Biodiversity and Organic farming: What do we know?

Gerold Rahmann*

Abstract

The number of studies on organic farming and biodiversity increased significantly within the last years. Meanwhile organic farming has been recognised as a field with scientific relevance. About 19,000 publications were found in the Web of Science (www.isiknowledge.com) using Endnote® software with the wording "organic farming", and out of these about 1,200 were published by German scientists (6 %). In total 766 publications of these papers contained also the word "biodiversity" (3.5 %). Half of them were published during the last five years, and are mostly authored by Europeans. A meta-data analysis of these 766 scientific papers has been carried out to answer the question whether organic farming has an advantage for biodiversity in comparison to conventional farming systems.

327 out of 396 relevant results found a higher degree of biodiversity in organic farming when compared to conventional farming. In 56 papers (14 %) no difference was verified, and in 13 contributions (3 %) organic farming yielded less biodiversity (7 of them for soil invertebrates).

Thus it may be concluded that organic farming produces more biodiversity. Research gaps still exist for the understanding of functional biodiversity and ecosystem impact which comprise soil biota, landscape (ecosystem and habitat) and genetic biodiversity on agricultural land in natural habitats. In addition, more information is required about biodiversity of farming systems in non-European regions, particularly in the tropics and sub-tropics.

Keywords: Agri-environmental schemes, organic farming, biodiversity, integration, long-term field studies, segregation

Zusammenfassung:

Biodiversität und Ökologischer Landbau – Was wissen wir?

In den letzten Jahren sind eine Vielzahl von neuen Studien zum Ökologischen Landbau und Biodiversität veröffentlicht worden. Der Ökologische Landbau hat als wissenschaftliches Objekt an Bedeutung gewonnen. Im web of science (www.isiknowledge.com) wurden mit dem Quellenrechercheprogramm Endnote® unter dem Stichwort "organic farming" 19.000 Quellen gefunden, davon 1.200 (6 %) aus Deutschland. Mit der ergänzenden Einschränkung "biodiversity" waren es immer noch 766 Quellen (3,5 %), wovon die Hälfte erst in den letzten fünf Jahren veröffentlicht wurde, vorwiegend aus Europa. In einer Metaanalyse wurden diese 766 Quellen auf ihre Aussagen bezüglich der Bedeutung des Ökologischen Landbaus für die Biodiversität untersucht.

Es konnten 396 Bewertungen verwendet warden. 327 (83 %) der Bewertungen stellten fest, dass der Ökologische Landbau mehr Biodiversität aufweisst als der konventionelle Landbau. Weitere 56 (14 %) der Bewertungen waren indifferent und nur 13 (3 %; davon 7 alleine im Bereich des Bodenlebens) stellten fest, dass die Biodiversität im Ökologischen Landbau niedriger als im konventionellen Landbau ist.

Zusammenfassend kann aus dieser Metaanalyse geschlossen werden, dass der Ökologische Landbau förderlich für die Biodiversität ist. Die wissenschaftliche Arbeit sollte sich verstärkt um die Lücken des Wissens zur funktionellen Biodiversität und landwirtschaftliche Systeme kümmern. Das Bodenleben, die Landschaft (Ökosystem, Habitate) sowie die genetische agro- und natürliche Biodiversität sind dabei hervorzuheben. Auch fehlt es an Wissen über die Wirkung des Ökolandbaus auf die Biodiversität tropischer oder sub-tropischer Agrozonen (vor allem außerhalb von Europa).

Schlüsselworte: Agrarumweltmaßnahmen, Ökologischer Landbau, Biodiversität, Integration, Langzeit Feldstudien, Segregation

* Johann Heinrich von Thünen Institute (vTI), Federal Research Institute for Rural Areas, Forestry and Fisheries, Institute of Organic Farming, Trenthorst 32, 23847 Westerau, Germany, gerold.rahmann@vti.bund.de

1 Introduction

Biodiversity is one of the most important resources on earth, and human activities endanger the total number of species. Large numbers are already extinct or close to being erased. At the Rio-conference 1992, the United Nations agreed to reduce biodiversity losses to zero in 2010. The goals have not been reached. Farming (intensification and land use change) are main reasons for biodiversity losses, but agriculture can also protect and enhance biodiversity. Several strategies have been developed to produce food and protect biodiversity. Organic farming is considered an environmentally-friendly form of food production and receives agri-environmental payments for the protection of biodiversity. But does organic farming live up to this expectation? A lot of scientific efforts have been made to answer this question. The presented meta-data analysis was made to give an up-to-date evaluation of the state of the art.

2 The background

Biodiversity is defined as 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 part; this includes diversity within species, between species and of ecosystems (Reference). This biodiversity is threatened by human activities. Land use changes, degradation, pollution, climate change, and desertification and last but not least human population growth enforced the loss of biodiversity by factor 100 to 1,000 when compared to natural extinction. In 1992, the United Nations agreed to rescue the world's biodiversity. The Convention of Biological Diversity (CBD: 192 countries and the European Union) is one of the three Rio conventions. "The target agreed by the world's Governments in 2002 [Rio+10 summit in Johannesburg; GR], "*to achieve by 2010 a* significant *reduction of the current rate of biodiversity loss at the global, regional and national level as a contribution to poverty alleviation and to the benefit of all life on Earth",* has not been met. This disappointing conclusion is the introduction of the "Global Biodiversity outlook 3 of the United Nations in 2010", the year of biodiversity. This fatal situation needs to be faced though more than 170 countries (87 % of the Parties to the Convention, including Germany and the European Union) implemented national biodiversity strategies and action plans (Convention of Biological Diversity (CBD), 2010).

It is a fact that the world's biodiversity is still decreasing. The global Living Planet Index (LPI)[1] (WWF, 2010) has declined by more than 30 % since 1970. While the Tropical LPI declined by almost 60 %, the Temperate LPI [including Germany] increased by 15 %. Obviously, the efforts to protect environment and nature in temperate climates (mainly developed countries of the western world) have been successful after substantial declines in the past. About 1.75 million species are described worldwide but they are probably only a small share of the true total number (estimates provide a number of up to 13 million species; CBD, 2010).

In Germany, 48,000 animal species are described (Anonymous, 2011a), and 3,600 different plants can be found of which 2,800 are indigenous (Bundesamt für Naturschutz (BfN) ,2007). These figures include 77 tree species; 111 shrubs; 33,305 insects; 4,000 bacteria (estimations are 1 million bacteria species exist); 703 vertebrates with 100 mammals; 256 bird species; 14 reptiles, and 21 amphibians. Most of the 3001 higher plant and animal species are endangered because of land use changes and land use intensification (Rahmann, 2000). Among the European countries, losses in biodiversity are highest in Germany. About 28 % of the flora species and even more animal species (44 % of the birds, 51 % of the mammals, 61 % of ants, and 52 % of bees) are extinct or endangered (Anonymous, 2011b; BfN, 2008).

Agro-biodiversity is an important part of the world biodiversity. From the 250,000 worldwide described plant species, about 30,000 are edible, and about 7,000 are currently used for consumption. Not more than 30 species comprise more than 95 % of the food composition. And it is only three species (rice, wheat, corn) which supply more than 50 % of today's human food (Bundesanstalt für Landwirtschaft und Ernährung (BLE-BEKO), 2008). About 75 % of the genetic diversity of cultivated plants is already extinct (genetic erosion). Particularly fruits and vegetables species and varieties are endangered (Anonymous, 2011c). Crop production dominates the land use of many countries of the world. In Germany more than 50 % of the land surface is used for agriculture. Only a small number of different crop species are planted: A total of 27 % of the arable land is used for wheat, 17 % for barley, 15 % for corn, 12 % for oilseed rape, 4 % for rye so that only a quarter of the land is cultivated with any other plant. Counterproductive in terms of biodiversity is that crops are regularly cultivated in monoculture. The use of pesticides causes a change of the habitat and reduce/eradicate wild plants and wild animal biodiversity on a regional scale.

A similar trend can be observed in pens. More than 25 animal species are domesticated but only 11 of them are of economic relevance. Human selection has created a large number of different breeds. Many livestock breeds are endangered, especially sheep and goat breeds (Sambraus, 1999; www.g-e-h.de).The FAO registered more

[1] The Living Planet Index tracks nearly 4,000 populations of 241 fish, 83 amphibian, 40 reptile, 811 bird and 302 mammal species (WWF, 2010).

than 7,600 different breeds worldwide (FAO, 2007), and more than 1,500 of them are endangered.

The protection and backing of biodiversity is one of the main challenges of farming. Even before public laws enforced protection of wild plants and animals, organic farming had declared the aim to protect the environment and biodiversity in the first version of principles (IFOAM, 1980; www.ifoam.org).

One of the four principles of organic farming is defined by the International Federation of Organic Agricultural Movement (IFOAM, 2007): "*The Principle of Ecology: Organic Agriculture should be based on living ecological systems and cycles, work with them, emulate them and help sustain them. […] Organic agriculture should attain ecological balance through the design of farming systems, establishment of habitats and maintenance of genetic and agricultural diversity. Those who produce, process, trade, or consume organic products should protect and benefit the common environment including landscapes, climate, habitats, biodiversity, air and water.*"

The preamble of the EU regulation 834/2007 confirms the IFOAM principle: "Organic production is an overall system of farm management and food production that combines best environmental practices, a high level of biodiversity, the preservation of natural resources, the application of high animal welfare standards and a production method in line with the preference of certain consumers for products produced using natural substances and processes." In Article 3 (Objectives and principles for organic production) is fixed that "Organic production shall pursue the following general objectives: (a) establish a sustainable management system for agriculture that: (i) respects nature's systems and cycles and sustains and enhances the health of soil, water, plants and animals and the balance between them; (ii) contributes to a high level of biological diversity;" This includes soil and aquatic biodiversity (article 5 (a) (n) as well as farm crop and livestock diversity (889/2008 introduction (8)).

In contrast to the segregation strategy of conventional farming (production or protection), biodiversity is an integral component of organic farming (production and protection) (Rahmann et al 2006; Schnug et al., 2008). Therefore wild plants, livestock and agricultural biodiversity are found as co-products of the farming activity. The use of herbicides (but also other pesticides) is prohibited which protects the natural flora and fauna. Only manual, mechanical and heat measures are permitted for weed control. Wild fauna such as insects, snails, beetles, and spiders can be controlled through biotechnological measures (traps, lime, etc.) and natural insecticides (Annex II of 889/2008/EU) (Kühne et al., 2006).

Organic farming is based on norms which are in force worldwide (IFOAM, 2005). Organic production is expanding continuously and is practiced in more than 160 countries (of a total of 195 countries; in the year 2000 only 86 countries were documented with organic production). In 2007, more than 1,800,000 farms (677,000 organic farms only in India) manage about 38 million hectares farmland organically with certification (0.9 % of total agricultural farmland; plus 42 million hectare wild collection area). 2/3 of the world's organic farmland is grassland (Willer et al., 2011).

Europe was and is the most driving continent in the development and establishment of organic farming. One quarter of the world's organic farm land is in Europe (200,000 farms, 7.8 million hectares, 1.9 % share of total farmland). In the European Union (EU27) about 180,000 farms manage 7.2 million hectares land organically (4 % of the total farmland; 2007) and generate produce worth 16.8 billion Euros (2008). With 5.9 billion Euros (2010), Germany has the biggest organic market in Europe. The market share of organic products in the German food market is about 3 %, about half of the Danish market share with 6.7 %, and Austria with 5.7 %. The world organic purchases are 6 Euro per capita and year (2009). In the USA, about 50 Euro $c^{-1} yr^{1}$ were spent in 2008 per capita. With 26 Euro $c^{-1} yr^{1}$ the organic purchases are less in the EU27. Danish citizens purchase about 132 Euro $c^{-1} yr^{1}$, while Germany is in the middle field with about 71 Euro $c^{-1} yr^{1}$ (AMI, 2010). 94 % of the German consumers buy organic food but only 3 % of all German consumers are relevant for 39 % of all organic sales. These intensive buyers spend about 730 Euro per year and household on organic food products. This is 39 % of total food purchase of these households (BÖLW, 2011). The Second National Nutrition Study of Germany (MRI, 2008) found that organic frequent consumers have a healthier lifestyle compared with non-organic consumers.

Currently the German farmers deliver about 50 % of the organic products for the German market, the other half is imported, mainly from other EU countries (BÖLW, 2011). The farmers get about 20 % of the market sales. That means, that 80 % of the value of organic products (final consumer spending) is earned in transport, processing and trade. This is comparable to conventional famers (AMI, 2010).

The implementation of official standards and regulations in the EU in 1992 (2092/91/EEC, 834/2007/EC and related regulations; http://ec.europa.eu/agriculture/organic/home_en) and the political support – European action plan for organic food and farming (since 2004) and national programmes like the German Bundespropgramm Ökologischer Landbau (www.bundesprogramm-oekolandbau.de) with more than 75 million Euro R&D fund since 2002 – were and are the main driving forces. The German speaking countries (DE, CH, AT) comprise the most relevant organic farming research in the world.

At the end of 2010, more than 21,000 German farms (5.6 % of total German farms) managed more than one million hectares farmland organically (5,6 % of total farmland) (BMELV, 2011). About 50 % of the German organic farmland is grassland, while total farmland comprises only 30 % in Germany. Grassland is important for biodiversity and has severely decreased in the last decades (Soussana and Duru, 2007), particularly in the last years in Germany in areas of biomass encroachment. The question is: Does organic farming fulfil the promise to protect the biodiversity better than non-organic (conventional) farming? A meta-data analysis was performed to answer this question.

3 Material and methods

The term "biodiversity" has many facets: It is commonly interpreted as species richness, only occasionally as the richness of varieties, cultivars or genetic expressions (e.g. micro-organisms) (Buchs, 2003; Buchs et al., 2003; Kasperczyk and Knickel, 2006). Not all papers gave clear answers on how to measure biodiversity. Classical ecology indexes were used to determine richness (S), but biodiversity (H') and dominance (D) were sometimes missing in the studies (Crowder et al., 2010). The impact of alpha (within-field level), beta (between-field level) and gamma diversity (landscape-level) is an important criterion (Rundlof et al., 2008). Here, it is necessary to evaluate and compare cultivation intensities, landscapes, micro-climate and agro-environments to respect the sensitivity of the biodiversity as an indicator of management.

The meta-data analysis was performed on the basis of scientific publications listed in the Web of Science and 'grey literature' in March 2011. The scientific papers are identified through a online database check in the Web of Science (www.isiknowledge.com), using Endnote® as the search and citation software, the online publication and project database organic eprints (http://orgprints.org) and grey literature in google (www.google.com), all under the search words "organic farming," "biodiversity", "[year]" and "[country]" in March 2011 (Table 1). In addition, the proceedings of the main scientific conferences of the organic sector in German speaking countries have been assessed as these papers are not listed in ISI.

Table 1:
Results of the web search "Organic farming", "biodiversity", "[year]", "[country]"

Results	**Web of Science** (Endnote® search March 2011)	**Organic eprints** (March 2011)	**Google** (x1.000)
"biodiversity"	97,215	n.a.	16,700
"Organic farming"	19.158	10.876**	8.860
"Organic farming", "Germany":	1.276	2.923**	7.740
"Organic farming", "biodiversity":	766	96***	3.390
- Year of publication:			
< 1991	0	0	142
1991 – 1995	17	1	145
1996 – 2000	78	3	142
2001 – 2005	250	37	530
2006 – 2011	421	55	2.010
- selected countries, continents:			
Germany	44	35	672
European Union	287*	83	1.978
USA, Canada	38+14	3+0	497
India	31	3	161
China	10	1	155
Australia, New Zealand	10+6	0	188
Africa	15	1	166
Country not specified	311	5	n.a.

* EU27 including Germany
** Including projects and institutions as dataset beside publication
*** Only publications

4 Results

4.1 The search results

In the last years the number of studies on organic farming and biodiversity increased significantly (Table 1). Despite the relatively new serious recognition of the organic system as a field of scientific relevance in the scientific world, about 19,000 publications were found in the Web of Science (www.isiknowledge.com) under the word of "organic farming". Out of these papers 1,200 were from Germany (6 %). 766 publications were found with the second search word "biodiversity" (3.5 %); half of them were published in the last five years by European researchers. This data set includes papers of the main international organic farming conferences.

In contrast to ISI listed data banks in the Web of Science it is usually hard to find grey literature. These papers may well meet scientific standards but miss a scientific platform for publication (e. g. diploma thesis, reports). The data bank http://orgprints.org was established in 2001 by the Danish DARCOF (today ICROFS) and joint by FiBL and BÖL to give grey organic farming papers a web-based source. All international and European organic conferences use the web platform for submission of papers (Table 2). Nowadays this organic farming databank has more than 10,000 entries. The majority of papers is from Europe, with about one third from Germany. A total of 1,154 submissions deal with environmental aspects, but only 526 publications focus on the subject "biodiversity and ecosystem service." 96 publications concentrate exclusively on biodiversity (1 %). The main activities of organic farming research are in the field of development of organic farming, while less attention has been paid to enhancing and strengthening sustainability (10 %). One reason is topic of the organic farming conference.

The Google search brought too many results without relevance to this study. This source was not considered for further analysis. However, it gives an impression about the importance of this topic in the web. The proceedings of the most important scientific conferences of organic farming proved to be the best source to get an overview of main research topics and the relevance of biodiversity in scientific studies. At the moment biodiversity is still a minor topic as only 105 papers dedicated their research to thus field of research (Table 1). This equals 4 % of all papers.

4.2 Meta-analysis of ISI listed papers

The meta-data analysis tried to answer the question, whether organic farming benefits biodiversity. From 766 studies found with Endnote® in Web of Science using the key words "organic farming" and "biodiversity," nearly half of the references (343) could be used for the assessment, 423 had to be rejected (Table 3). Because some studies have assessed more than one species, multiple answers were given. Thus some studies are cited more than once (total citations = 396). Not all studies made clear comparisons between organic and conventional farming systems (Pimentel et al., 2005; Pimpini et al., 2005). Nevertheless, the meta-data analysis comes to the unequivocal conclu-

Table 2:
Proceedings of the scientific conferences of organic farming in the last 10 years, published under http://orgprints.org

Selected scientific Organic Farming conferences	Place	Year	Papers total	Papers Biodiversity
13st International IFOAM Scientific conference	Basel, CH	2000	500	19
6. Wissenschaftstagung Ökologischer Landbau[1]	Freising, DE	2001	116	10
14th IFOAM Organic World Congress	Victoria, CA	2002	294	13
7. Wissenschaftstagung Ökologischer Landbau[1]	Wien, AT	2003	214	7
1st ISOFAR conference[1]	Adelaide, AU	2005	141	5
8. Wissenschaftstagung Ökologischer Landbau[1]	Kassel, DE	2005	215	6
Joint Organic Conference	Odense, DK	2006	275	1
9. Wissenschaftstagung Ökologischer Landbau[1]	Hohenheim, DE	2007	245	19
2nd ISOFAR conference	Modena, IT	2008	385	15
10. Wissenschaftstagung Ökologischer Landbau[1]	Zürich, CH	2009	287	10
11. Wissenschaftstagung Ökologischer Landbau[1]	Gießen, DE	2011	209	6
Total			2,881	111

[1] The papers of the biannual German speaking organic farming conferences are not found with Endnote® in web of science (ISI). The papers of these conferences have been assessed additionally because of their relevance on a global scale.

sion that biodiversity is higher in organic farming than in conventional farming. 327 citations backed this result, 56 were not clear and only 13 suggested that biodiversity was lower under organic farming management (Table 3).

Table 3:

Impact of organic farming[1] on biodiversity in comparison to conventional farming (no. of citations in ISI listed publications[2])

Subject	More biodiversity	Unclear, indifferent	Less biodiversity
Landscape	28	5	0
Flora on arable land	61	3	0
Flora on grass land	20	5	0
Flora perennial land use[3]	12	1	2
Invertebrates	77	12	7
Vertebrates	26	5	0
Bacteria, yeast, pests	6	2	1
Soil biota	38	15	0
Agro-biodiversity	28	2	0
Biodiversity in general	31	6	3
Total	327	56	13

[1] This includes organic farming, wild plant collection, traditional farming under organic standards (without certification).
[2] Multiple citations of 343 used papers are possible due to different conclusions for different species.
[3] Perennial land use: vineyards, orchards, special biotopes are for example: orchards, hedges, ponds, farm buildings, paths, fences, forests or stone heaps, special buildings, plantation or facilities for nature (e. g., herb loops). They are assessed in the context of adjacent farming systems.
Source: Web of Science search using Endnote® in March 2011; see Annex 1)

Most of the 396 citations were from Europe (80 %; only EU27 72 %), North-America (6 %) and Latin-America (5 %) (Table 4). Important countries for comparative studies on biodiversity were UK (65 citations; 20 %), DE (51; 16 %), SE (30; 9 %), CH (27; 8 %), IT (24; 7 %), FR (23; 7 %), NL (21; 6 %), US (20; 6 %) and ES (18; 6 %) (McLaughlin and Mineau, 1995).

Table 4:

Origin of the citations[1] about comparative studies of organic and conventional farming on biodiversity in different land use systems

Region	more	unclear	less	Total
Europe (from EU27)	258 (228)	48 (47)	11 (11)	317 (286)
North America	20	4	1	25
Latin America	16	3	0	19
Asia	11	0	0	11
Africa	4	0	0	4
Oceania	9	1	1	11
miscellaneous	9	0	0	9
Total	327	56	13	396

[1] Multiple citations of 343 used papers are possible due to different conclusions for different species.
Source: web of science search using Endnote® in March 2011; see Annex 1)

Organic farming was in favour for all species. The restricted use of pesticides and low nutrient input in organic farming were identified as main factors for a higher biodiversity of flora and fauna was usually (Frost and Ardeshir, 2004). Agro-biodiversity and landscape architecture were less often identified as key parameters for biodiversity. Some flora and fauna have adapted on intensive conventional farming (high nutrient level in soils and high crop yields etc.): epigaeic spiders, birds, plants like *Urtica dioica* (Nettel) (Rydberg and Milberg, 2000). Usually these flora and fauna is not endangered.

4.3 Long term trials

It seems safe to assume that the influence of the land use management is best reflected and assessed in long-term field experiments. And all long-term field studies (BMELV, 2005) with the topic "organic versus conventional farming" (Raupp, 2009) confirm the advantage of organic farming to improve biodiversity (soil biota, flora, arthropods): Glenlea long-term rotation study in Canada (Entz et al., 2005); the DOC-trial in Switzerland (Pfiffner, 1996; Fliessbach et al., 2000; Mader et al., 2002); State Research Institute at Osiny in Poland (Feledyn-Szewczyk, 2008); Rodale Institute Farming Systems Trial (Hepperly et al., 2006); Ekhaga Experimental Farm in Sweden (Lundkvist et al., 2008); Trenthorst organic farming system comparison study in Germany (Rahmann et al., 2006); Mediterranean Arable Systems Comparison Trial (MASCOT) and (MOLTE) in Italy (Migliorini and Vazzana, 2006; Mazzoncini et al., 2010).

4.4 Other meta-analysis

Pfiffner (1996) compiled 44 studies related to fauna richness of different land use management systems (Table 4). They concluded that fauna is more diverse on organic compared to conventional farm land. Bartram and Perkins (2003) found an advantage of organic farming in biodiversity in 33 UK studies, too. Lynch (2009) analysed studies from Canada and the USA and concluded that organic farming contributes to diversity of cropping, flora and habitat.

Bengtsson et al. (2005) found in their meta-data analysis of literature, published before December 2002 that organic farming increases species richness in general. Species richness was on average 30 % higher than in conventional farming systems. However, the results were variable among studies, and 16 % of them actually showed a negative effect of organic farming on species richness. On average, organisms were 50 % more abundant in organic farming systems, but the results were highly variable between studies and organism groups. Birds, predatory in-

Table 5:
Significant impact of organic farming on selected fauna

	Abundance of fauna No. of studies[1], where ...			Diversity of fauna species No. of studies[1], where ...		
Fauna group[2]	Organic more than conventional	Organic like conventional	Organic less than conventional	Organic more than conventional	Organic like conventional	Organic less than conventional
Earth worms	17	1	0	4	3	0
Ground beetles	13	2	0	6	2	0
Spiders	6	1	0	0	0	0
Millipedes	4	0	0	1	1	0
Bugs	2	1	0	1	1	0
Mites	2	0	1	1	1	0
Birds	5	0	0	1	1	0
Total	49	5	1	15	7	0

[1] Results of 44 studies; multiple answer possible.
[2] Most of these groups have important functions in agro-eco-systems.
Source: Pfiffner, 1996

sects, soil organisms and plants responded positively to organic farming, while non-predatory insects and pests did not. The positive effects of organic farming on abundance were verified at plot and field scale, but not on farm level.

Bugg (2002) found in studies conducted in the USA (Pennsylvania and North Dakota), UK (Wales and England) and Canada (Saskatchewan and Ontario) that organic farming and minimum tillage systems support a higher bird diversity and abundance than do conventional systems.

Mondelaers et al. (2009) performed a meta-data analysis of the peer reviewed literature comparing the environmental impacts of organic and conventional farming. They concluded that soils in organic farming systems have, on average, a higher content of organic matter and that organic farming contributes positively to agro-biodiversity (breeds used by the farmers) and natural biodiversity (wild life).

4.5 Agro-biodiversity

Biodiversity is not only defined for wild flora and fauna but also for cultivated crops (Mondelaers et al., 2009). While a higher diversity of cultivated and wild plants and associated fauna is found on grassland, arable land usually lacks biodiversity due to pesticide applications (Geiger et al., 2010). More than one third of the German surface is arable land and very often the cultivated crops are the only plants on these areas. There are about 40 different crops/crop groups cultivated on organic and conventional farms. These crops have different importance (abundance) and are not equally distributed over the area. Some crop species dominate, while others have only a very small share Table 5). The impact on agro-biodiversity can be measured through the inequality of the distribution. Using the statistical data from the cropping in organic farming, this is less equal than on conventional farming. The Gini coefficient[2] for organic farming is 0.69 and for conventional 0.82. The higher equality of organic farming can be easily explained. The crop rotation is broader than in conventional farming (a minimum of six versus a maximum of three different crops in the rotation).

5 Conclusions

In the presented comprehensive meta-data analysis, publications were assessed to prove whether organic farming has an advantage for biodiversity or not. This and other meta-analyses (Pfiffner, 1996; Bartram and Perkins, 2003; Bengtsson et al., 2005; Chamberlain et al., 2010) provide evidence that organic farming enhances and conserves biodiversity. A total of 766 ISI-listed publications were found with the search words "organic farming" and "biodiversity", 83 % from Europe. Half of them were published in the last five years. 396 papers could be used for the answer and 327 (83 %) of the citations (multi citations of the 343 papers were possible) found an advantage of organic farming for more biodiversity compared with conventional farming. 56 (14 %) citations were not sure or they found no difference and only 13 (3 %) came to the conclusion that organic farming has less biodiversity (7 of them for soil invertebrates).

[2] The Gini coefficient is defined as a ratio of the area on the Lorenz curve diagram and can be from "0" (very equal: all crops are cultivated on the same number of hectares) up to "1" (very unequal: nearly all hectares are used for only one crop).

Table 6:
Statistical data on cultivated crops in relation to the land use system in Germany (2008)

Crop	Organic (x1,000 ha)	% of organic	Conventional (x1,000 ha)	% of conventional	Percentage organic (%)
Farmland (utilised)	908	100.00	16,926	100,00	5.09
Cropland	385	42.40	12,103	71,50	3.08
Grassland	490	54.00	4,789	28,30	9.28
Mixed orchard/pasture	13	1.43	300	1,77	4.15
Permanent culture	12	1.32	200	1,18	5.66
Grain	188	20.70	6,518	38,50	2.80
Winter wheat	40	4.41	3,164	18,70	1.25
Summer wheat	7	0.72	43	0,25	13.10
Rye	52	5.73	737	4,35	6.59
Triticale	21	2.31	399	2,36	5.00
Winter barley	9	0.94	1,418	8,38	0.60
Summer barley	13	1.43	544	3,21	2.33
Dinkel	18	1.98	0	0,00	100.00
Oat	23	2.53	179	1,06	11.49
Maize (corn)	5	0.50	515	3,04	0.87
Maize (silage)	8	0.88	1,672	9,88	0.48
Mixed feed crops	9	0.99	126	0,74	6.67
Legume feed	76	8.37	206	1,22	26.95
Cultivated grassland	24	2.64	392	2,32	5.77
Pulses	24	2.64	84	0,50	22.22
Faba beans	6	0.66	11	0,06	35.29
Lupine	9	0.99	20	0,12	31.03
Peas	9	0.99	48	0,28	15.79
Potatoes (fresh)	7	0.77	109	0,64	6.03
Potatoes (industry)	1	0.08	73	0,43	0.95
Sugar beets	1	0.12	369	2,18	0.30
Feeding beets	0	0.01	4	0,02	2.44
Rape	2	0.25	1,371	8,10	0.17
Sunflowers	2	0.18	25	0,15	6.02
Soy beans	1	0.06		0,00	100.00
Flax	0	0.04	4	0,02	8.70
Medical plants	1	0.07	6	0,04	9.77
Cannabis	0	0.04		0,00	100.00
Hops	0	0.01	18	0,11	0.55
Carrots	1	0.15	10	0,06	12.30
Cabbage	0	0.03	7	0,04	3.45
Onions	0	0.04	9	0,05	3.54
Red beet	0	0.03	2	0,01	13.33
Salad	0	0.01	10	0,06	1.31
Asparagus	1	0.07	18	0,11	3.49
Strawberry	0	0.04	13	0,08	2.66
Flowers	0	0.01	34	0,20	0.36
Apples	3	0.30	32	0,19	7.83
Wine yards	4	0.48	102	0,60	4.14
Tree nursery	0	0.05	22	0,13%	2.08

Source: AMI 2010 using the basis of the test farm net data of the BMELV.

Long-term field studies on "organic versus conventional farming" confirm the advantage of organic farming to improve biodiversity for soil biota, flora, arthropods (Pfiffner, 1996; Mader et al., 2002; Entz et al., 2005; Feledyn-Szewczyk, 2008) and contribute to a better understanding of functional biodiversity (Wolfe, 2002; Zhong et al., 2005). The impact can be found on the farm land and attached areas such as hedges. Herbaceous field boundaries are rich in biodiversity and can be used as a separation between organic and conventional fields (Moonen et al., 2006; Gardarin et al., 2007). If the local biodiversity is already poor due to intensive farming in the surrounding area, organic farming can not compensate the loss of biodiversity. This was for instance shown for flower visiting insects (Hopkins and Feber, 1997; Brittain et al., 2010). Seed banks were not influenced by management (Hawes et al., 2010). It is no suitable political solution to define preference areas for organic (remote and low productive soils) and conventional farming (high potential soils) as every region should have a mixture of organic and conventional farming systems (Taube et al., 2006).

Conventional farming can have similar results in the case of compulsory set-aside farm land (segregation). Mac Donald et al. (2007) and Nemecek et al. (2006, 2011a, b) found advantages of organic farming in alpha-diversity but state that set-aside land on conventional farms can equalize this advantage. But on-farm segregation like set-aside land can be a risk for long-term biodiversity protection. As the EU set the obligation for set-aside farm land to zero in 2008, conventional farmers have converted set-aside land into crop land (Rundlof et al., 2010). This has been followed by losses of biodiversity on conventional farms.

Agri-environmental schemes (AES) have a high importance in biodiversity protection (Purtauf et al., 2005; Rund-lof et al., 2008; Taylor and Morecroft, 2009). This can be carried out as organic farming (paid under the agri-environmental schemes) or as a part of conventional farming (nature protection areas) (Schader et al., 2008). Good farming practice becomes more important to enhance and improve biodiversity in organic and conventional farming (Rydberg and Milberg, 2000; Strasser and Ryffel, 2010). Biodiversity assessment is not part of the inspection process (889/2008/EC) so that it is possible that it depends on the organic farm manager whether biodiversity will be promoted or repelled.

The main question is the antagonism between food security and biodiversity. One options to solve this problem is segregation (conventional) and integration (organic) (Gabriel et al., 2009). Differences in biodiversity have a positive and a negative impact: For example, weeds, pests and parasites dominate in organic farming (more biodiversity), are, however, negative for crop yield, product quality and animal welfare (Poetsch et al., 2005; Meyling et al., 2010). This has to be considered in the analysis of the impact of biodiversity (Letourneau and Goldstein, 2001; Letourneau and Bothwell, 2008; Ryan et al., 2010). Biodiversity needs equilibrium between biodiversity and food production (Vandana, 2000; Crowder et al., 2010; Chappell and LaValle, 2011). Biomass production is a new challenge for biodiversity protection, particularly if maize is encroaching as a monoculture (Fritsche, 2004). In addition, it should be decided, if "organic-herbicides" are a strategy (additional to mechanical and temperature weed control measures). A strong argument against such procedure is that organic farming would start to go conventional with the risk of loss of biodiversity and loss of consumer confidence (Darnhofer et al., 2010).

Hole et al. (2005) came to the conclusion, that *"(1) It remains unclear whether a 'holistic' whole-farm approach (i.e. organic) provides greater benefits to biodiversity than carefully targeted prescriptions applied to relatively small areas of cropped and/or non-cropped habitats within conventional agriculture (i.e. agri-environment schemes); (2) Many comparative studies encounter methodological problems, limiting their ability to draw quantitative conclusions; (3) Our knowledge of the impacts of organic farming in pastoral and upland agriculture is limited; (4) There remains a pressing need for longitudinal, system-level studies in order to address these issues and to fill in the gaps in our knowledge of the impacts of organic farming, before a full appraisal of its potential role in biodiversity conservation in agro-ecosystems can be made"*

The presented meta-data analysis confirms the conclusions of Hole et al. (2005). However, it is important to emphasise the fact that numerous studies favour organic farming for improving biodiversity in comparison to conventional farming. Yet, it needs to be taken into account that farming systems (including organic) and farm functions change rapidly. Energy farming and agri-environmental schemes force science to understand the impact more rapidly than in previous years. For example, biomass production can have a negative impact on biodiversity (maize domination) and biogas-facilities are installed for many decades. In future, the aspects of food security and food safety will gain increasing importance irrespective of the land use system. Putative solutions towards more biodiversity is the use of set aside farm land for segregation as it can have the same or even better impact on biodiversity than integrated measures such as organic farming. A mixture of intensive farming with set aside, non-farm land, agri-environmental schemes and organic farms may deliver a high range of biodiversity throughout all landscapes (Holland et al., 2007). A separation of these systems into specific farming areas (intensive/conventional and extensive/organic) is counter-productive.

6 Annex

Annex 1:

Comparison of Organic farming[1] (OF) and Conventional farming (CF) on biodiversity (by countries[2])

Subject	More biodiversity	Unclear, indifferent	Less biodiversity
Landscape, whole farm approach on biodiversity	BE: (Beider et al., 2007); CA: (Lynch, 2009); CH: (Schader et al., 2008; Steiner and Pohl, 2009); CR: (Blanco-Metzler and Diaz Porras, 2008); DE: (Haas and Wetterich, 2000; Holzschuh et al., 2010); DK: (Tybirk and Fredshavn, 2003; Tybirk et al., 2004); ES: (Mena et al., 2009; Jose-Maria et al., 2010); FR: (Gardarin et al., 2007); IT: (Ronchi and Nardone, 2003; Moonen et al., 2006; Lazzerini et al., 2007); SE: (Weibull, 2002; Rundlof and Smith, 2006; Rundlof et al., 2008; Rundlof et al., 2008; Rundlof et al., 2010); UK: (Norton et al., 2006; Watson et al., 2006; Gibson et al., 2007; Watson et al., 2008; Norton et al., 2009; van der Gast et al., 2011); US: (Smukler et al., 2008; Lynch, 2009; Smukler et al., 2010)	DE: (Holzschuh et al., 2007); NL: (Manhoudt and Snoo, 2003); SE: (Weibull, 2002); UK: (Hole et al., 2005; Holland et al., 2007)	
Flora on arable land	AT: (Kaar and Freyer, 2008); AU: (Macfadyen et al., 2009); CA: (Lynch, 2009); CH: (Mader et al., 2002; Nemecek et al., 2006; Hiltbrunner et al., 2008; Wyss and Pfiffner, 2008; Nemecek et al., 2011); CZ: (Tyser et al., 2008); DE: (Albrecht, 2005; Roschewitz et al., 2005a; Glemnitz et al., 2006; Himstedt and van Elsen, 2006; Clough et al., 2007a; Albrecht, 2008); DK: (Aude et al., 2003; Aude et al., 2004); ES: (Romero et al., 2005; Caballero-Lopez et al., 2010; Jose-Maria et al., 2010); EU: (Albrecht, 2003); FI: (Hyvonen et al., 2003; Ekroos et al., 2010); FR: (Bochu et al., 2004; Mesleard et al., 2005; Chateil et al., 2007); HU: (Glemnitz et al., 2006); IT: (Caporali et al., 2003; Migliorini and Vazzana, 2007; Mazzoncini et al., 2010); LT: (Balezentiene, 2008; Balezentiene, 2009); NL: (Alebeek et al., 2003; Manhoudt et al., 2007); PL: (Feledyn-Szewczyk and Duer, 2006; Feledyn-Szewczyk, 2008; Krawczyk, 2009; Krawczyk et al., 2010); SE: (Mattsson, 1999; Rydberg and Milberg, 2000; Belfrage et al., 2005; Bengtsson et al., 2005; Lundkvist et al., 2008; Rundlof et al., 2010); UK: (Cobb et al., 1999; Leake, 2002; Bartram and Perkins, 2003; Asteraki et al., 2004; Turner, 2004; Fuller et al., 2005; Hole et al., 2005; Gibson et al., 2007; Brandao et al., 2010; Hawes et al., 2010); US: (Hepperly et al., 2006; Lynch, 2009; Ryan et al., 2010; Wortman et al., 2010); ZA: (Baudron et al., 2009); No specific country: (Leifert et al., 2007; Mondelaers et al., 2009; Ulber et al., 2009)	CH: (Aavik and Liira, 2010); FI: (Hyvonen, 2007); SE: (Mattsson, 1999)	
Flora on grass land	AT: (Matthes et al., 2002; Poetsch et al., 2005); BR: (Aroeira, 2003; Aroeira and Paciullo, 2004); CH: (Schmid et al., 2001; Britschgi et al., 2006); DE: (Elsasser, 2000; Haas et al., 2001; Mayer et al., 2008; Muller-Lindenlauf et al., 2010); DK: (Petersen et al., 2006); EE: (Geherman and Viiralt, 2004); ES: (Mena et al., 2009); NL: (Baars, 2002); PT: (Crespo et al., 2004); UK: (Adamson et al., 2004; Fuller et al., 2005; Hole et al., 2005; Younie and Baars, 2005);	CA: (Brandt et al., 2010); CZ: (Sarapatka and Cizkova, 2007); EE: (Geherman and Ellermae, 2001); FR: (Benoit et al., 2005; Fiorelli et al., 2008)	
Flora on perennial crop land[3]	BR: (Batista et al., 2002); CR: (Somarriba and Harvey, 2003; Somarriba et al., 2003); DE: (Ammer et al., 1995; Geier et al., 2000); DK: (Boutin et al., 2008); ES: (Cotes et al., 2009; Minarro et al., 2009; Cotes et al., 2010); US: (Reganold et al., 2001; Nicholls et al., 2008); ZA: (Gaigher and Samways, 2010)	ES: (Minarro et al., 2009)	ES: (Minarro et al., 2009); IT: (Bruggisser et al., 2010)
Invertebrates: insects, spiders, beetles, parasites, earth worms, nematodes	AT: (Matthes et al., 2002); AU: (Macfadyen et al., 2009); AR: (Zalazar and Salvo, 2007; Fernandez et al., 2008); BG: (Andreev et al., 2001); CA: (Lynch, 2009); CH: (Pfiffner, 1996; Mader et al., 2002; Britschgi et al., 2006; Nemecek et al., 2006; Nemecek et al., 2011); CN: (Zhong et al., 2005; Chen et al., 2010; Yuan et al., 2010); DE: (Clough et al., 2005; Roschewitz et al., 2005b; Schmidt et al., 2005; Humann-Ziehank and Ganter, 2006; Clough et al., 2007a; Clough et al., 2007b; Clough et al., 2007c; Hallmann et al., 2007; Holzschuh et al., 2007; Holzschuh et al., 2008; Bates and Harris, 2009; Diekotter et al., 2010; Holzschuh et al., 2010); DK: (Boutin et al., 2009; Meyling et al., 2010); ES: (Cotes et al., 2009; Caballero-Lopez et al., 2010; Cotes et al., 2010); FR: (Garcin et al., 2004; Viaux and Rameil, 2004; Mesleard et al., 2005); FI: (Salonen et al., 2001a; Salonen et al., 2001b; Salonen et al., 2005; Ekroos et al., 2008; Ekroos et al., 2010); IN: (Suthar, 2009); IT: (Benvenuti et al., 2007; Migliorini and Vazzana, 2007; Peverieri et al., 2009; Mazzoncini et al., 2010); IR: (Hutton and Giller, 2003); NI: (Ottonetti et al., 2010); NL: (Mulder et al., 2003; Postma-Blaauw et al., 2010); NZ: (Bowie et al., 2003; Moller et al., 2007); PK: (Siddiqui et al., 2005); PT: (Santos et al., 2007); SE: (Belfrage et al., 2005; Bengtsson et al., 2005; Oberg, 2007; Rundlof et al., 2008; Rundlof et al., 2008); UK: (Cobb et al., 1999; Leake, 2002; Asteraki et al., 2004; Wickramasinghe et al., 2004; Fuller et al., 2005; Hole et al., 2005; Birkhofer et al., 2008; Eyre et al., 2009; Mondelaers et al., 2009; Hodgson et al., 2010; Eyre and Leifert, 2011); US: (Nicholls et al., 2008); ZA: (Carvalheiro et al., 2010; Gaigher and Samways, 2010); No country specified: (Boisclair and Estevez, 2006; Crowder et al., 2010)	DE: (Doring et al., 2003; Irmler, 2003; Purtauf et al., 2005); DK: (Boutin et al., 2009); FR: (Ricard et al., 2007; Pelosi et al., 2009); SE: (Weibull et al., 2000; Weibull, 2002; Weibull and Ostman, 2003); UK: (Feber et al., 1998; Feber et al., 2007; Birkhofer et al., 2008)	DE: (Clough et al., 2007a); BE: (Albert et al., 2003); IT: (Boisclair and Estevez, 2006; Bruggisser et al., 2010); FR: (Garcin et al., 2004); SE: (Oberg, 2007; Oberg, 2009)

Subject	More biodiversity	Unclear, indifferent	Less biodiversity
Birds, mammals, aquatic fauna	DE: (Batary et al., 2010); CA: (Freemark and Kirk, 2001; Bugg, 2002); IT: (Ciani, 1997; Genghini et al., 2006); FR: (Mesleard et al., 2005; Ondine et al., 2009); PA: (Bael et al., 2007); NL: (Kragten and de Snoo, 2007; Kragten and de Snoo, 2008); SE: (Belfrage et al., 2005; Bengtsson et al., 2005; Danhardt et al., 2010; Smith et al., 2010); UK: (McLaughlin and Mineau, 1995; Bugg, 2002; Leake, 2002; Potts, 2002; Wickramasinghe et al., 2003; Wickramasinghe et al., 2004; Fuller et al., 2005; Hole et al., 2005; McKenzie and Whittingham, 2009; Mondelaers et al., 2009; Chamberlain et al., 2010); US: (Bugg, 2002)	NL: (Kragten and de Snoo, 2007; Kragten and de Snoo, 2008); FR: (Ondine et al., 2009); SE: (Danhardt et al., 2010); UK: (Chamberlain et al., 2010)	
bacteria, yeast, pests	AU: (Bissett et al., 2006; Bissett et al., 2007; Macfadyen et al., 2009); ES: (Escudero et al., 2007; Cordero-Bueso et al., 2011); US: (Letourneau and Goldstein, 2001; Letourneau and Bothwell, 2008)	BE:(Coorevits et al., 2008); US: (Letourneau and Bothwell, 2008)	FR: (Benoit et al., 2005)
Soil biota	AU: (Bruggen and Termorshuizen, 2003; Bell et al., 2004); BR: (Lal, 2005); CH: (Fliessbach et al., 2000; Mader et al., 2002; Oehl et al., 2004; Nemecek et al., 2006; Oehl et al., 2009; Nemecek et al., 2011); DE: (Poveda et al., 2006; Diekotter et al., 2010); CL: (Peredo et al., 2009); DK: (Hansen et al., 2001); FR: (Peres et al., 2008); GR: (Tsiafouli et al., 2006); HR: (Custovic and Tvica, 2004); IN: (Tilak et al., 2005); IT: (Cardelli et al., 2004; Migliorini and Vazzana, 2007; Mocali and Benedetti, 2008; Campaneili et al., 2010; Mazzoncini et al., 2010; Paoletti et al., 2010); JP: (Nakamura et al., 2000); NL: (Mulder et al., 2003; Breure et al., 2004; van Diepeningen et al., 2006; Verbruggen et al., 2010); PK: (Rana et al., 2010); UK: (Leake, 2002; Shannon et al., 2002; Mondelaers et al., 2009; Stockdale and Watson, 2009; van der Gast et al., 2011); US: (Wander et al., 1995; Tu et al., 2006; Reeve et al., 2010); No country specified: (Creamer et al., 2010)	CL: (Peredo et al., 2009); DE: (Schrader et al., 2006; Chirinda et al., 2008); FR: (Peres et al., 2008; Pelosi et al., 2009); IT: (Bedini et al., 2008; Paoletti et al., 2010); NL: (Zanen et al., 2008; Galvan et al., 2009); NZ: (Parfitt et al., 2005); UK: (Shannon et al., 2002; Brussaard et al., 2004; Orr et al., 2011); US: (Bossio et al., 1998; Sanchez-Moreno et al., 2008)	
Agro-biodiversity	AT: (Vogl and Vogl-Lukasser, 2003); CA: (Scott, 2000; Lynch, 2009); CH: (Freyer, 1997); DE: (Muller et al., 2000; Wolff et al., 2002; Buchs, 2006); EU: (Bocci and Chable, 2009); ES: (Correal et al., 2006; Mena et al., 2009; Cordero-Bueso et al., 2011); FR: (Tronel and Codarin, 2010); HU: (Birol et al., 2005; Birol et al., 2006); IT: (Ronchi and Nardone, 2003); IN: (Vijayalakshmi and Arumugasamy, 2004); HR: (Lotti et al., 2008; Matotan et al., 2008); NL: (Bueren and Osman, 2001; Bueren et al., 2002); SE: (Rydberg and Milberg, 2000); UK: (Leake, 2002; Hole et al., 2005; Gibson et al., 2007; McKenzie and Whittingham, 2009; Mondelaers et al., 2009); US: (Lynch, 2009); No specific country: (Shiva, 1997)	DE: (Langer and Frederiksen, 2008)	
General and not species-specified comments concerning organic farming and biodiversity, farm assessments	AT: (Loidl, 2007); BE: (Baltus, 1997); BH: (Aziz and Al-Barakah, 2005); BR: (Alvarenga et al., 2002); CH: (Fliessbach et al., 2000; Wolfe, 2002; Nemecek et al., 2006; Strasser and Ryffel, 2010; Nemecek et al., 2011); CN: (Wang et al., 2007; Wang et al., 2009); CR: (Somarriba and Harvey, 2003; Somarriba et al., 2003; Dahlquist et al., 2007); DE: (Ammer et al., 1995; Elsen, 2000; Stein-Bachinger et al., 2005; Gabriel et al., 2006; Gabriel and Tscharntke, 2007; Stein-Bachinger and Fuchs, 2008; Gabriel et al., 2009; Gabriel et al., 2010; Muller-Lindenlauf et al., 2010); DK: (Porter and Petersen, 1997; Noe et al., 2005; Vaarst, 2010); ES: (Calero Castillo, 2003; Parra-Lopez et al., 2007); EU: (Bandarra, 2001); FR: (Chable et al., 2002; Dron and Ferron, 2003; Lamine and Bellon, 2009); GE: (Adl et al., 2006); HU: (Toth and Baldi, 2006); IN: (Ayyappan and Jena, 2003; Singh, 2005a; Singh, 2005b; Singh et al., 2007; Singh and Satapathy, 2007; Dubey and Sharma, 2008; Subhasis et al., 2008); IT: (Pacini et al., 2003; Ronchi and Nardone, 2003; Migliorini and Vazzana, 2007); MX: (Bray et al., 2002; Escamilla et al., 2005); NL: (Smis and Meijerink, 2006); NO: (Olsson and Rnningen, 1999); PO: (Link, 2004); UK: (McLaughlin and Mineau, 1995; Cobb et al., 1999; Atkinson et al., 2002; Dabrowski and Abanowska-Bury, 2005; Firth et al., 2006; Norton, et al. 2006; Watson et al., 2006; Watson et al., 2008; Norton et al., 2009; Taylor and Morecroft, 2009); US: (Altieri, 1999; Lotter, 2003; Snapp et al., 2010; Chappell and LaValle, 2011); No specific country: (Mansvelt and Lubbe, 1999; Leake, 2002; Scialabba et al., 2003; Xie et al., 2003; Kairo, 2005; Pimentel et al., 2005; Leifert et al., 2007; Briggs, 2008; Schnug et al., 2008)	AT: (Darnhofer et al., 2010); MX: (Philpott et al., 2007); NL: (Bueren and Osman, 2001; Ammann, 2007; Ammann, 2008; Ammann, 2009)	US: (Avery, 1996); SE: (Kirchmann and Thorvaldsson, 2000); NZ: (Rowarth, 2008)

343 papers were assessed. Multiple citations are possible due to different conclusions for different species.
[1] This includes organic farming, wild plant collection, traditional farming under organic standards (without certification).
[2] ISO country codes are used.
[3] Perennial crop land: e.g., agro-forestry, orchards, vineyards.
Source: web of science search using Endnote® in March 2011)

References

Cited grey literature:

AMI (Agrarmarkt Informations-Gesellschaft) (2011) AMI Marktbilanz Öko-Landbau 2010. Bonn : AMI

Anonymous (2011a) [online]. To be found at <http://www.genres.de> [quoted 23.08.2011]

Anonymous (2011b) [online]. To be found at <http://www.bfn.de> [quoted 23.08.2011]

Anonymous 2011c [online]. German National Agriculture and Gardening Plant: To be found at <http://www.genres.de/en/cultivated-and-wild-plants>[quoted 23.08.2011]

BfN (Bundesamt für Naturschutz) (2007) Biologische Vielfalt – das Netz des Lebens [online]. To be found at <http://www.bfn.de/fileadmin/MDB/documents/service/broschuere_biodiv.pdf> [quoted 29.06.2011]

BfN (Bundesamt für Naturschutz) (2008) Lebensvielfalt für die Erde [online]. To be found at <http://www.bfn.de/fileadmin/MDB/documents/service/BfN_Lebensvielfalt_f3r_die_Erde_Internet.pdf> [quoted 29.06.2011]

BLE (Bundesanstalt für Landwirtschaft und Ernährung), Informations- und Koordinationszentrum für Biologische Vielfalt (2008) Fakten wissen zu Agrobiodiversität [online]. To be found at <http://www.hier-waechst-vielfalt.de/uploads/media/faktenblatt_agrobiodiversitaet_de_01.pdf> [quoted 29.06.2011]

BMELV (2005) Langzeituntersuchungen – mit Ausdauer zur Erkenntnis : (Editorial) [online]. To be found at <www.bmelv-forschung.de/no_cache/de/startseite/veroeffentlichungen/forschungsreport/archiv.html> [quoted 29.06.2011]

BMELV (2011) Ökologischer Landbau in Deutschland. Agrarbericht der Bundesregierung. Bonn [online]. To be found at <http://www.bmelv.de/SharedDocs/Downloads/Broschueren/Agrarbericht2011.pdf?__blob=publicationFile> [quoted 25.08.2011]

BÖLW (2011) Zahlen, Daten, Fakten : Ökolandbau 2011. Berlin

CBD (Convention of Biological Diversity) (2010) Global biodiversity outlook 3. Montreal : Secretariat Convention Biol Diversity, 94 p

FAO (Food and Agriculture Organization of the United Nations) (2007) The state of the world's animal genetic resources for food and agriculture. Rome : FAO, 511 p

IFOAM (1980) Organic farming and biodiversity [online]. To be found at <www.ifoam.org> [quoted 23.08.2011]

IFOAM (2005) Organic farming and biodiversity [online]. To be found at <www.ifoam.org> [quoted 23.08.2011] [

IFOAM (2007) IFOAM basic norms for organic production and processing : version 2005 ; including IFOAM basic standards for organic production and processing, IFOAM accreditation criteria for bodies certifying organic production and processing. Bonn : IFOAM, 132 p

Kühne S, Burth U, Marx P (eds) (2006) Biologischer Pflanzenschutz im Freiland : Pflanzengesundheit im Ökologischen Landbau. Stuttgart : Ulmer, 288 p

MRI (2008) Nationale Verzehrstudie II [online]. To be found at <http://www.was-esse-ich.de/uploads/media/NVSII_Abschlussbericht_Teil_2.pdf> [quoted 05.07.2011]

Rahmann G (2000) Biotoppflege als neue Funktion und Leistung der Tierhaltung : dargestellt am Beispiel der Entbuschung von Kalkmagerrasen durch Ziegenbeweidung. Hamburg : Kovac, 384 p, Kassel, Univ, Habilitation, SchrR Agraria 28

Raupp J (2009) Long-term trials in Europe and North America, experience and research approaches [online]. To be found at <http://orgprints.org/16421/> [quoted 05.07.2011]

Sambraus HH (1999) Gefährdete Nutztierrassen : ihre Zuchtgeschichte, Nutzung und Bewahrung. Stuttgart : Ulmer, 384 p

Willer H, Kilcher L (Eds.) (2011) The World of Organic Agriculture - Statistics and Emerging Trends 2011. IFOAM, Bonn, and FiBL, Frick. [online] To be found at <http://www.organic-world.net/fileadmin/documents/yearbook/2011/world-of-organic-agriculture-2011-page-1-34.pdf> [quoted 25.08.2011]

WWF (2010) 2010 and beyond : rising to the biodiversity challenge [online]. To be found at <http://www.wwf.org.au/publications/wwf-2010-and-beyond/> [quoted 05.07.2011]

Scientific references used for Web of Science analysis:

Aavik T, Liira J (2010) Quantifying the effect of organic farming, field boundary type and landscape structure on the vegetation of field boundaries. Agr Ecosyst Environ 135(3):178-186

Adamson HF, Critchley CNR, Moon AE (2004) Vegetation change on an upland organic livestock unit in the North East of England from 1992-2001. In: Hopkins A (ed) Organic farming : science and practice for profitable livestock and cropping ; proceedings of the BGS/AAB/COR Conference ; held at the Harper Adams University College, Newport, Shropshire, UK, 20-22 April 2004. Reading : British Grassland Soc, pp 92-95

Adl SM, Coleman DC, Read F (2006) Slow recovery of soil biodiversity in sandy loam soils of Georgia after 25 years of no-tillage management. Agr Ecosyst Environ 114(2-4):323-334

Albert S, Hastir P, Hance T (2003) Agricultural biodiversity and control of carrot fly. Notes Fauniques Gembloux (50):3-8

Albrecht H (2003) Suitability of arable weeds as indicator organisms to evaluate species conservation effects of management in agricultural ecosystems. Agric Ecosyst Environ 98(1/3):201-211

Albrecht H (2005) Development of arable weed seedbanks during the 6 years after the change from conventional to organic farming. Weed Res 45(5):339-350

Albrecht H (2008) Effects of introducing organic farming on the population ecology and diversity of arable weeds. J Plant Dis Protect Spec Iss 21:357-362

Alebeek FANv, Kamstra JH, Venhorst B, Visser AJ (2003) Manipulating biodiversity in arable farming for better pest suppression : which species and what scale? Bull OILB/SROP 26(4):185-190

Altieri MA (1999) The ecological role of biodiversity in agroecosystems. Agric Ecosyst Environ 74(1-3):19-31

Alvarenga MIN, Martins M, Paula MB (2002) Ecological management of organic coffee farms. Informe Agropecuario 23(214/215):21-31

Ammann K (2007) Reconciling traditional knowledge with modern agriculture : a guide for building bridges. In: Krattiger AF (ed) Intellectual property management in health and agricultural innovation : a handbook of best practices ; vol 1 and 2. Oxford : Centre for the Management of Intellectual Property in Health Research and Development (MIHR), pp 1539-1559

Ammann K (2008) Integrated farming : why organic farmers should use transgenic crops. New Biotechnol 25(2/3):101-107

Ammann K (2009) Why farming with high tech methods should integrate elements of organic agriculture. New Biotechnol 25(6):378-388

Ammer U, Detsch R, Schulz U (1995) Concepts of land use. Forstwiss Centralbl 114(2):107-125

Andreev R, Letcheva I, Angelova R (2001) Biodiversity of predatory insect and mite species in an apple agrocoenosis within an organically grown orchard. Zhivotnovdni Nauki 38(2):161-163

Aroeira LJM (2003) Organic milk production : an alternative for the future. In: Martins CE (ed) Alternativas tecnologicas, processuais e de politicas publicas para a producaao de leite em bases sustentaveis. Juiz de Fora : Embrapa Gado de Leite, pp 59-91

Aroeira LJM, Paciullo DSC (2004) Milk production by grazing cattle. Informe Agropecuario 25(221):56-63

Asteraki EJ, Hart BJ, Ings TC, Manley WJ (2004) Factors influencing the plant and invertebrate diversity of arable field margins. Agric Ecosyst Environ 102(2):219-231

Atkinson D, Watson CA, Pearce B, Woodward L, Wolfe M, Welsh J, Nowack K (2002) Organic agriculture and GM crops. In: Pests and diseases 2002 : the BCPC Conference : conference proceedings ; proceedings of an international conference held at the Brighton Hilton Metropole Hotel, Brighton, UK, 18-21 November 2002 : vol 2. Farnham : British Crop Protection Council, pp 523-530

Aude E, Tybirk K, Michelsen A, Ejrnaes R, Hald AB, Mark S (2004) Conservation value of the herbaceous vegetation in hedgerows - does organic farming make a difference? Biol Conserv 118(4):467-478

Aude E, Tybirk K, Pedersen MB (2003) Vegetation diversity of conventional and organic hedgerows in Denmark. Agric Ecosyst Environ 99(1-3):135-147

Avery DT (1996) The farmers' plea to environmentalists. J Agribusiness 14(1):1-14

Ayyappan S, Jena JK (2003) Grow-out production of carps in India. J Appl Aquacult 13(3/4):251-282

Aziz RATA, Al-Barakah FN (2005) Composting technology and the impact of /i compost/ on soil biochemical properties. Arab Gulf J Sci Res 23(2):80-91

Baars T (2002) Botanical diversity of conventional and organic pastures in relation to mineral inputs. Grassland Sci Europe 7:760-761

Bael SAv, Bichier P, Ochoa I, Greenberg R (2007) Bird diversity in cacao farms and forest fragments of western Panama. Biodivers Conserv 16(8):2245-2256

Balezentiene L (2008) Organic and intensive farming impact on phytodiversity. Vagos (79):30-36

Balezentiene L (2009) Phytocenotical approach to synanthropic species in organic farm. Vagos (83):7-12

Baltus C (1997) Incentives for the conservation of genetic diversity for agriculture 1 agricultural programmes for the conservation of biodiversity in Belgium. BASE: Biotechnol AgronSociete Environnement 1(3):178-186

Bandarra NJ (2001) The agri-environment in rural development plans (2000-2006). Rev Marche Commun Union Europ (449):405-414

Bartram H, Perkins A (2003) The biodiversity benefits of organic farming. In: Organic agriculture: sustainability, markets and policies : OECD workshop on Organic Agriculture held on 23-26 September 2002 in Washington, DC. Paris : OECD, pp 77-93

Batary P, Matthiesen T, Tscharntke T (2010) Landscape-moderated importance of hedges in conserving farmland bird diversity of organic vs. conventional croplands and grasslands. Biol Conserv 143(9):2020-2027

Bates FS, Harris S (2009) Does hedgerow management on organic farms benefit small mammal populations? Agric Ecosyst Environ 129(1-3):124-130

Batista DCP, Azevedo ECGd, Bernhard T (2002) Viabilidade da producao ecologica no interior de Montenegro, RS. Caderno de Pesquisa Ser Biol 14(2):7-15

Baudron F, Corbeels M, Monicat F, Giller KE (2009) Cotton expansion and biodiversity loss in African savannahs, opportunities and challenges for conservation agriculture : a review paper based on two case studies. Biodivers Conserv 18(10):2625-2644

Bedini S, Cristani C, Avio L, Sbrana C, Turrini A, Giovannetti M (2008) Influence of organic farming on arbuscular mycorrhizal fungal populations in a Mediterranean agro-ecosystem. In: Neuhoff D, Halsberg N, Alföldi T (eds) Cultivating the Future Based on Science : vol 1: Organic crop production ; proceedings of the Second Scientific Conference of the International Society of Organic Agriculture Research (ISOFAR), held at the 16th IFOAM Organic World Congress in Cooperation with the International Federation of Organic Agriculture Movements (IFOAM) and the Consorzio ModenaBio, 18-20 June 2008 in Modena, Italy. Bonn : ISOFAR, pp 172-175

Beider E, Elderson J, Schelling G (2007) Effect of the surrounding landscape on the abundance of cabbage aphid in Brussels sprout fields. Bull OILB/SROP 30(8):31-36

Belfrage K, Bjorklund J, Salomonsson L (2005) The effects of farm size and organic farming on diversity of birds, pollinators, and plants in a Swedish landscape. Ambio 34(8):582-588

Bell M, Seymour N, Stirling G, Zwieten Lv, Sutton G, Moody P (2004) Impact of management practices on activity of soil biota and productivity constraints in Vertosols of the northern grains region. In: Lines-Kelly R (ed) Soil biology in agriculture : proceedings of a workshop on current research into soil biology in agricuture ; Tamworth Sustainable Farming Centre, Australia, 11-12 August 2004. Orange: NSW Agriculture, pp 18-24

Bengtsson J, Ahnstrom J, Weibull AC (2005) The effects of organic agriculture on biodiversity and abundance: a meta-analysis. J Appl Ecol 42(2):261-269

Benoit M, Herve T, Jean-Pierre D, Jacques C, Sophie P (2005) Conversion of a lamb production system to organic farming : how to manage, for what results? In: Köpke U, Niggli U, Neuhoff D, Cornish P, Lockeretz W, Willer H (eds) Researching sustainable systems : proceedings of the First Scientific Conference of the International Society of Organic Agriculture Research (ISOFAR), held in cooperation with the International Federation of Organic Agriculture Movements (IFOAM) and the National Association for Sustainable Agriculture, Australia (NASAA), 21-23 September 2005, Adelaide, South Australia. Bonn : ISOFAR, pp 584-587

Benvenuti S, Loddo D, Basteri G, Russo A (2007) Insect-pollinated weeds as indicator of the agroecosystem biodiversity. Agricoltura Mediterranea 137(3/4):132-137

Birkhofer K, Fliessbach A, Wise DH, Scheu S (2008) Generalist predators in organically and conventionally managed grass-clover fields : implications for conservation biological control. Ann Appl Biol 153(2):271-280

Birol E, Smale M, Gyovai A (2005) Explaining farmer demand for agricultural biodiversity in Hungary's transition economy. In: Smale M (ed) Valuing crop biodiversity : on-farm genetic resources and economic change. Wallingford : CABI, pp 119-145

Birol E, Smale M, Gyovai A (2006) Using a choice experiment to estimate farmers' valuation of agrobiodiversity on Hungarian small farms. Environ Resource Econ 34(4):439-469

Bissett A, Bowman J, Burke C (2006) Bacterial diversity in organically-enriched fish farm sediments. Fems Microbiol Ecol 55(1):48-56

Bissett A, Burke C, Cook PL, Bowman JP (2007) Bacterial community shifts in organically perturbed sediments. Environ Microbiol 9(1):46-60

Blanco-Metzler H, Diaz Porras A (2008) Organization of a sustainable agroforestry model for small farmers in the Montes de Oro Region, Puntarenas, Costa Rica. In: Neuhoff D, Halsberg N, Alföldi T (eds) Cultivating the Future Based on Science : vol 1: Organic crop production ; proceedings of the Second Scientific Conference of the International Society of Organic Agriculture Research (ISOFAR), held at the 16th IFOAM Organic World Congress in Cooperation with the International Federation of Organic Agriculture Movements (IFOAM) and the Consorzio ModenaBio, 18-20 June 2008 in Modena, Italy. Bonn : ISOFAR, pp 734-737

Bocci R, Chable V (2009) Peasant seeds in Europe : stakes and prospects. J Agric Environ Internat Develop 103(1/2):81-93

Bochu JL, Pointereau P, Ravier S, Doublet S (2004) Towards taking a better account of the environment in arable crops in Midi-Pyrenees. Courrier de l'Environnement de l'INRA (51):19-30

Boisclair J, Estevez B (2006) Insect pest management in organic agriculture : acting in harmony with complexity. Phytoprotection 87(2):83-90

Bossio DA, Scow KM, Gunapala N, Graham KJ (1998) Determinants of soil microbial communities : effects of agricultural management, season, and soil type on phospholipid fatty acid profiles. Microb Ecol 36(1):1-12

Boutin C, Baril A, Martin PA (2008) Plant diversity in crop fields and woody hedgerows of organic and conventional farms in contrasting landscapes. Agric Ecosyst Environ 123(1-3):185-193

Boutin C, Martin PA, Baril A (2009) Arthropod diversity as affected by agricultural management (organic and conventional farming), plant species, and landscape context. Ecoscience 16(4):492-501

Bowie M, Wratten S, Tylianakis J (2003) An introduction to entomological research on Kowhai Farm : the Heinz Wattie's organic farm at Lincoln University. Weta 25:18-23

Brandao M, Clift R, Milai Canals L, Basson L (2010) A life-cycle approach to characterising environmental and economic impacts of multifunctional land-use systems : an integrated assessment in the UK. Sustainability 2(12):3747-3776

Brandt SA, Thomas AG, Olfert OO, Leeson JY, Ulrich D, Weiss R (2010) Design, rationale and methodological considerations for a long term alternative cropping experiment in the Canadian plain region. Eur J Agron 32(1):73-79

Bray DB, Sanchez JLP, Murphy EC (2002) Social dimensions of organic coffee production in Mexico : lessons for eco-labeling initiatives. Soc Nat Resour 15(5):429-446

Breure AM, Mulder C, Rutgers M, Schouten AJ, Wijnen HJv (2004) Belowground biodiversity as an indicator for sustainability of soil use. Grassland Sci Europe 9:195-197

Briggs S (2008) Organic cereal and pulse production : a complete guide. Marlborough : Crowood Pr, 432 p

Britschgi A, Spaar R, Arlettaz R (2006) Impact of grassland farming intensification on the breeding ecology of an indicator insectivorous passerine, the Whinchat Saxicola rubetra : lessons for overall Alpine meadowland management. Biol Conserv 130(2):193-205

Brittain C, Bommarco R, Vighi M, Settele J, Potts SG (2010) Organic farming in isolated landscapes does not benefit flower-visiting insects and pollination. Biol Conserv 143(8):1860-1867

Bruggen AHCv, Termorshuizen AJ (2003) Integrated approaches to root disease management in organic farming systems. Australasian Plant Pathol 32(2):141-156

Bruggisser OT, Schmidt-Entling MH, Bacher S (2010) Effects of vineyard management on biodiversity at three trophic levels. Biol Conserv 143(6):1521-1528

Brussaard L, Kuyper TW, Didden WAM, Goede RGMd, Bloem J (2004) Biological soil quality from biomass to biodiversity : importance and resilience to management stress and disturbance. In: Schjnning P, Elmholt S, Christensen BT (eds) Managing soil quality : challenges in modern agriculture. Wallingford : CABI, pp 139-161

Buchs W (2003) Biodiversity and agri-environmental indicators : general scopes and skills with special reference to the habitat level. Agric Ecosyst Environ 98(1-3):35-78

Buchs W, Harenberg A, Zimmermann J, Weiss B (2003) Biodiversity, the ultimate agri-environmental indicator? Potential and limits for the application of faunistic elements as gradual indicators in agroecosystems. Agric Ecosyst Environ 98(1-3):99-123

Bueren ELv, Osman A (2001) Stimulating GMO-free breeding for organic agriculture : a view from Europe. Leisa 17(4):12-14

Bueren ETLv, Struik PC, Jacobsen E (2002) Ecological concepts in organic farming and their consequences for an organic crop ideotype. Neth J Agric Sci 50(1):1-26

Bugg RL (2002) Restoration ecology and conservation biology in agriculture : part II [online]. To be found at <http://www.sarep.ucdavis.edu/newsltr/v14n1/technical-1.htm> [quoted 06.07.2011]

Caballero-Lopez B, Blanco-Moreno JM, Perez N, Pujade-Villar J, Ventura D, Oliva F, Sans FX (2010) A functional approach to assessing plant-arthropod interaction in winter wheat. Agric Ecosyst Environ 137(3-4):288-293

Calero Castillo C (2003) Ecological production key aspects. Agricultura (Madrid), 72(849):200-204

Campaneili G, Ferrari V, Bertone A, Leteo F, Mancinelli G, Scalzo Rl, Cesare LFd, Sgolastra F, Ramilli F, Burgio G (2010) Comparison between organic and conventional agricultural ecosystems. Italus Hortus 17(2):36-38

Caporali F, Mancinelli R, Campiglia E (2003) Indicators of cropping system diversity in organic and conventional farms in central Italy. Int J Agric Sustainability 1(1):67-72

Cardelli R, Levi-Minzi R, Saviozzi A, Riffaldi R (2004) Organically and conventionally managed soils : biochemical characteristics. J Sustainable Agric 25(2):63-74

Carvalheiro LG, Seymour CL, Veldtman R, Nicolson SW (2010) Pollination services decline with distance from natural habitat even in biodiversity-rich areas. J Appl Ecol 47(4):810-820

Chable V, Chiffoleau Y, Chittrit JJ, Dreyfus F, Jaillard B, Lagadec Fl, Conseil M, Jeune Bl, Lea R, Miossec R (2002) Biological vegetable culture : the varietal challenge example of cabbages and cauliflowers in Brittany. PHM Revue Horticole (443/Suppl):xiv-xvii

Chamberlain DE, Joys A, Johnson PJ, Norton L, Feber RE, Fuller RJ (2010) Does organic farming benefit farmland birds in winter? Biol Lett 6(1):82-84

Chappell MJ, LaValle LA (2011) Food security and biodiversity : can we have both? : an agroecological analysis. Agric Hum Values 28(1):3-26

Chateil C, Abadie JC, Gachet S, Machon N, Porcher E (2007) Can agri-environmental measures benefit plant biodiversity? An experimental test of the effects ofChen YQ, Li Q, Chen YL, Wang SM, Yang YC (2010) Lac-production, arthropod biodiversity and abundance, and pesticide use in Yunnan Province, China. Trop Ecol 51(2):255-263

Chirinda N, Olesen JE, Porter JR (2008) Effects of organic matter input on soil microbial properties and crop yields in conventional and organic cropping systems. In: Neuhoff D, Halsberg N, Alföldi T (eds) Cultivating the Future Based on Science : vol 1: Organic crop production ; proceedings of the Second Scientific Conference of the International Society of Organic Agriculture Research (ISOFAR), held at the 16th IFOAM Organic World Congress in Cooperation with the International Federation of Organic Agriculture Movements (IFOAM) and the Consorzio ModenaBio, 18-20 June 2008 in Modena, Italy. Bonn : ISOFAR, pp 56-59

Ciani F (1997) Problems and perspective for a correct zootechnic-faunistic management of wild and domestic animals in protected areas. Zootec Nutr Anim 23(5):65-68

Clough Y, Holzschuh A, Gabriel D, Purtauf T, Kleijn D, Kruess A, Steffan-Dewenter I, Tscharntke T (2007a) Alpha and beta diversity of arthropods and plants in organically and conventionally managed wheat fields. J Appl Ecol 44(4):804-812

Clough Y, Kruess A, Kleijn D, Tscharntke T (2005) Spider diversity in cereal fields : comparing factors at local, landscape and regional scales. J Biogeogr 32(11):2007-2014

Clough Y, Kruess A, Tscharntke T (2007b) Organic versus conventional arable farming systems : functional grouping helps understand staphylinid response. Agric Ecosyst Environ 118(1-4):285-290

Clough Y, Kruess A, Tscharntke T (2007c) Local and landscape factors in differently managed arable fields affect the insect herbivore community of a non-crop plant species. J Appl Ecol 44(1):22-28

Cobb D, Feber R, Hopkins A, Stockdale L, O'Riordan T, Clements B, Firbank L, Goulding K, Jarvis S, Macdonald D (1999) Integrating the environmental and economic consequences of converting to organic agriculture: evidence from a case study. Land Use Policy 16(4):207-221

Coorevits A, De Jonghe V, Vandroemme J, Reekmans R, Heyrman J, Messens W, De Vos P, Heyndrickx M (2008) Comparative analysis of the diversity of aerobic spore-forming bacteria in raw milk from organic and conventional dairy farms. System Appl Microbiol 31(2):126-140

Cordero-Bueso G, Arroyo T, Serrano A, Tello J, Aporta I, Velez MD, Valero E (2011) Influence of the farming system and vine variety on yeast communities associated with grape berries. Int J Food Microbiol 145(1):132-139

Correal E, Robledo A, Rios S, Rivera D (2006) Mediterranean dryland mixed sheep-cereal systems. Grassland Sci Europe 11:14-26

Cotes B, Campos M, Pascual F, Garcia PA, Ruano F (2010) Comparing taxonomic levels of epigeal insects under different farming systems in Andalusian olive agroecosystems. Appl Soil Ecol 44(3):228-236

Cotes B, Castro J, Cardenas M, Campos M (2009) Responses of epigeal beetles to the removal of weed cover crops in organic olive orchards. Bull Insectol 62(1):47-52

Creamer RE, Brennan F, Fenton O, Healy MG, Lalor STJ, Lanigan GJ, Regan JT, Griffiths BS (2010) Implications of the proposed soil framework directive on agricultural systems in atlantic Europe : a review. Soil Use Manage 26(3):198-211

Crespo DG, Barradas AMC, Santos PV, Carneiro JPG (2004) Sustainable improvement of Mediterranean pastures. Grassland Sci Europe 9:840-842

Crowder DW, Northfield TD, Strand MR, Snyder WE (2010) Organic agriculture promotes evenness and natural pest control. Nature 466(7302):109-112

Custovic H, Tvica M (2004) Organic agriculture and soil biodiversity. Radovi Poljoprivrednog Fakulteta Univerziteta u Sarajevu 49(54(2)):143-155

Dabrowski ZT, Abanowska-Bury D (2005) Extended impacts of ecological farming: the United Kingdom experience. Nowosci Warzywnicze 41:51-64

Dahlquist RM, Whelan MP, Winowiecki L, Polidoro B, Candela S, Harvey CA, Wulfhorst JD, McDaniel PA, Bosque-Perez NA (2007) Incorporating livelihoods in biodiversity conservation : a case study of cacao agroforestry systems in Talamanca, Costa Rica. Biodivers Conserv 16(8):2311-2333

Danhardt J, Green M, Lindstrom A, Rundlof M, Smith HG (2010) Farmland as stopover habitat for migrating birds : effects of organic farming and landscape structure. Oikos 119(7):1114-1125

Darnhofer I, Lindenthal T, Bartel-Kratochvil R, Zollitsch W (2010) Conventionalisation of organic farming practices : from structural criteria towards an assessment based on organic principles ; a review. Agron Sustain Dev 30(1):67-81

Diekotter T, Wamser S, Wolters V, Birkhofer K (2010) Landscape and management effects on structure and function of soil arthropod communities in winter wheat. Agric Ecosyst Environ 137(1-2):108-112

Doring TF, Hiller A, Wehke S, Schulte G, Broll G (2003) Biotic indicators of carabid species richness on organically and conventionally managed arable

fields. Agric Ecosyst Environ 98(1/3):133-139
Dron D, Ferron P (2003) Biological diversity and agriculture: functions and stakes. Dossiers Environnement INRA (23):153-178
Dubey OP, Sharma OP (2008) Crop protection in organic agriculture : huge potential. In: Goel SC (ed) Emerging trends of researches in insect pest management and environmental safety. Muzaffarnagar: Uttar Pradesh Zoological Society, Insect Environment 8-9:17-22
Ekroos J, Hyvonen T, Tiainen J, Tiira M (2010) Responses in plant and carabid communities to farming practises in boreal landscapes. Agric Ecosyst Environ 135(4):288-293
Ekroos J, Piha M, Tiainen J (2008) Role of organic and conventional field boundaries on boreal bumblebees and butterflies. Agric Ecosyst Environ 124(3-4):155-159
Elsasser M (2000) The impact of extensive and intensive pasture systems on organic matter digestibility and forage intake. Ber Landwirtsch 78(3):437-453
Elsen Tv (2000) Species diversity as a task for organic agriculture in Europe. Agric Ecosyst Environ 77(1/2):101-109
Entz M, Hoeppner JW, Wilson L, Tenuta M, Bamford KC, Holliday N (2005) Influence of organic management with different crop rotations on selected productivity parameters in a long-term Canadian field study. In: Köpke U, Niggli U, Neuhoff D, Cornish P, Lockeretz W, Willer H (eds) Researching sustainable systems : proceedings of the First Scientific Conference of the International Society of Organic Agriculture Research (ISOFAR), held in cooperation with the International Federation of Organic Agriculture Movements (IFOAM) and the National Association for Sustainable Agriculture, Australia (NASAA), 21-23 September 2005, Adelaide, South Australia. Bonn : ISOFAR, pp 206-209
Escamilla PE, Ruiz RO, Diaz PG, Landeros SC, Platas RDE, Zamarripa CA, Gonzalez HVA (2005) The coffee agroecosystem in Mexico. Manejo Integrado de Plagas y Agroecologia (76):5-16
Escudero A, Vilajeliu M, Batllori JL, Ferragut F (2007) Effect of different pest control strategies on phytophagous and predatory mites in apple orchards of Girona (NE of Spain). Bulletin OILB/SROP 30(4):75-75
Eyre MD, Labanowska-Bury D, Avayanos JG, White R, Leifert C (2009) Ground beetles (Coleoptera, Carabidae) in an intensively managed vegetable crop landscape in eastern England. Agric Ecosyst Environ 131(3-4):340-346
Eyre MD, Leifert C (2011) Crop and field boundary influences on the activity of a wide range of beneficial invertebrate groups on a split conventional/organic farm in northern England. Bull Entomol Res 101(2):135-144
Feber RE, Bell J, Johnson PJ, Firbank LG, Macdonald DW (1998) The effects of organic farming on surface-active spider (Araneae) assemblages in wheat in southern England, UK. J Arachnol 26(2):190-202
Feber RE, Johnson PJ, Firbank LG, Hopkins A, Macdonald DW (2007) A comparison of butterfly populations on organically and conventionally managed farmland. J Zool 273(1):30-39
Feledyn-Szewczyk B (2008) The changes of biodiversity of weed flora in organic system in the years 1996-2007. J Res Appl Agric Eng 53(3):63-68
Feledyn-Szewczyk B, Duer I (2006) The comparison of the structure of weed community in winter wheat cultivated in different crop production systems using ecological indices. Fragmenta Agronomica 23(4):79-93
Fernandez DE, Cichon LI, Sanchez EE, Garrido SA, Gittins C (2008) Effect of different cover crops on the presence of arthropods in an organic apple (/i Malus domestica/ Borkh) orchard. J Sustainable Agric 32(2):197-211
Fiorelli JL, Coquil X, Gouttenoire L, Gaujour E, Bazard C, Trommenschlager JM, Mignolet C (2008) Evaluating an organic low input grassland dairy system farming on permanent pastures in eastern France (Vosges lowland). Grassland Sci Europe 13:980-982
Firth C, Cubison S, Cross J (2006) The challenges and potential benefits of perennial organic cropping systems-example of organic top fruit. Asp Appl Biol (79):97-101
Fliessbach A, Mäder P, Dubois D, Gunst L (2000) Results from a 21 year old field trial : organic farming enhances soil fertility and biodiversity. Frick : FiBL, 15 p, FiBL dossier 1/2000
Freemark KE, Kirk DA (2001) Birds on organic and conventional farms in Ontario : partitioning effects of habitat and practices on species composition and abundance. Biol Conserv 101(3):337-350
Freyer B (1997) Coefficients of durability of 317 arable ecological agriculture enterprises in Switzerland, evaluated on the basis of inspection data. SchrR Inst Org Landbau 4:103-108
Fritsche UR (2004) Bioenergy : progress for rural areas. Entwickl Ländl Raum 38(5):25-28
Frost D, Ardeshir D (2004) Monitoring the effects of the organic farming scheme in Wales : preliminary findings. In: Hopkins A (ed) Organic farming : science and practice for profitable livestock and cropping ; proceedings of the BGS/AAB/COR Conference held at the Harper Adams University College, Newport, Shropshire, UK, 20-22 April 2004. Reading: BGS, pp 23-26. BGS Occasional Symposium / BGS 37
Fuller RJ, Norton LR, Feber RE, Johnson PJ, Chamberlain DE, Joys AC, Mathews F, Stuart RC, Townsend MC, Manley WJ, Wolfe MS, Macdonald DW, Firbank LG (2005) Benefits of organic farming to biodiversity vary among taxa. Biol Lett 1(4):431-434
Gabriel D, Carver SJ, Durham H, Kunin WE, Palmer RC, Sait SM, Stagl S, Benton TG (2009) The spatial aggregation of organic farming in England and its underlying environmental correlates. J Appl Ecol 46(2):323-333
Gabriel D, Roschewitz I, Tscharntke T, Thies C (2006) Beta diversity at different spatial scales : plant communities in organic and conventional agriculture. Ecol Appl 16(5):2011-2021
Gabriel D, Sait SM, Hodgson JA, Schmutz U, Kunin WE, Benton TG (2010) Scale matters : the impact of organic farming on biodiversity at different spatial scales. Ecol Lett 13(7):858-869
Gabriel D, Tscharntke T (2007) Insect pollinated plants benefit from organic farming. Agric Ecosyst Environ 118(1-4):43-48
Gaigher R, Samways M (2010) Surface-active arthropods in organic vineyards, integrated vineyards and natural habitat in the Cape Floristic Region. J Insect Conserv 14(6):595-605
Galvan GA, Paradi I, Burger K, Baar J, Kuyper TW, Scholten OE, Kik C (2009) Molecular diversity of arbuscular mycorrhizal fungi in onion roots from organic and conventional farming systems in the Netherlands. Mycorrhiza 19(5):317-328
Garcin A, Demarle O, Soldati F (2004) Carabids, indicators of biodiversity and generalist auxilaries. Infos-Ctifl (199):42-47
Gardarin A, Tremoy M, Bretagnolle F, Chauvel B (2007) Distribution of the weed flora at the landscape scale : ecological gradient of species. Conference du COLUMA 20:305-314
Geherman V, Ellermae O (2001) Biodiversity of conventional and organic grasslands and the content of plant nutrients in soil. Transactions Estonian Agric Univ Agronomy (212):93-96
Geherman V, Viiralt R (2004) Comparison of legume-rich leys in conventional and organic farms. Transactions Estonian Agric Univ Agronomy (219):148-150
Geier U, Frieben B, Gutsche V, Köpke U (2000) Ecobalance of integrated and ecological apple cultivation in Hamburg. In: Boos M, Betz E (eds) 9. Internationaler Erfahrungsaustausch über Forschungsergebnisse zum Ökologischen Obstbau : Beiträge zur Tagung vom 01. bis 02.02.2000 an der Staatlichen Lehr- und Versuchsanstalt für Wein- und Obstbau Weinsberg (LVWO). Weinsberg : Fördergem Ökol Obstbau, pp 130-134
Geiger F, Bengtsson J, Berendse F, Weisser WW, Emmerson M, Morales MB, Ceryngier P, Liira J, Tscharntke T, Winqvist C, Eggers S, Bommarco R, Part T, Bretagnolle V, Plantegenest M, Clement LW, Dennis C, Palmer C, Onate JJ, Guerrero I, Hawro V, Aavik T, Thies C, Flohre A, Hanke S, Fischer C, Goedhart PW, Inchausti P (2010) Persistent negative effects of pesticides on biodiversity and biological control potential on European farmland. Basic Appl Ecol 11(2):97-105
Genghini M, Gellini S, Gustin M (2006) Organic and integrated agriculture : the effects on bird communities in orchard farms in northern Italy. Biodivers Conserv 15(9):3077-3094
Gibson RH, Pearce S, Morris RJ, Symondson WOC, Memmott J (2007) Plant diversity and land use under organic and conventional agriculture : a whole-farm approach. J Appl Ecol 44(4):792-803
Glemnitz M, Czimber G, Radics L, Hoffmann J (2006) Weed flora diversity and

composition in different agricultural management systems : comparative investigations in Hungary, Germany and Europe. Magyar Gyomkutatas es Technologia 7(1):83-100

Haas G, Wetterich F (2000) Optimizing agri-environmental program to reduce negative environmental impact in the Allgaeu region using life cycle assessment. Ber Landwirtsch 78(1):92-105

Haas G, Wetterich F, Kopke U (2001) Comparing intensive, extensified and organic grassland farming in southern Germany by process life cycle assessment. Agric Ecosyst Environ 83(1-2):43-53

Hallmann J, Frankenberg A, Paffrath A, Schmidt HS (2007) Occurrence and importance of plant-parasitic nematodes in organic farming in Germany. Nematology 9:869-879

Hansen B, Alre HF, Kristensen ES (2001) Approaches to assess the environmental impact of organic farming with particular regard to Denmark. Agric Ecosyst Environ 83(1/2):11-26

Hawes C, Squire GR, Hallett PD, Watson CA, Young M (2010) Arable plant communities as indicators of farming practice. Agric Ecosyst Environ 138(1-2):17-26

Hepperly PR, Douds D Jr, Seidel R (2006) The Rodale Institute Farming Systems Trial 1981 to 2005: long-term analysis of organic and conventional maize and soybean cropping systems. In: Raupp J, Pekrun C, Oltmanns M, Kopke U (eds) Long-term field experiments in organic farming. Berlin : Köster, pp 15-31, Scientific Series / ISOFAR

Hiltbrunner J, Scherrer C, Streit B, Jeanneret P, Zihlmann U, Tschachtli R (2008) Long-term weed community dynamics in Swiss organic and integrated farming systems. Weed Res 48(4):360-369

Himstedt M, van Elsen T (2006) Vegetational analyses on organic fields in middle and northern Germany. J Plant Dis Protect 20:597-604

Hodgson JA, Kunin WE, Thomas CD, Benton TG, Gabriel D (2010) Comparing organic farming and land sparing : optimizing yield and butterfly populations at a landscape scale. Ecol Lett 13(11):1358-1367

Hole DG, Perkins AJ, Wilson JD, Alexander IH, Grice F, Evans AD (2005) Does organic farming benefit biodiversity? Biol Conserv 122(1):113-130

Holland JM, Orson J, Powell W, Storkey J, Chamberlain D (2007) Managing uncropped land in order to enhance biodiversity benefits of the arable farmed landscape. Asp Appl Biol (81):255-260

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. J Appl Ecol 44(1):41-49

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, Tscharntke T (2010) How do landscape composition and configuration, organic farming and fallow strips affect the diversity of bees, wasps and their parasitoids? J Anim Ecol 79(2):491-500

Hopkins A, Feber RE(1997) Management for plant and butterfly species diversity on organically farmed grassland field margins. Grassland Sci Europe 2:69-73

Humann-Ziehank E, Ganter M (2006) Preventive animal health in small ruminants : results of an interdisciplinary workshop ; part 3: Trace elements. Tieraerztl Umsch 61(3):148

Hutton SA, Giller PS (2003) The effects of the intensification of agriculture on northern temperate dung beetle communities. J Appl Ecol 40(6):994-1007

Hyvonen T (2007) Can conversion to organic farming restore the species composition of arable weed communities? Biol Conserv 137(3):382-390

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. Agric Ecosyst Environ 97(1-3):131-149

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. Agric Ecosyst Environ 98(1/3):141-151

Jose-Maria L, Armengot L, Blanco-Moreno JM, Bassa M, Sans FX (2010) Effects of agricultural intensification on plant diversity in Mediterranean dryland cereal fields. J Appl Ecol 47(4):832-840

Kaar B, Freyer B (2008) Weed species diversity and cover-abundance in organic and conventional winter cereal fields and 15 years ago. In: Neuhoff D, Halsberg N, Alföldi T (eds) Cultivating the Future Based on Science : vol 2: Livestock, socio-economy and cross disciplinary research in organic agriculture ; proceedings of the Second Scientific Conference of the International Society of Organic Agriculture Research (ISOFAR), held at the 16th IFOAM Organic World Congress in Cooperation with the International Federation of Organic Agriculture Movements (IFOAM) and the Consorzio ModenaBio, 18-20 June 2008 in Modena, Italy. Bonn : ISOFAR, pp 686-689

Kairo MTK (2005) Hunger, poverty, and protection of biodiversity : opportunities and challenges for biological control. In: Hoddle MS (ed) Second International Symposium on Biological Control of Arthropods, Davos, Switzerland, 12-16 September, 2005. Morgantown : USDA, pp 228-236,USDA Forest Service Publication FHTET-2005-08

Kasperczyk N, Knickel K (2006) Environmental impacts of organic farming. In: Kristiansen P, Taji A, Reganold J (eds) Organic agriculture : a global perspective. Collingwood : CSIRO, pp 259-294

Kirchmann H, Thorvaldsson G (2000) Challenging targets for future agriculture. Eur J Agron 12(3-4):145-161

Kragten S, de Snoo GR (2007) Nest success of Lapwings Vanellus vanellus on organic and conventional arable farms in the Netherlands. Ibis 149(4):742-749

Kragten S, de Snoo GR (2008) Field-breeding birds on organic and conventional arable farms in the Netherlands. Agric Ecosyst Environ 126(3-4):270-274

Krawczyk R (2009) Comparison of segetal flora of blue lupin (/i Lupinus angustifolius/ L) in organic and conventional cultivation systems. Progr Plant Protect 49(4):1799-1803

Krawczyk R, Matysiak K, Kierzek R, Kaczmarek S, Horoszkiewicz-Janka J (2010) The effect of weed infestation of winter wheat within conversion to organic farming. J Res Applicat Agric Eng 55(3):195-199

Lal R (2005) Soil carbon sequestration for sustaining agricultural production and improving the environment with particular reference to Brazil. J Sustain Agric 26(4):23-42

Lamine C, Bellon S (2009) Conversion to organic farming: a multidimensional research object at the crossroads of agricultural and social sciences : a review. Agron Sustain Dev 29(1):97-112

Langer V, Frederiksen P (2008) Diversity as a key concept for organic agriculture. In: Neuhoff D, Halsberg N, Alföldi T (eds) Cultivating the Future Based on Science : vol 2: Livestock, socio-economy and cross disciplinary research in organic agriculture ; proceedings of the Second Scientific Conference of the International Society of Organic Agriculture Research (ISOFAR), held at the 16th IFOAM Organic World Congress in Cooperation with the International Federation of Organic Agriculture Movements (IFLazzerini G, Camera A, Benedettelli S, Vazzana C (2007) The role of field margins in agro-biodiversity management at the farm level. Ital J Agron 2(2):127-134

Leake AR (2002) Biodiversity in different farming systems. In: Pests and diseases 2002 : the BCPC conference ; conference proceedings ; proceedings of an international conference held at the Brighton Hilton Metropole Hotel, Brighton, UK, 18-21 November 2002. Farnham : British Crop Protection Council, pp 949-956

Leifert C, Rembiakowska E, Nielson JH, Cooper JM, Butler G, Lueck L (2007) Effects of organic and ‚low input' production methods on food quality and safety. In: Niggli U (ed) Improving sustainability in organic and low input food production systems : proceedings of the 3rd International Congress of the European Integrated Project „Quality Low Input Food" (QLIF), University of Hohenheim, Germany, 20-23 March, 2007. Frick : Research Institute of Organic Agriculture (FiBL), pp 75-95

Letourneau DK, Bothwell SG (2008) Comparison of organic and conventional farms : challenging ecologists to make biodiversity functional. Front Ecol Environ 6(8):430-438

Letourneau DK, Goldstein B (2001) Pest damage and arthropod community structure in organic vs. conventional tomato production in California. J Appl Ecol 38(3):557-570

Link M (2004) Biodiversity changes in Central Poland. Spiegel Forsch 21(1/2):34-41

Loidl F (2007) The contribution of agriculture to biodiversity. In: Biodiversitat in Österreich : welchen Beitrag leistet die Land- und Forstwirtschaft in Österreich ; 28. Juni 2007. Irdning : HBLFA, pp 1-4

Lotter DW (2003) Organic agriculture. J Sustain Agric 21(4):59-128

Lotti C, Resta P, Pavan S, Marzano CF, Marcotrigiano AR, Zonno V, Ricciardi L (2008) Usefulness of genetic resources in organic farming: case studies relative to the 'SIAB' project. Agronomski Glasnik 70(4):355-363

Lundkvist A, Salomonsson L, Karlsson L, Gustavssone AMD (2008) Effects of organic farming on weed flora composition in a long term perspective. Eur J Agron 28(4):570-578

Lynch D (2009) Environmental impacts of organic agriculture : a Canadian perspective. Can J Plant Sci 89(4):621-628

MacDonald DW, Tattersall FH, Service KM, Firbank LG, Feber RE (2007) Mammals, agri-environment schemes and set-aside - what are the putative benefits? Mammal Rev 37(4):259-277

Macfadyen S, Gibson R, Raso L, Sint D, Traugott M, Memmott J (2009) Parasitoid control of aphids in organic and conventional farming systems. Agric Ecosyst Environ 133(1-2):14-18

Mader P, Fliessbach A, Dubois D, Gunst L, Fried P, Niggli U (2002) Soil fertility and biodiversity in organic farming. Science 296(5573):1694-1697

Manhoudt AGE, Snoo GRd (2003) A quantitative survey of semi-natural habitats on Dutch arable farms. Agric Ecosyst Environ 97(1/3):235-240

Manhoudt AGE, Visser AJ, de Snoo GR (2007) Management regimes and farming practices enhancing plant species richness on ditch banks. Agric Ecosyst Environ 119(3-4):353-358

Mansvelt JDv, Lubbe MJvd (1999) Checklist for sustainable landscape management : final report of the EU concerted action AIR-CT93-1210 ; the landscape and nature production capacity of organic/sustainable types of agriculture. Amsterdam : Elsevier, 181 p

Matotan Z, Samobor V, Erhatic R (2008) Preserving biodiversity of cultivated vegetable species in Croatia. Agronomski Glasnik 70(6):527-541

Matthes HD, Kahl M, Mohring H, Pastushenko V, Micklich D (2002) Influence of keeping of farm animals on biodiversity of grassland and solution of opposition between land use and requirements of nature and species protection. Angewandte Wissenschaft 494:136-146

Mattsson B (1999) Environmental Life Cycle Assessment (LCA) of agricultural food production. Uppsala : SLU/Repro, Acta Univ Agric Sueciae : Agraria 187

Mayer F, Heinz S, Kuhn G (2008) Effects of agri-environment schemes on plant diversity in Bavarian grasslands. Community Ecol 9(2):229-236

Mazzoncini M, Canali S, Giovannetti M, Castagnoli M, Tittarelli F, Antichi D, Nannelli R, Cristani C, Barberi P (2010) Comparison of organic and conventional stockless arable systems : a multidisciplinary approach to soil quality evaluation. Appl Soil Ecol 44(2):124-132

McKenzie AJ, Whittingham MJ (2009) Why are birds more abundant on organic farms? J Food Agric Environ 7(2):807-814

McLaughlin A, Mineau P (1995) The impact of agricultural practices on biodiversity. Agric Ecosyst Environ 55(3):201-212

Mena Y, Nahed J, Ruiz FA, Castel JM, Ligero M (2009) Proximity to the organic model of dairy goat systems in the Andalusian mountains (Spain). Trop Subtrop Agroecosyst 11(1):69-73

Mesleard F, Garnero S, Beck N, Rosecchi E (2005) Uselessness and indirect negative effects of an insecticide on rice field invertebrates. C R Biol 328(10/11):955-962

Meyling NV, Navntoft S, Eilenberg J (2010) Organic farming systems benefit biodiversity and natural pest regulation in white cabbage. ICROFS News (1):4-5

Migliorini P, Vazzana C (2006) Evaluation of sustainability : results from a long term experimental arable systems in Tuscany. Asp Appl Biol (79):175-179

Migliorini P, Vazzana C (2007) Biodiversity indicators for sustainability evaluation of conventional and organic agro-ecosystems. Ital J Agron 2(2):105-110

Minarro M, Espadaler X, Melero VX, Suarez-Alvarez V (2009) Organic versus conventional management in an apple orchard: effects of fertilization and tree-row management on ground-dwelling predaceous arthropods. Agr For Entomol 11(2):133-142

Mocali S, Benedetti A (2008) Microbial diversity of soil under organic management. In: Marinari S, Caporali F (eds) Soil carbon sequestration under organic farming in the mediterranean environment. Trivandrum : Transworld Res Network, pp 97-111

Moller H, Wearing A, Perley C, Rosin C, Blackwell G, Campbell H, Hunt L, Fairweather J, Manhire J, Benge J, Emanuelsson M, Steven D (2007) Biodiversity on kiwifruit orchards : the importance of shelterbelts. Acta Hortic (Wageningen) 753(2):609-618

Mondelaers K, Aertsens J, Huylenbroeck Gv (2009) A meta-analysis of the differences in environmental impacts between organic and conventional farming. Br Food J 111(10):1098-1119

Moonen C, Rodas NC, Barberi P, Petacchi R (2006) Field margin structure and vegetation composition effects on beneficial insect diversity at farm scale : a case study on an organic farm near Pisa (Italy). Bulletin OILB/SROP 29(6):77-80

Mulder C, De Zwart D, Van Wijnen HJ, Schouten AJ, Breure AM (2003) Observational and simulated evidence of ecological shifts within the soil nematode community of agroecosystems under conventional and organic farming. Funct Ecol 17(4):516-525

Muller-Lindenlauf M, Deittert C, Kopke U (2010) Assessment of environmental effects, animal welfare and milk quality among organic dairy farms. Livest Sci 128(1-3):140-148

Nakamura Y, Fujikawa T, Fujita M (2000) Long-term changes in the soil properties and the soil macrofauna and mesofauna of an agricultural field in northern Japan during transition from chemical-intensive farming to nature farming. J Crop Prod 3(1):63-75

Nemecek T, Dubois D, Huguenin-Elie O, Gaillard G (2006) Life cycle assessment of Swiss organic farming systems. Asp Appl Biol (79):15-18

Nemecek T, Dubois D, Huguenin-Elie O, Gaillard G (2011a) Life cycle assessment of Swiss farming systems : I. Integrated and organic farming. Agric Syst 104(3):217-232

Nemecek T, Huguenin-Elie O, Dubois D, Gaillard G, Schaller B, Chervet A (2011b) Life cycle assessment of Swiss farming systems : II. Extensive and intensive production. Agric Syst 104(3):233-245

Nicholls CI, Altieri MA, Ponti L (2008) Enhancing plant diversity for improved insect pest management in northern California organic vineyards. Acta Hortic (Wageningen) 785:263-278

Noe E, Halberg N, Reddersen J (2005) Indicators of biodiversity and conservational wildlife quality on danish organic farms for use in farm management : a multidisciplinary approach to indicator development and testing. J Agr Environ Ethic 18(4):383-414

Norton L, Johnson P, Joys A, Stuart R, Chamberlain D, Feber R, Firbank L, Manley W, Wolfe M, Hart B, Mathews F, MacDonald D, Fuller RJ (2009) Consequences of organic and non-organic farming practices for field, farm and landscape complexity. Agric Ecosyst Environ 129(1-3):221-227

Norton LR, Fuller RJ, Feber RE, Johnson PJ, Chamberlain DE, Joys AC, Mathews F, Stuart RC, Townsend MC, Manley WJ, Wolfe MS, MacDonald DW, Firbank LG (2006) The benefits of organic farming for biodiversity. Asp Appl Biol (79):191-194

Oberg S (2007) Diversity of spiders after spring sowing - influence of farming system and habitat type. J Appl Entomol 131(8):524-531

Oberg S (2009) Influence of landscape structure and farming practice on body condition and fecundity of wolf spiders. Basic Appl Ecol 10(7):614-621

Oehl F, Sieverding E, Ineichen K, Mader P, Wiemken A, Boller T (2009) Distinct sporulation dynamics of arbuscular mycorrhizal fungal communities from different agroecosystems in long-term microcosms. Agric Ecosyst Environ 134(3-4):257-268

Oehl F, Sieverding E, Mader P, Dubois D, Ineichen K, Boller T, Wiemken A (2004) Impact of long-term conventional and organic farming on the diversity of arbuscular mycorrhizal fungi. Oecologia 138(4):574-583

Olsson GA, Rnningen K (1999) Environmental values in traditional agricultural landscapes in Norway. Landbruksökonomisk Forum 16(4):27-38

Ondine FC, Jean C, Romain J (2009) Effects of organic and soil conservation management on specialist bird species. Agric Ecosyst Environ 129(1-3):140-143

Orr CH, James A, Leifert C, Cooper JM, Cummings SP (2011) Diversity and activity of free-living nitrogen-fixing bacteria and total bacteria in organic and conventionally managed soils. Appl Environ Microb 77(3):911-919

Ottonetti L, Tucci L, Frizzi F, Chelazzi G, Santini G (2010) Changes in ground-foraging ant assemblages along a disturbance gradient in a tropical agricultural landscape. Ethol Ecol Evol 22(1):73-86

Pacini C, Wossink A, Giesen G, Vazzana C, Huirne R (2003) Evaluation of sustainability of organic, integrated and conventional farming systems : a farm and field-scale analysis. Agric Ecosyst Environ 95(1):273-288

Paoletti MG, D'Inca A, Tonin E, Tonon S, Migliorini C, Petruzzelli G, Pezzarossa B, Gomiero T, Sommaggio D (2010) Soil invertebrates as bio-indicators in a natural area converted from agricultural use : the case study of Vallevecchia-Lugugnana in North-Eastern Italy. J Sustain Agric 34(1):38-56

Parfitt RL, Yeates GW, Ross DJ, Mackay AD, Budding PJ (2005) Relationships between soil biota, nitrogen and phosphorus availability, and pasture growth under organic and conventional management. Appl Soil Ecol 28(1):1-13

Parra-Lopez C, Calatrava-Requena J, De-Haro-Gimenez T (2007) A multi-criteria evaluation of the environmental performances of conventional, organic and integrated olive-growing systems in the south of Spain based on experts' knowledge. Renew Agr Food Syst 22(3):189-203

Pelosi C, Bertrand M, Roger-Estrade J (2009) Earthworm community in conventional, organic and direct seeding with living mulch cropping systems. Agron Sustain Dev 29(2):287-295

Peredo SF, Parada E, Vega M, Barrera CP (2009) Edaphic mesofauna community structure in organic and conventional management of cranberry (Vaccinium Sp.) plantations : an agroecological approach. R C Suelo Nutr Veg 9(3):236-244

Peres G, Piron D, Bellido A, Goater C, Cluzeau D (2008) Earthworms used as indicators of agricultural managements. Fresenius Envir Bull 17(8b):1181-1189

Petersen S, Axelsen JA, Tybirk K, Aude E, Vestergaard P (2006) Effects of organic farming on field boundary vegetation in Denmark. Agric Ecosyst Environ 113(1-4):302-306

Peverieri GS, Simoni S, Goggioli D, Liguori M, Castagnoli M (2009) Effects of variety and management practices on mite species diversity in Italian vineyards. Bull Insectol 62(1):53-60

Pfiffner L (1996) Which farming methods enhance faunal diversity? Agrarforsch 3(11/12):527-530

Philpott SM, Bichier P, Rice R, Greenberg R (2007) Field-testing ecological and economic benefits of coffee certification programs. Conserv Biol 21(4):975-985

Pimentel D, Hepperly P, Hanson J, Douds D, Seidel R (2005) Environmental, energetic, and economic comparisons of organic and conventional farming systems. Bioscience 55(7):573-582

Pimpini F, Gianquinto G, Sambo P (2005) Organic vegetable production: evolution, base principles and quality of products. Italus Hortus 12(4):31-44

Poetsch EM, Blaschka A, Resch R (2005) Impact of different management systems and location parameters on floristic diversity of mountainous grassland. Grassland Sci Europe 10:315-318

Porter JR, Petersen EH (1997) Danish agriculture and its sustainability : a profile. Ambio 26(7):462-465

Postma-Blaauw MB, de Goede RGM, Bloem J, Faber JH, Brussaard L (2010) Soil biota community structure and abundance under agricultural intensification and extensification. Ecology 91(2):460-473

Potts D (2002) Arable farming : the options for game and wildlife. J Royal Agric Soc England 163:72-82

Poveda K, Steffan-Dewenter I, Scheu S, Tscharntke T (2006) Belowground effects of organic and conventional farming on aboveground plant-herbivore and plant-pathogen interactions. Agric Ecosyst Environ 113(1-4):162-167

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. Agric Ecosyst Environ 108(2):165-174

Rahmann G, Paulsen HM, Hötker H, Jeromin K, Schrader S, Haneklaus S, Schnug E (2006) Contribution of organic farming to conserving and improving biodiversity in Germany avi-fauna as an example. Asp Appl Biol (79):187-190

Rana N, Rana SA, Khan HA, Sohail A (2010) Assessment of possible threats to soil macro-invertebrates diversity in wheat fields from high input farming. Int J Agric Biol 12(6):801-808

Reeve JR, Schadt CW, Carpenter-Boggs L, Kang S, Zhou JZ, Reganold JP (2010) Effects of soil type and farm management on soil ecological functional genes and microbial activities. Isme J 4(9):1099-1107

Reganold JP, Glover JD, Andrews PK, Hinman HR (2001) Sustainability of three apple production systems. Nature 410(6831):926-930

Ricard JM, Garcin A, Damian-Picollet S, Bousquet L (2007) Soil arthropod biodiversity in olive orchards : seeking predators for the olive fly. Infos-Ctifl (229):25-30

Romero A, Chamorro L, Sans FX (2005) Weed vegetation of organic and conventional dryland cereal fields in the Mediterranean region. In: Köpke U, Niggli U, Neuhoff D, Cornish P, Lockeretz W, Willer H (eds) Researching sustainable systems : first Scientific Conference of the International Society of Organic Agriculture Research (ISOFAR), 21-23 September, 2005, Adelaide, South Australia ; proceedings. Bonn : ISOFAR, pp 127-130

Ronchi B, Nardone A (2003) Contribution of organic farming to increase sustainability of Mediterranean small ruminants livestock systems. Livest Prod Sci 80(1-2):17-31

Roschewitz I, Gabriel D, Tscharntke T, Thies C (2005a) The effects of landscape complexity on arable weed species diversity in organic and conventional farming. J Appl Ecol 42(5):873-882

Roschewitz I, Hucker M, Tscharntke T, Thies C (2005b) The influence of landscape context and farming practices on parasitism of cereal aphids. Agric Ecosyst Environ 108(3):218-227

Rowarth JS (2008) Agricultural intensification protects global biodiversity. N Z J Agric Res 51(4):451-455

Rundlof M, Bengtsson J, Smith HG (2008a) Local and landscape effects of organic farming on butterfly species richness and abundance. J Appl Ecol 45(3):813-820

Rundlof M, Edlund M, Smith HG (2010) Organic farming at local and landscape scales benefits plant diversity. ECO 33(3):514-522

Rundlof M, Nilsson H, Smith HG (2008b) Interacting effects of farming practice and landscape context on bumblebees. Biol Conserv 141(2):417-426

Rundlof M, Smith HG (2006) The effect of organic farming on butterfly diversity depends on landscape context. J Appl Ecol 43(6):1121-1127

Ryan MR, Mortensen DA, Bastiaans L, Teasdale JR, Mirsky SB, Curran WS, Seidel R, Wilson DO, Hepperly PR (2010) Elucidating the apparent maize tolerance to weed competition in long-term organically managed systems. Weed Res 50(1):25-36

Rydberg NT, Milberg P (2000) A survey of weeds in organic farming in Sweden. Biol Agric Hort 18(2):175-185

Salonen J, Hyvonen T, Jalli H (2001a) Weed flora in organically grown spring cereals in Finland. Agric Food Sci Finland 10(3):231-242

Salonen J, Hyvonen T, Jalli H (2001b) Weeds in spring cereal fields in Finland - a third survey. Agric Food Sci Finland 10(4):347-364

Salonen J, Hyvonen T, Jalli H (2005) Weed flora and weed management of field peas in Finland. Agric Food Sci 14(2):189-201

Sanchez-Moreno S, Smukler S, Ferris H, O'Geen AT, Jackson LE (2008) Nematode diversity, food web condition, and chemical and physical properties in different soil habitats of an organic farm. Biol Fertil Soils 44(5):727-744

Santos SAP, Pereira JA, Torres LM, Nogueira AJA (2007) Evaluation of the effects, on canopy arthropods, of two agricultural management systems to control pests in olive groves from north-east of Portugal. Chemosphere 67(1):131-139

Sarapatka B, Cizkova S (2007) Grassland diversity in relation to subsidies. In: Ekologia Travneho Porastu VII, Banska Bystrica, Slovakia, 28-30 November 2007. Banska Bystrica : Vyskumny Ustav Travnych Porastov a Horskeho Pol'nohospodarstva, pp 114-117

Schader C, Pfiffner L, Schlatter C, Stolze M (2008) Uptake of agri-environmental measures on organic and conventional farms in Switzerland. Agrarforschung 15(10):506-511

Schmid K, Kesper C, Caloz G (2001) Ecology at Swiss vegetable farms. Agrarforschung 8(4):158-162

Schmidt MH, Roschewitz I, Thies C, Tscharntke T (2005) Differential effects of landscape and management on diversity and density of ground-dwelling farmland spiders. J Appl Ecol 42(2):281-287

Schnug E, Haneklaus S, Walker KC, Walker RL, Rahmann G (2008) Mögliche Synergie-Effekte zwischen Landwirtschaft und Naturschutz unter den Bedingungen des Klimawandels. Landbauforsch 58(4):267-270

Schrader S, Kiehne J, Anderson T-H, Paulsen HM, Rahmann G (2006) Development of collembolans after conversion towards organic farming. Asp Appl Biol (79):181-185

Scialabba NEH, Grandi C, Henatsch C (2003) Organic agriculture and genetic resources for food and agriculture. In: Biodiversity and the ecosystem approach in agriculture, forestry and fisheries : [satellite event on the occasion of the ninth regular session of the Commission on Genetic REsources for Food and Agriculture; Rome 12-13 October 2002 ; proceedings. Rome : FAO, pp 72-99

Scott J (2000) Wheat varieties for organic production and processing in New Brunswick, Canada. In: Almekinders C, Boef W de (eds) Encouraging diversity : the conservation and development of plant genetic resources. London : Intermediate Technol Publ, pp 85-89

Shannon D, Sen AM, Johnson DB (2002) A comparative study of the microbiology of soils managed under organic and conventional regimes. Soil Use Manage 18:274-283

Shiva V (1997) Biodiversity totalitarianism : IPRs as seed monopolies. Econ Polit Weekly 32(41):2582-2585

Siddiqui MJI, Rana SA, Naureen R, Anjum S (2005) Biodiversity of insects in high and low input wheat (/i Triticum aestivum/) fields agroecosystems of Punjab. Pakistan Entomologist 27(2):25-28

Singh DRR (2005a) Study of adoption of new technologies for furthering biodiversity conservation commerce and trade of medicinal and aromatic plants of India. Indian Forester 131(3):308-315

Singh HP, Singh BP, Gulia SK (2007) Research and application imperatives for the sustainable production of phytomedicines. Acta Hortic (756):25-31

Singh KA (2005b) Impact of forage resource development on sustained land use and environment in north eastern hills region of India. Range Manage Agroforestry 26(1):58-70

Singh RK, Satapathy KK (2007) Environment-friendly indigenous farming systems of North East Hill Region. Environ Ecol 25S(Special 4):1170-1173

Smis MJ, Meijerink G (2006) Contrasting interpretations of sSmith HG, 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

Smukler SM, Jackson LE, Moreno SS, Fonte SJ, Ferris H, Klonsky K, O'Geen AT, Scow KM, Al-Cordova-Kreylos AL (2008) Enhancing biodiversity and multifunctionality of an organic farmscape in California's Central Valley. In: Neuhoff D, Halsberg N, Alföldi T (eds) Cultivating the Future Based on Science : vol 2: Livestock, socio-economy and cross disciplinary research in organic agriculture ; proceedings of the Second Scientific Conference of the International Society of Organic Agriculture Research (ISOFAR), held at the 16th IFOAM Organic World Congress in Cooperation with the International Federation of Organic Agriculture Movements (IFOAM) and the Consorzio ModenaBio, 18-20 June 2008 in Modena, Italy. Bonn : ISOFAR, pp 654-657

Smukler SM, Sanchez-Moreno S, Fonte SJ, Ferris H, Klonsky K, O'Geen AT, Scow KM, Steenwerth KL, Jackson LE (2010) Biodiversity and multiple ecosystem functions in an organic farmscape. Agric Ecosyst Environ 139(1-2):80-97

Snapp SS, Gentry LE, Harwood R (2010) Management intensity - not biodiversity - the driver of ecosystem services in a long-term row crop experiment. Agric Ecosyst Environ 138(3-4):242-248

Somarriba E, Harvey CA (2003) How to integrate sustainable production and conservation of biodiversity in indigenous organic cocoa plantations? Agroforesteria en las Americas 10(37/38):12-17

Somarriba E, Trivelato M, Villalobos M, Suarez A, Benavides P, Moran K, Orozco L, Lopez A (2003) Diagnosis of agroforestry in indigenous Bribri and Cabecar small organic cacao farms in Talamanca, Costa Rica. Agroforesteria en las Americas 10(37/38):24-30

Soussana JF, Duru M (2007) Grassland science in Europe facing new challenges : biodiversity and global environmental change. CAB Rev 2(002):11

Stein-Bachinger K, Fuchs S (2008) Organic farming and biodiversity - how to create a viable farm business including conservation issues. In: Neuhoff D, Halsberg N, Alföldi T (eds) Cultivating the Future Based on Science : vol 2: Livestock, socio-economy and cross disciplinary research in organic agriculture ; proceedings of the Second Scientific Conference of the International Society of Organic Agriculture Research (ISOFAR), held at the 16th IFOAM Organic World Congress in Cooperation with the International Federation of Organic Agriculture Movements (IFOAM) and the Consorzio ModenaBio, 18-20 June 2008 in Modena, Italy. Bonn : ISOFAR, pp 666-669

Stein-Bachinger K, Zander P, Schobert H, Frielinghaus H (2005) New ways of increasing biodiversity on organic farms and their effects on profitability : the Nature Conservation Farm Brodowin. In: Köpke U, Niggli U, Neuhoff D, Cornish P, Lockeretz W, Willer H (eds) Researching sustainable systems : first Scientific Conference of the International Society of Organic Agriculture Research (ISOFAR), 21-23 September, 2005, Adelaide, South Australia ; proceedings. Bonn : ISOFAR, pp 468-471

Steiner RS, Pohl C (2009) Is organic farming reflected in the landscape? A comparison of the effects of different farming techniques on rural landscapes. Gaia 18(1):41-48

Stockdale EA, Watson CA (2009) Biological indicators of soil quality in organic farming systems. Renewable Agric Food Syst 24(4):308-318

Strasser F, Ryffel T (2010) Biodiverser Biobetrieb am Stadtrand. ART-SchriftenR (14):59-63

Subhasis M, Datta KK, Hore DK, Suchitra M (2008) Biodiversity and organic agriculture : opportunities and challenges for the north-east region of India and a model for the principles involved. Outlook Agric 37(2):87-94

Suthar S (2009) Earthworm communities a bioindicator of arable land management practices : a case study in semiarid region of India. Ecol Indicators 9(3):588-594

Taube F, Kelm M, Loges R, Wachendorf M (2006) Resource efficiency as a regulation variable for the promotion of sustainable production systems : are there priority areas for organic farming? Ber Landwirtsch 84(1):73-105

Taylor ME, Morecroft MD (2009) Effects of agri-environment schemes in a long-term ecological time series. Agric Ecosyst Environ 130(1-2):9-15

Tilak KVBR, Ranganayaki N, Pal KK, De R, Saxena AK, Nautiyal CS, Mittal S, Tripathi AK, Johri BN (2005) Diversity of plant growth and soil health supporting bacteria. Curr Sci India 89(1):136-150

Toth Z, Baldi A (2006) The impact of organic farming on biodiversity. Termeszetvedelmi Kozlemenyek (12):17-33

Tronel C, Codarin S (2010) Organically managed orchards : choice of apple varieties. Infos-Ctifl (264):22-25

Tsiafouli MA, Argyropoulou MD, Stamou GP, Sgardelis SP (2006) Soil nematode biodiversity in organic and conventional agroecosystems of Northern Greece. Russ J Nematol 14(2):159-169

Tu C, Louws FJ, Creamer NG, Mueller JP, Brownie C, Fager K, Bell M, Hu SJ (2006) Responses of soil microbial biomass and N availability to transition strategies from conventional to organic farming systems. Agric Ecosyst Environ 113(1-4):206-215

Turner RJ (2004) Changes in abundance and diversity of the weed seedbank in an organic field-scale vegetable system : from conversion through the first course of a rotation. In: Hopkins A (ed) Organic farming : science and practice for profitable livestock and cropping ; proceedings of the BGS/AAB/COR Conference, held at the Harper Adams University College, Newport, Shropshire, UK, 20-22 April 2004. Reading : British Grassland Society, pp 240-243, Occasional Symposium / BGS 37

Tybirk K, Alroe HF, Frederiksen P (2004) Nature quality in organic farming : a conceptual analysis of considerations and criteria in a European context. J Agric Environ Ethics 17(3):249-274

Tybirk K, Fredshavn J (2003) Nature quality in organic farming - concept and preliminary results. DJF Rapport Markbrug (89):189-198

Tyser L, Novakova K, Hamouz P, Necasova M (2008) Species diversity of weed communities in conventional and organic farming systems in the Czech Republic. J Plant Dis Protect 115:291-295

Ulber L, Steinmann HH, Klimek S, Isselstein J (2009) An on-farm approach to investigate the impact of diversified crop rotations on weed species richness and composition in winter wheat. Weed Res 49(5):534-543

Vaarst M (2010) Organic farming as a development strategy : who are interested and who are not? J Sustain Dev 3(1):38-50

van der Gast CJ, Gosling P, Tiwari B, Bending GD (2011) Spatial scaling of arbuscular mycorrhizal fungal diversity is affected by farming practice. Environ Microbiol 13(1):241-249 van Diepeningen AD, de Vos OJ, Korthals GW, van Bruggen AHC (2006) Effects of organic versus conventional management on chemical and biological parameters in agricultural soils. Appl Soil Ecol 31(1-2):120-135

Vandana, S. (2000). In situ conservation of agricultural biodiversity and organic farming - the basis for future food security. Zurich, vdf Hochschulverlag AG an der ETH Zurich.

Verbruggen E, Roling WF, Gamper HA, Kowalchuk GA, Verhoef HA, van der Heijden MG (2010) Positive effects of organic farming on below-ground mutualists : large-scale comparison of mycorrhizal fungal communities in agricultural soils. New Phytol 186(4):968-979

Viaux P, Rameil V (2004) Arthropods in arable farms. Phytoma (570):8-11

Vijayalakshmi K, Arumugasamy S (2004) Seed keepers : organic farming and indigenous seed conservation experiences from Tamil Nadu, India. In: 6th IFOAM-Asia Scientific Conference, Yangpyung, Korea, 7-11 September, 2004: "Benign environment and safe food". Yangpyung : Research Institute of Organic Agriculture, pp 76-86

Vogl CR, Vogl-Lukasser B (2003) Tradition, dynamics and sustainability of plant species composition and management in homegardens on organic and non-organic small scale farms in Alpine Eastern Tyrol, Austria. Biol Agric Hortic 21(4):349-366

Wander MM, Hedrick DS, Kaufman D, Traina SJ, Stinner BR, Kehrmeyer SR, White DC (1995) The functional significance of the microbial biomass in organic and conventionally managed soils. Plant Soil 170(1):87-97

Wang C, Wang G, Wan S, Qin P (2007) Effects of organic and conventional farming systems on farmland biodiversity. J Ecol Rural Environ 23(1):75-80

Wang S, Yuan W, Li W, Yang L (2009) A plan for developing the ecological agricultural zone of the Changjiang farm. Acta Agric Shanghai 25(2):141-144

Watson CA, Chamberlain DE, Norton LR, Fuller RJ, Atkinson CJ, Fowler SM, McCracken DI, Wolfe MS, Walker RL (2006) Can organic farming deliver natural heritage goals in the UK uplands? Asp Appl Biol (79):5-8

Watson CA, Walker RL, Stockdale EA (2008) Research in organic production systems - past, present and future. J Agr Sci 146:1-19

Weibull AC (2002) Higher biodiversity in heterogeneous landscapes. Entomol Tidskr 123(4):163-165

Weibull AC (2002) Diversity in the agricultural landscape : species richness and composition in relation to farm management, landscape structure and habitat. Uppsala : Sveriges Lantbruksuniv, 43, 69 p, Acta universitatis agriculturae sueciae : agraria 326

Weibull AC, Bengtsson J, Nohlgren E (2000) Diversity of butterflies in the agricultural landscape : the role of farming system and landscape heterogeneity. ECO 23(6):743-750

Weibull AC, Ostman O (2003) Species composition in agroecosystems : the effect of landscape, habitat, and farm management. Basic Appl Ecol 4(4):349-361

Wickramasinghe LP, Harris S, Jones G, Jennings NV (2004) Abundance and species richness of nocturnal insects on organic and conventional farms : effects of agricultural intensification on bat foraging. Conserv Biol 18(5):1283-1292

Wickramasinghe LP, Harris S, Jones G, Vaughan N (2003) Bat activity and species richness on organic and conventional farms : impact of agricultural intensification. J Appl Ecol 40(6):984-993

Wolfe MS (2002) The role of functional biodiversity in managing pests and diseases in organic production systems. In: Pests and diseases 2002 : the BCPC conference ; proceedings of an international conference held at the Brighton Hilton Metropole Hotel, Brighton, UK, 18-21 November 2002. Farnham : British Crop Protection Council, pp 531-538

Wolff P, Hethke M, Hammer K (2002) History of 100 years of the Witzenhausen greenhouses for useful tropical plants - from a colonial plant collection towards a research and education unit. Tropenlandwirt 74:64

Wortman SE, Lindquist JL, Haar MJ, Francis CA (2010) Increased weed diversity, density and above-ground biomass in long-term organic crop rotations. Renewable Agric Food Syst 25(4):281-295

Wyss E, Pfiffner L (2008) Biodiversity in organic horticulture - an indicator for sustainability and a tool for pest management. Acta Hortic (Wageningen) (767):75-80

Xie B, Wang X, Ding Z, Yang Y (2003) Critical impact assessment of organic agriculture. J Agric Environ Ethics 16(3):297-311

Younie D, Baars T (2005) Organic grassland : principles, practices and potential. In: Reynolds SG, Frame J (eds) Grasslands : developments,opportunities, perspectives. Enfield: Science Publ, pp 207-232

Yuan W, Liu H, Zhang S, Li W (2010) Evaluation of communities of insect pests and natural enemies in organic rice fields of Changjiang Farm. Acta Agric Shanghai 26(2):132-136

Zalazar L, Salvo A (2007) Entomofauna associated to horticultural crops under organic and conventional practices in Cordoba, Argentina. Neotrop Entomol 36(5):765-773

Zanen M, Bokhorst JG, Koopmans CJ (2008) Soil fertility and biodiversity effects from organic amendments in organic farming. In: Neuhoff D, Halsberg N, Alföldi T (eds) Cultivating the Future Based on Science : vol 1: Organic crop production ; proceedings of the Second Scientific Conference of the International Society of Organic Agriculture Research (ISOFAR), held at the 16th IFOAM Organic World Congress in Cooperation with the International Federation of Organic Agriculture Movements (IFOAM) and the Consorzio ModenaBio, 18-20 June 2008 in Modena, Italy. Bonn : ISOFAR, pp 94-97

Zhong P, Liang G, Zeng L (2005) Biodiversity of major natural enemies in organic farming rice fields. Chinese J Biol Control 21(3):155-158