 297–303. https://doi.org/10.1016/j.ppees.2011.08.001	less than 1 year	Germany	Organic, conventional	Biodiveristy Conservation	Not included	predators	Cereal and grassland	Regulating	Biological Control
Database II	Garnier, J., Anglade, J., Benoit, M., Billen, G., Puech, T., Ramarson, A., … Tallec, G. (2016). Reconnecting crop and cattle farming to reduce nitrogen losses to river water of an intensive agricultural catchment (Seine basin, France): Past, present and future. *Environmental Science and Policy*, *63*, 76–90. https://doi.org/10.1016/j.envsci.2016.04.019	More than 10 years	France	Organic, conventional	Production & Biodiveristy conservation	Not included	Soil quality	Grassland, cropland and cereal	Regulating	Soil quality regulation
Database II	Giuliano, S., Ryan, M. R., Véricel, G., Rametti, G., Perdrieux, F., Justes, E., & Alletto, L. (2016). Low-input cropping systems to reduce input dependency and environmental impacts in maize production: A multi-criteria assessment. *European Journal of Agronomy*, *76*, 160–175. https://doi.org/10.1016/j.eja.2015.12.016	1 to 3 years	France	Conventional, Integrated	Production & Biodiveristy conservation	Not included	Soil quality, plant and production	Cropland	Regulating and Provisioning	Biological control, Soil quality Regulation and food production
Database II	Głąb, T., Pużyńska, K., Pużyński, S., Palmowska, J., & Kowalik, K. (2016). Effect of organic farming on a Stagnic Luvisol soil physical quality. *Geoderma*, *282*, 16–25. https://doi.org/10.1016/j.geoderma.2016.07.008	3 to 10 years	Poland	Organic, conventional	Production & Biodiveristy conservation	Not included	soil quality and production	Cropland	Regulating	Soil quality regulation
Database II	Grass, I., Albrecht, J., Jauker, F., Diekötter, T., Warzecha, D., Wolters, V., & Farwig, N. (2016). Much more than bees-Wildflower plantings support highly diverse flower-visitor communities from complex to structurally simple agricultural landscapes. Agriculture, Ecosystems and Environment, 225, 45–53. https://doi.org/10.1016/j.agee.2016.04.001	less than 1 year	Germany	AES	Production & Biodiveristy conservation	Included	plant and pollinators	Cereal and grassland	Regulating and cultural	Pollination and Heritage, Cultural, Bequest, Inspirational& art

Database II	Hardman, C. J., Norris, K., Nevard, T. D., Hughes, B., & Potts, S. G. (2016). Delivery of floral resources and pollination services on farmland under three different wildlife-friendly schemes. *Agriculture, Ecosystems and Environment*, *220*, 142–151. https://doi.org/10.1016/j.agee.2016.01.015	less than 1 year	UK	Organic, AES	Production & Biodiveristy conservation	Not included	plant and pollinators	Cereal and grassland	Regulating and cultural	Pollination and Heritage, Cultural, Bequest, Inspirational& art
Database II	Hawes, C., Squire, G. R., Hallett, P. D., Watson, C. A., & Young, M. (2010). Arable plant communities as indicators of farming practice. *Agriculture, Ecosystems and Environment*, *138*(1–2), 17–26. https://doi.org/10.1016/j.agee.2010.03.010	3 to 10 years	UK	Organic, conventional, Integrated	Production & Biodiveristy conservation	Not included	plant	Cereal and grassland	Regulating	Biological control
Database II	Herzon, I., & Mikk, M. (2007). Farmers' perceptions of biodiversity and their willingness to enhance it through agri-environment schemes: A comparative study from Estonia and Finland. *Journal for Nature Conservation*, *15*(1), 10–25. https://doi.org/10.1016/j.jnc.2006.08.001	less than 1 year	Estonia and Finland	AES	Biodiveristy Conservation	Not included	NO	Cereal and grassland	NO	NO
Database II	Hiron, M., Berg, Å., Eggers, S., Josefsson, J., & Pärt, T. (2013). Bird diversity relates to agri-environment schemes at local and landscape level in intensive farmland. *Agriculture, Ecosystems & Environment*, *176*, 9–16. https://doi.org/http://dx.doi.org/10.1016/j.agee.2013.05.013	less than 1 year	Sweden	Organic, AES	Biodiveristy Conservation	Not included	Birds	Cereal and grassland	Cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database II	Holland, J. M., Smith, B. M., Storkey, J., Lutman, P. J. W., & Aebischer, N. J. (2015). Managing habitats on English farmland for insect pollinator conservation. *Biological Conservation*, *182*, 215–222. https://doi.org/10.1016/j.biocon.2014.12.009	1 to 3 years	UK	Organic, AES	Biodiveristy Conservation	Not included	Pollinators	Cereal and grassland	Regulating	Pollination
Database II	Holland, J. M., Storkey, J., Lutman, P. J. W., Birkett, T. C., Simper, J., & Aebischer, N. J. (2014). Utilisation of agri-environment scheme habitats to enhance invertebrate ecosystem service providers. *Agriculture, Ecosystems and Environment*, *183*, 103–109. https://doi.org/10.1016/j.agee.2013.10.025	1 to 3 years	UK	Organic, conventional	Production & Biodiveristy conservation	Included	Invertebrats	Cereal and grassland	Regulating	Biological control
Database II	Horrocks, C. A., Heal, K. V., Harvie, B., Tallowin, J. B., Cardenas, L. M., & Dungait, J. A. J. (2016). Can species-rich grasslands be established on former intensively managed arable soils? *Agriculture, Ecosystems and Environment*, *217*, 59–67. https://doi.org/10.1016/j.agee.2015.10.015	3 to 10 years	UK	AES	Production & Biodiveristy conservation	Not included	Soil quality and plant	Grassland	Regulating and cultural	Soil quality regulation and Herritage, Cultural, bequest, inspiration & art
Database II	Irminger Street, T., Prentice, H. C., Hall, K., Smith, H. G., & Olsson, O. (2015). Removal of woody vegetation from uncultivated field margins is insufficient to promote non-woody vascular plant diversity. *Agriculture, Ecosystems And Environment*, *201*1-10. doi:10.1016/j.agee.2014.11.020	less than 1 year	Sweden	AES	Biodiveristy Conservation	Not included	Plant	Cropland and grassland	Cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database II	Johansson, S., Belfrage, K., & Olsson, M. (2013). Impact on food productivity by fossil fuel independence – A case study of a Swedish small-scale integrated organic farm. *Acta Agriculturae Scandinavica, Section B - Soil & Plant Science*, *63*(2), 123–135. https://doi.org/10.1080/09064710.2012.733020	Unknown	Sweden	Organic	Production & Biodiveristy conservation	Included	Production	Grassland, cropland and cereal	Provisioning	Food production
Database II	Jonason, D., Andersson, G. K. S., Öckinger, E., Smith, H. G., & Bengtsson, J. (2012). Field scale organic farming does not counteract landscape effects on butterfly trait composition. *Agriculture, Ecosystems and Environment*, *158*, 66–71. https://doi.org/10.1016/j.agee.2012.05.026	less than 1 year	Sweden	Organic, conventional	Biodiveristy Conservation	Not included	Arthrophods	Cereal	Regulating	Biological control
Database II	Klaus, V. H., Kleinebecker, T., Prati, D., Gossner, M. M., Alt, F., Boch, S., … Hölzel, N. (2013). Does organic grassland farming benefit plant and arthropod diversity at the expense of yield and soil fertility? *Agriculture, Ecosystems and Environment*, *177*, 1–9. https://doi.org/10.1016/j.agee.2013.05.019	More than 10 years	Germany	Organic, conventional	Production & Biodiveristy conservation	Not included	Soil quality, production and arthropods	grassland	Regulating	Biological Control and Soil quality regulation

Database II	Knudsen, M. T., Hermansen, J. E., Cederberg, C., Herzog, F., Vale, J., Jeanneret, P., … Dennis, P. (2017). Characterization factors from direct measures of plant species in European farmland to estimate land use impacts on biodiversity in Life Cycle Assessment Characterization. *Science of the Total Environment*, *580*(December 2016), 358–366. https://doi.org/10.1016/j.scitotenv.2016.11.172	Unknown	Austria, Germany, France, Hungary, Switzerland and UK	Organic, conventional	Biodiveristy Conservation	Not included	Plant	Cropland and grassland	Cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database II	Korpela, E. L., Hyvönen, T., Lindgren, S., & Kuussaari, M. (2013). Can pollination services, species diversity and conservation be simultaneously promoted by sown wildflower strips on farmland? *Agriculture, Ecosystems and Environment*, *179*, 18–24. https://doi.org/10.1016/j.agee.2013.07.001	3 to 10 years	Finland	AES	Production & Biodiveristy conservation	Not included	Pollinators	Cropland and grassland	Regulating	Pollination
Database II	Kovács-Hostyánszki, A., & Báldi, A. (2012). Set-aside fields in agri-environment schemes can replace the market-driven abolishment of fallows. *Biological Conservation*, *152*, 196–203. https://doi.org/10.1016/j.biocon.2012.03.039	1 to 3 years	Hungary	AES	Biodiveristy Conservation	Not included	Birds and Plant	Cropland and grassland	Cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database II	Kuiper, M., Ottens, H., Ruijven, J., Koks, B., Snoo, G., & Berendse, F. (2015). Effects of breeding habitat and field margins on the reproductive performance of Skylarks (Alauda arvensis) on intensive farmland. *Journal of Ornithology*, *156*(3), 557–568. Retrieved from http://10.0.3.239/s10336-015-1159-8	3 to 10 years	Netherlands	AES	Biodiveristy Conservation	Not included	Birds	Cropland and grassland	Cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database II	Lees, K. J., McKenzie, A. J., Newell Price, J. P., Critchley, C. N., Rhymer, C. M., Chambers, B. J., & Whittingham, M. J. (2016). The effects of soil compaction mitigation on below-ground fauna: How earthworms respond to mechanical loosening and power harrow cultivation. *Agriculture, Ecosystems and Environment*, *232*, 273–282. https://doi.org/10.1016/j.agee.2016.07.026	1 to 3 years	UK	Organic	Production & Biodiveristy conservation	Included	Earthworms	Cereal	Regulating and Provisioning	Soil quality regulation, Water regulation, and food production
Database II	Loucougaray, G., Dobremez, L., Gos, P., Pauthenet, Y., Nettier, B., & Lavorel, S. (2015). Assessing the Effects of Grassland Management on Forage Production and Environmental Quality to Identify Paths to Ecological Intensification in Mountain Grasslands. *Environmental Management*, *56*(5), 1039–1052. https://doi.org/10.1007/s00267-015-0550-9	1 to 3 years	France	AES	Production & Biodiveristy conservation	Included	Plant	Grassland	Provisioning	Food production
Database II	Lüscher, G., Jeanneret, P., Schneider, M. K., Turnbull, L. A., Arndorfer, M., Balázs, K., … Herzog, F. (2014). Responses of plants, earthworms, spiders and bees to geographic location, agricultural management and surrounding landscape in European arable fields. *Agriculture, Ecosystems and Environment*, *186*, 124–134. https://doi.org/10.1016/j.agee.2014.01.020	less than 1 year	Germany, Hungary, Austria, France	Organic, conventional	Production & Biodiveristy conservation	Not included	Plant, earthworms, arthropods and pollinators	Cropland and grassland	Regulating	Soil quality regulation, water regulation, biological control and Pollination
Database II	Lüscher, G., Schneider, M. K., Turnbull, L. A., Arndorfer, M., Bailey, D., Herzog, F., … Jeanneret, P. (2014). Appropriate metrics to inform farmers about species diversity. *Environmental Science and Policy*, *41*, 52–62. https://doi.org/10.1016/j.envsci.2014.04.012	less than 1 year	Switzerland	Organic, conventional	Biodiveristy Conservation	Included	Plant, soil invertebratsand above ground invertebrats	Grassland	Regulating	Soil quality regulation, water regulation, biological control and Pollination
Database II	Manoharan, L., Rosenstock, N. P., Williams, A., & Hedlund, K. (2017). Agricultural management practices influence AMF diversity and community composition with cascading effects on plant productivity. *Applied Soil Ecology*, *115*, 53–59. https://doi.org/http://dx.doi.org/10.1016/j.apsoil.2017.03.012	1 to 3 years	Sweden	Organic, conventional	Production & Biodiveristy conservation	Included	Soil quality	Grassland, cropland and cereal	Regulating	Soil quality regulation

Database II	Marja, R., Herzon, I., Viik, E., Elts, J., Mänd, M., Tscharntke, T., & Batáry, P. (2014). Environmentally friendly management as an intermediate strategy between organic and conventional agriculture to support biodiversity, *178 OP-*, 146. https://doi.org/10.1016/j.biocon.2014.08.005	1 to 3 years	Estonia	Organic, conventional, AES	Biodiveristy Conservation	Not included	Plant, birds and pollinators	Cropland and grassland	Regulating and cultural	Pollination and Heritage, Cultural, Bequest, Inspirational& art
Database II	Masilionyte, L., Maiksteniene, S., Kriauciuniene, Z., Jablonskyte-Rasce, D., Zou, L., & Sarauskis, E. (2017). Effect of cover crops in smothering weeds and volunteer plants in alternative farming systems. *Crop Protection*, *91*, 74–81. Retrieved from http://10.0.3.248/j.cropro.2016.09.016	3 to 10 years	Lithuania	Organic	Production & Biodiveristy conservation	Not included	Plant	Cropland and grassland	Regulating and cultural	Soil quality regulation, Biological control and herritage, cultural, bequest, inspiration & art
Database II	Mayer, J., Gunst, L., Mäder, P., Samson, M.-F., Carcea, M., Narducci, V., … Dubois, D. (2015). "Productivity, quality and sustainability of winter wheat under long-term conventional and organic management in Switzerland," *65 OP-I*, 27. https://doi.org/10.1016/j.eja.2015.01.002	3 to 10 years	Switzerland	Organic, conventional, Integrated	Production & Biodiveristy conservation	Not included	Production	Cropland and grassland	Provisioning	Food production
Database II	Mccarthy, B., Delaby, L., Pierce, K. M., Mccarthy, J., Fleming, C., Brennan, A., & Horan, B. (2016). The multi-year cumulative effects of alternative stocking rate and grazing management practices on pasture productivity and utilization efficiency, (2013), 3784–3797.	3 to 10 years	Ireland	Integrated	Production & Biodiveristy conservation	Not included	Plant	Grassland	Provisioning	Food production
Database II	McGinlay, J., Gowing, D. J. ., & Budds, J. (2017). The threat of abandonment in socio-ecological landscapes: Farmers' motivations and perspectives on high nature value grassland conservation. *Environmental Science & Policy*, *69*, 39–49. https://doi.org/10.1016/j.envsci.2016.12.007	1 to 3 years	UK	AES	Biodiveristy Conservation	Not included	Plant	Grassland and non-crop	Cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database II	Meichtry-Stier, K. S., Jenny, M., Zellweger-Fischer, J., & Birrer, S. (2014). Impact of landscape improvement by agri-environment scheme options on densities of characteristic farmland bird species and brown hare (Lepus europaeus). *Agriculture, Ecosystems and Environment*, *189*, 101–109. https://doi.org/10.1016/j.agee.2014.02.038	More than 10 years	Switzerland	AES	Biodiveristy Conservation	Not included	Birds and mammals	Cropland and grassland	Cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database II	Meyer, S., Unternährer, D., Arlettaz, R., Humbert, J.-Y., & Menz, M. H. M. (2017). Promoting more diverse communities of wild bees and hoverflies requires a landscape approach to managing meadows. *Agriculture, Ecosystems & Environment*, *239*, 376–384. https://doi.org/10.1016/j.csl.2006.06.005	3 to 10 years	Switzerland	AES	Production & Biodiveristy conservation	Not included	Pollinators	Grassland	Regulating	Pollination
Database II	Moos, J. H., Schrader, S., Paulsen, H. M., & Rahmann, G. (2016). Occasional reduced tillage in organic farming can promote earthworm performance and resource efficiency. *Applied Soil Ecology*, *103*, 22–30. https://doi.org/10.1016/j.apsoil.2016.01.017	1 to 3 years	Germany	Organic	Production & Biodiveristy conservation	Included	Earthworms	Cropland and grassland	Regulating and Provisioning	Soil quality regulation, Water regulation, and food production
Database II	Nemecek, T., Dubois, D., Huguenin-Elie, O., & Gaillard, G. (2011). Life cycle assessment of Swiss farming systems: I. Integrated and organic farming, *104*(3 OP-In Agricultural Systems 2011 104(3):217-232), 217. https://doi.org/10.1016/j.agsy.2010.10.002	Unknown	Switzerland	Organic, Integrated	Production & Biodiveristy conservation	Not included	Production	Cropland and grassland	Regulating and Provisioning	Climate regulation and food production
Database II	Norris, S. L., Blackshaw, R. P., Dunn, R. M., Critchley, N. R., Smith, K. E., Williams, J. R., … Murray, P. J. (2016). Improving above and below-ground arthropod biodiversity in maize cultivation systems. *Applied Soil Ecology*, *108*, 25–46. https://doi.org/10.1016/j.apsoil.2016.07.015	1 to 3 years	UK	Conventional	Production & Biodiveristy conservation	Included	Plants and arthropods	Cropland	Regulating	Biological control

Database II	Ó hUallacháin, D., Finn, J. A., Keogh, B., Fritch, R., & Sheridan, H. (2016). A comparison of grassland vegetation from three agri-environment conservation measures. *Irish Journal of Agricultural and Food Research*, *55*(2), 176–192. https://doi.org/10.1515/ijafr-2016-0018	1 to 3 years	Ireland	AES	Biodiveristy Conservation	Not included	Plant	Grassland	Cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database II	Odgaard, M. V., Moeslund, J. E., Bøcher, P. K., Dalgaard, T., & Svenning, J. C. (2013). The relative importance of geophysical constraints, amenity values, and farm-related factors in the dynamics of grassland set-aside. *Agriculture, Ecosystems and Environment*, *164*, 286–291. https://doi.org/10.1016/j.agee.2012.09.009	1 to 3 years	Denmark	Organic, AES	Biodiveristy Conservation	Not included	Plant	Grassland and non-crop	Cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database II	Perkins, A. J., Maggs, H. E., Wilson, J. D., & Watson, A. (2013). Delayed mowing increases corn bunting Emberiza calandra nest success in an agri-environment scheme trial. *Agriculture, Ecosystems and Environment*, *181*, 80–89. https://doi.org/10.1016/j.agee.2013.09.010	3 to 10 years	UK	Conventional, AES	Biodiveristy Conservation	Not included	Birds	Cropland and grassland	Cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database II	Petit, S., Gaba, S., Grison, A. L., Meiss, H., Simmoneau, B., Munier-Jolain, N., & Bretagnolle, V. (2016). Landscape scale management affects weed richness but not weed abundance in winter wheat fields. *Agriculture, Ecosystems and Environment*, *223*, 41–47. https://doi.org/10.1016/j.agee.2016.02.031	Unknown	France	Organic, conventional, AES	Production & Biodiveristy conservation	Included	Plant	Cropland	Regulating	Biological control
Database II	Petit, S., Munier-Jolain, N., Bretagnolle, V., Bockstaller, C., Gaba, S., Cordeau, S., … Colbach, N. (2015). Ecological Intensification Through Pesticide Reduction: Weed Control, Weed Biodiversity and Sustainability in Arable Farming. *Environmental Management*, *56*(5), 1078–1090. https://doi.org/10.1007/s00267-015-0554-5	1 to 3 years	France	Organic, conventional, Integrated	Production & Biodiveristy conservation	Included	production	Cropland	Regulating and Provisioning	Biological control and food production
Database II	Power, E. F., Jackson, Z., & Stout, J. C. (2016). Organic farming and landscape factors affect abundance and richness of hoverflies (Diptera, Syrphidae) in grasslands. *Insect Conservation & Diversity*, *9*(3), 244-253. doi:10.1111/icad.12163	less than 1 year	Ireland	Organic, conventional, AES	Production & Biodiveristy conservation	Not included	plant and pollinators	Grassland	Regulating and cultural	Pollination and Heritage, Cultural, Bequest, Inspirational& art
Database II	Power, E. F., Kelly, D. L., & Stout, J. C. (2013). Impacts of organic and conventional dairy farmer attitude, behaviour and knowledge on farm biodiversity in Ireland, *21*(5 OP-In Journal for Nature Conservation October 2013 21(5):272-278), 272. https://doi.org/10.1016/j.jnc.2013.02.002	less than 1 year	Ireland	Organic, conventional, AES	Biodiveristy Conservation	Not included	Plant	Cropland and grassland	Cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database II	Princé, K., & Jiguet, F. (2013). Ecological effectiveness of French grassland agri-environment schemes for farmland bird communities. *Journal of Environmental Management*, *121*, 110–116. https://doi.org/10.1016/j.jenvman.2013.02.039	3 to 10 years	France	AES	Biodiveristy Conservation	Not included	Birds	Grassland	Cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database II	Princé, K., Moussus, J. P., & Jiguet, F. (2012). Mixed effectiveness of French agri-environment schemes for nationwide farmland bird conservation. *Agriculture, Ecosystems and Environment*, *149*, 74–79. https://doi.org/10.1016/j.agee.2011.11.021	More than 10 years	France	AES	Biodiveristy Conservation	Not included	Birds	Non-crop	Cultural	Heritage, Cultural, Bequest, Inspirationa l& art

Database II	Puech, C., Baudry, J., Joannon, A., Poggi, S., & Aviron, S. (2014). Organic vs. conventional farming dichotomy: Does it make sense for natural enemies? *Agriculture, Ecosystems and Environment*, *194*, 48–57. https://doi.org/10.1016/j.agee.2014.05.002	less than 1 year	France	Organic, conventional	Production & Biodiveristy conservation	Included	Birds, arthropods and parasitoids	Cropland	Regulating and cultural	Biological control and heritage, cultural, bequest, inspiration & art
Database II	Pywell, R. F., Meek, W. R., Loxton, R. G., Nowakowski, M., Carvell, C., & Woodcock, B. A. (2011). Ecological restoration on farmland can drive beneficial functional responses in plant and invertebrate communities. *Agriculture, Ecosystems and Environment*, *140*(1–2), 62–67. https://doi.org/10.1016/j.agee.2010.11.012	1 to 3 years	UK	Conventional, AES	Production & Biodiveristy conservation	Included	Plant and invertebrats	Cropland and grassland	Regulating and Provisioning	Biological control and food production
Database II	Quinio, M., De Waele, M., Dessaint, F., Biju-Duval, L., Buthiot, M., Cadet, E., … Cordeau, S. (2017). Separating the confounding effects of farming practices on weeds and winter wheat production using path modelling. *European Journal of Agronomy*, *82*(Part A), 134–143. Retrieved from http://10.0.3.248/j.eja.2016.10.011	3 to 10 years	France	Conventional	Production & Biodiveristy conservation	Not included	Production	Cropland	Regulating and Provisioning	Biological control and food production
Database II	Rannap, R., Kaart, T., Pehlak, H., Kana, S., Soomets, E., & Lanno, K. (2017). Coastal meadow management for threatened waders has a strong supporting impact on meadow plants and amphibians. *Journal For Nature Conservation*, *35*77-91. doi:10.1016/j.jnc.2016.12.004	1 to 3 years	Estonia	AES	Biodiveristy Conservation	Not included	Plant, birds and amphibians	Grassland	Regulating and cultural	Biological control and heritage, cultural, bequest, inspiration & art
Database II	Sechi, V., Goede, R. G. M. De, Rutgers, M., Brussaard, L., & Mulder, C. (2017). A community trait-based approach to ecosystem functioning in soil. *Agriculture, Ecosystem and Environment*, *239*, 265–273. https://doi.org/10.1016/j.agee.2017.01.036	less than 1 year	Netherlands	Conventional, AES	Production & Biodiveristy conservation	Not included	Soil quality	Cropland and grassland	Regulating	Soil quality regulation
Database II	Smith, J., Potts, S. G., Woodcock, B. A., & Eggleton, P. (2009). The impact of two arable field margin management schemes on litter decomposition. *Applied Soil Ecology*, *41*, 90–97. Retrieved from http://10.0.3.248/j.apsoil.2008.09.003	1 to 3 years	UK	AES	Production & Biodiveristy conservation	Not included	Soil quality and invertebrats	Cropland and grassland	Regulating	Soil quality regulation
Database II	Staley, J. T., Botham, M. S., Chapman, R. E., Amy, S. R., Heard, M. S., Hulmes, L., … Pywell, R. F. (2016). Little and late: How reduced hedgerow cutting can benefit Lepidoptera. *Agriculture, Ecosystems and Environment*, *224*, 22–28. https://doi.org/10.1016/j.agee.2016.03.018	1 to 3 years	UK	AES	Production & Biodiveristy conservation	Not included	Arthrophods	Non-crop	Regulating and cultural	Biological control and heritage, cultural, bequest, inspiration & art
Database II	Stoeckli, S., Birrer, S., Zellweger-Fischer, J., Balmer, O., Jenny, M., & Pfiffner, L. (2017). Quantifying the extent to which farmers can influence biodiversity on their farms. *Agriculture, Ecosystems & Environment*, *237*, 224–233. https://doi.org/10.1016/j.agee.2016.12.029	1 to 3 years	Switzerland	Organic, Conventional, Integrated, AES	Biodiveristy Conservation	Not included	Plant, birds and arthropods	Cropland and grassland	Regulating and cultural	Biological control and heritage, cultural, bequest, inspiration & art
Database II	Sun, H., Koal, P., Liu, D., Gerl, G., Schroll, R., Gattinger, A., … Munch, J. C. (2016). Soil microbial community and microbial residues respond positively to minimum tillage under organic farming in Southern Germany. *Applied Soil Ecology*, *108*, 16–24. Retrieved from http://10.0.3.248/j.apsoil.2016.07.014	More than 10 years	Germany	Organic, Integrated	Production & Biodiveristy conservation	Included	Soil quality	Cropland and grassland	Regulating	Soil quality regulation
Database II	Säle, V., Aguilera, P., Laczko, E., Mäder, P., Berner, A., Zihlmann, U., … Oehl, F. (2015). Impact of conservation tillage and organic farming on the diversity of arbuscular mycorrhizal fungi. *Soil Biology and Biochemistry*, *84*(February), 38–52. https://doi.org/10.1016/j.soilbio.2015.02.005	1 to 3 years	Switzerland	Organic, Integrated	Production & Biodiveristy conservation	Not included	Fungi	Cropland	Regulating	Biological control

Database II	Thorup-Kristensen, K., Dresbøll, D. B., & Kristensen, H. L. (2012). Crop yield, root growth, and nutrient dynamics in a conventional and three organic cropping systems with different levels of external inputs and N re-cycling through fertility building crops, *37*(1 OP-In European Journal of Agronomy 2012 37(1):66-82), 66. https://doi.org/10.1016/j.eja.2011.11.004	1 to 3 years	Denmark	Organic, conventional	Production & Biodiveristy conservation	Included	Soil quality, plant and production	Cropland	Regulating and Provisioning	Soil quality regulation, soil retention and Food production
Database II	Toivonen, M., Herzon, I., & Helenius, J. (2013). Environmental fallows as a new policy tool to safeguard farmland biodiversity in Finland. *Biological Conservation*, *159*, 355–366. https://doi.org/10.1016/j.biocon.2012.11.016	1 to 3 years	Finland	Conventional, AES	Biodiveristy Conservation	Not included	Plant	Cropland and grassland	Cultural	Heritage, Cultural, Bequest, Inspirationa l& art
Database II	Tóth, Z., Hornung, E., Báldi, A., & Kovács-Hostyánszki, A. (2016). Effects of set-aside management on soil macrodecomposers in Hungary. Applied Soil Ecology, 99, 89–97. Retrieved from http://10.0.3.248/j.apsoil.2015.11.003	1 to 3 years	Hungary	AES	Production & Biodiveristy conservation	Included	Soil quality	Grassland, cropland and cereal	Regulating	Soil quality regulation
Database II	Tschumi, M., Albrecht, M., Bärtschi, C., Collatz, J., Entling, M. H., & Jacot, K. (2016). Perennial, species-rich wildflower strips enhance pest control and crop yield. *Agriculture, Ecosystems and Environment*, *220*, 97–103. https://doi.org/10.1016/j.agee.2016.01.001	1 to 3 years	Switzerland	AES	Production & Biodiveristy conservation	Included	Production	Cropland and grassland	Provisioning	Food production
Database II	Vrignon-Brenas, S., Celette, F., Amossé, C., & David, C. (2016). Effect of spring fertilization on ecosystem services of organic wheat and clover relay intercrops, *73 OP-I*, 73. https://doi.org/10.1016/j.eja.2015.10.011	1 to 3 years	France	Organic	Production & Biodiveristy conservation	Not included	Production	Cropland and grassland	Regulating and Provisioning	Biological control and food production
Database II	Wagner, M., Bullock, J. M., Hulmes, L., Hulmes, S., & Pywell, R. F. (2016). Cereal density and N-fertiliser effects on the flora and biodiversity value of arable headlands. *Biodiversity and Conservation*, *26*(1), 1–18. https://doi.org/10.1007/s10531-016-1225-4	1 to 3 years	UK	Conventional	Production & Biodiveristy conservation	Not included	Production	Cropland	Provisioning	Food production
Database II	Wilkinson, N. I., Wilson, J. D., & Anderson, G. Q. A. (2012). Agri-environment management for corncrake Crex crex delivers higher species richness and abundance across other taxonomic groups. *Agriculture, Ecosystems and Environment*, *155*, 27–34. https://doi.org/10.1016/j.agee.2012.03.007	3 to 10 years	UK	AES	Production & Biodiveristy conservation	Not included	plant, pollinators and arthropods	Cropland and grassland	Regulating	Biological control and Pollination
Database II	Williams, A., & Hedlund, K. (2013). Indicators of soil ecosystem services in conventional and organic arable fields along a gradient of landscape heterogeneity in southern Sweden, *65 OP-I*, 1. https://doi.org/10.1016/j.apsoil.2012.12.019	less than 1 year	Sweden	Organic, conventional	Production & Biodiveristy conservation	Included	soil quality and production	Cropland	Regulating and Provisioning	Soil quality regulation and food production
Database II	Williams, A., & Hedlund, K. (2014). Indicators and trade-offs of ecosystem services in agricultural soils along a landscape heterogeneity gradient. *Applied Soil Ecology*, *77*, 1–8. https://doi.org/10.1016/j.apsoil.2014.01.001	less than 1 year	Sweden	Conventional	Production & Biodiveristy conservation	Not included	Soil quality	Cropland and grassland	Regulating	Soil quality regulation
Database II	Wood, T. J., Holland, J. M., & Goulson, D. (2015). Pollinator-friendly management does not increase the diversity of farmland bees and wasps. *Biological Conservation*, *187*, 120–126. https://doi.org/10.1016/j.biocon.2015.04.022	1 to 3 years	UK	AES	Production & Biodiveristy conservation	Not included	Pollinators	Cropland and grassland	Regulating	Pollination
Database II	Woodcock, B. A., Bullock, J. M., McCracken, M., Chapman, R. E., Ball, S. L., Edwards, M. E., … Pywell, R. F. (2016). Spill-over of pest control and pollination services into arable crops. *Agriculture, Ecosystems and Environment*, *231*, 15–23. https://doi.org/10.1016/j.agee.2016.06.023	1 to 3 years	UK	Conventional	Production & Biodiveristy conservation	Included	Pollinators, invertebrats and predators	Cropland and grassland	Regulating	Biological control and Pollination
Database II	Yousef, E. A. A., Lampei, C., & Schmid, K. J. (2015). Evaluation of cauliflower genebank accessions under organic and conventional cultivation in Southern Germany. *Euphytica*, *201*(3), 389–400. https://doi.org/10.1007/s10681-014-1225-y	1 to 3 years	Germany	Organic, conventional	Production & Biodiveristy conservation	Not included	Production	Cropland	Provisioning	Food production
Database II	Zmihorski, M., Kotowska, D., Berg, Å., & Pärt, T. (2016). Evaluating conservation tools in Polish grasslands: The occurrence of birds in relation to agri-environment schemes and Natura 2000 areas. *Biological Conservation*, *194*, 150–157. https://doi.org/10.1016/j.biocon.2015.12.007	1 to 3 years	Poland	AES	Biodiveristy Conservation	Not included	Birds	Grassland	Cultural	Heritage, Cultural, Bequest, Inspirationa l& art