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Organic Agriculture and Biodiversity

Dossier 2

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Author: Sue Stolton

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[1] Sue Stolton, Equilibrium, 23 Bath Buildings, Bristol BS6 5PT, UK. Tel/Fax: +44-117-942-8674
Email: Equilibrium@compuserve.com, www.EquilibriumConsultants.com

CONTENT

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Pictures

Bumblebee on water avens – G.T. Klosowscy

Organic farm in Southern Brazil

Alley cropping in Rwanda

Executive Summary

The 2000 IUCN *Red List* of threatened species of the world highlights habitat loss as the main threat to biodiversity, with agricultural activities affecting 70 per cent of all threatened bird species and 49 per cent of all plant species. However, despite agriculture being responsible for such well-documented losses in biodiversity, it can also provide a tool for biodiversity conservation if policies and approaches, which combine agricultural production and biodiversity conservation, can be defined and implemented.

Organic agriculture is a system of production that is committed to the conservation of biodiversity within agricultural systems, both from a philosophical perspective and from the practical viewpoint of maintaining productivity. The aim of this paper is to discuss the evidence for the role organic agriculture can play in maintaining and enhancing biodiversity. To do this, the relationship between organic agriculture, biodiversity and the rural landscape, are discussed broadly at each of the three levels at which biodiversity can be assessed – genetic, species and ecosystem level. The paper explores the scientific evidence that this relationship is beneficial and provides examples of projects that are encouraging the dual aims of biodiversity conservation and organic agriculture.

The paper concludes that there is a positive relationship between organic production and biodiversity conservation, and as such organic farmers and organisations should ensure that biodiversity conservation has a place at the heart of the organic system. It is also noted, however, that these positive contributions to conservation do not necessarily guarantee the protection of individual threatened or endangered species, particularly where the agricultural policy climate stresses the economic necessity of land use intensity.

Conversion to organic farming is therefore at present only the first step towards a modern system of agriculture that not only produces crops but also increases biodiversity. To continue along this path there are several more steps which need to be taken. Research needs to go further than comparing farming systems and making the links between farming systems and biodiversity losses and gains, and should instead address questions on how to maximise biodiversity within the agricultural landscape. The organic and conservation movements also need to identify and act upon a number of changes to organic farming practice, support and policy areas to ensure that the positive interactions between farming and conservation are achieved. Finally, as ecosystem diversity is a pre-condition for species diversity, the key to increasing linkages between organic farming systems and biodiversity conservation should perhaps first and foremost be to develop habitats – within farms and as part of the wider landscape – which more fully realise their potential for biodiversity conservation. Thus organic farming *in combination* with management strategies aimed at biodiversity conservation could play an important role in a sustainable enhancement of biodiversity worldwide. The result should be that organic farming becomes part of a system for landscape protection and improvement, contributing to agro-ecosystem conservation and to the maintenance, enhancement and management of the landscape and its related biodiversity.

Definitions

What is biodiversity and why is it important?

Biological diversity, or biodiversity, refers to the variety of life on earth. Human beings could not exist without the abundance and diversity of nature. Biodiversity not only provides direct benefits like food, medicine and energy; it also affords us a 'life support system'.

Biodiversity has subsistence and tradable values. The former describes the vast range of biological goods that are harvested or hunted from natural or managed systems to provide food, materials for clothing or shelter, medicines etc. Tradable values cover the sources of income available from biodiversity that provide our food, clothing, building materials and medicines, through farming, fishing, forestry etc.

Biodiversity also provides a range of environmental services that provide clean water, absorb carbon dioxide and produce oxygen and protect us from environmental disasters such as flooding and landslides. And biodiversity provides us with many so-called non-use values that have educational, cultural, religious, spiritual, philosophical or aesthetic values for individuals, communities or tourists (Koziell, 2001).

Until recently, efforts to preserve biodiversity have focused on natural ecosystems, using tools such as protected areas – despite the fact that these areas represent less than 10 per cent of the earth's land surface (Carey *et al*, 2000). In contrast, approximately 37 per cent of the earth's land is currently under agricultural production (Wiseman and Hopkins, 2001). Given this pattern, there is increasing recognition that many species interact with agricultural systems, even if their primary habitat is in natural areas. Moreover, large proportions of the total species of a region are likely to be found in agriculture systems (Pimentel *et al*, 1992). The management of these agricultural systems can, thus, dramatically affect overall levels of biodiversity, as well as the success of particular species. Unfortunately in the last century much of this land management was detrimental to biodiversity, with agriculture now the cause of more losses to biodiversity than gains (see box overleaf). As the 2000 IUCN *Red List* of threatened species highlights, habitat loss is the main threat to biodiversity, with agricultural activities affecting 70 per cent of all threatened bird species and 49 per cent of all plant species (Hilton-Taylor, 2000).

From 1992, the Convention on Biological Diversity (CBD), the international agreement stemming from the Earth Summit held in Rio de Janeiro in June 1992, has provided a lead in biodiversity conservation across many nations. Article 1 of the convention states the convention's objectives as the: 'conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources, including by appropriate transfer of relevant technologies'. The CBD recognises the 'sovereign right' of nations to 'exploit their own resources pursuant to their own environmental policies'. In line with this, countries are responsible for their own biodiversity and are required to develop National Strategies and Action Plans as tools to integrate biodiversity issues into national legislation.

Causes of biodiversity losses linked to agriculture

Problems	Proximate Causes	Underlying Causes (for all problems)
Erosion of genetic resources (livestock and plants) Resulting in: • disease/insect pest attack • loss of insect diversity	Spread of HYVs (high yielding varieties) and monocultures Biases in breeding methods Weak conservation efforts	Demographic changes Industrial/Green Revolution Model that stresses uniformity Disparities in resources distribution and in control of land Pressures and influences of seed/agrochemical companies Policies that support HYVs, uniformity, and chemicals (subsidies, credit, market standards) Producers/companies focus on short-term returns to neglect of longer-term social factors Disrespect for local knowledge and structural inequities
Erosion of insect diversity	Heavy use of pesticides Use of monocultures Loss of organic material	
Erosion of soil diversity Resulting in: • fertility loss • productivity decline	Heavy use of agrochemicals Poor tillage practices Use of monocultures	
Erosion of habitat diversity	Extensification in marginal land Chemical drift	
Erosion of indigenous methods for using agrodiversity	Replacement by uniform species	

Source: WRI, 1997

Originally, agro-biodiversity was not going to be discussed within the Convention, however when the CBD's programme of work was discussed, there was a strong outcry, in particular from developing countries, to incorporate agricultural issues into the Convention. In 1996, the Third Conference of Parties of the CBD established a programme of work on Agricultural Biological Diversity and at the Fifth Conference of Parties in 2000, these discussions were elaborated with the result that Agricultural Biological Diversity will need to be addressed in National Reports and in National Biodiversity Strategies and Action Plans. However, agro-biodiversity remains a poorly understood concept by those countries committed to the CBD. In general, countries have concentrated on crop genetic resources, as this is an area where most conservation effort has taken place. However, other issues such as soil biodiversity and wild biodiversity in the farming landscape tend to be more poorly understood (Gemmill, 2001).

Agro-biodiversity

Agricultural biodiversity, or agro-biodiversity, is a vital sub-set of biological diversity. According to the FAO, agro-biodiversity refers to the variety and variability of animals, plants, and micro-organisms on earth that are important to food and agriculture and which result from the interaction between the environment, genetic resources and the management systems and practices used by people (FAO, 1999). It includes both wild and domesticated species.

Biodiversity is generally discussed and measured on three levels: Genetic Diversity, Species Diversity and Ecosystem Diversity. In terms of agro-biodiversity the scope of these levels is given below:

- Genetic diversity: The variety and variability of animals, plants and micro-organisms that are used or related to food production and agriculture.
- Species diversity: The diversity of species that support production (soil biota, pollinators, predators, etc.) and the species diversity in non-productive but associated landscapes.
- Ecosystem diversity: The diversity of the agro-ecosystems and its role in the landscape (Hoffmann, 2000).

What is organic agriculture?

Organic farming is a system of agriculture that relies largely on locally available resources and is dependent upon maintaining ecological balances and developing biological processes to their optimum. These systems take soil fertility as a key to successful production. Wild species perform a variety of ecological services within organic systems: for example pollinators, natural enemies of pests and soil micro-organisms are all key components in agro-ecosystems. Thus, higher levels of biodiversity can strengthen farming systems and practices. Organic systems also dramatically reduce external inputs by refraining from the use of synthetic chemical fertilisers, pesticides and pharmaceuticals. Instead, systems are designed to manage nature in order to determine agricultural yields and disease resistance. By relying on the natural capacity of plants, animals and the landscape, organic systems aim to optimise quality in all aspects of agriculture and the environment.

An estimated 99 per cent of potential crop pests are controlled by natural enemies (de Bach, 1974). Pest control on organic farms thus relies on maintaining healthy populations of pest predators (hence, as will be seen later, the concentration of research on invertebrate species diversity). One of the most important elements in converting conventionally managed farmland to organic systems has proved to be the time needed to restore a natural ecological balance with respect to pest-predator populations (Lampkin, 1990).

Organic agriculture also encourages variety. Reduced reliance on agrochemicals to control changes in soil conditions means that the plants must themselves be better adapted to local conditions. Organic systems thus encourage the expansion of varieties grown, and the preservation of older, locally bred and indigenous varieties and breeds. Organic farming systems aim to increase this diversity of crops, in time (through three to four-year rotations) or in space (through intercropping or growing several species in the same season in different fields). Wider rotations also reduce economic risks for farmers. In India, for example, cotton is intercropped with pulses and a range of legumes one year and maize and sorghum another, and then followed by a second crop of irrigated wheat. Although this reduces the yield of the main cotton crop, the overall farming system is more diverse and can be more profitable and more suited to producing both food and cash for the farmer (Myers and Stolton, 1999).

Learning from traditional/indigenous practices

Throughout the developing world, small farmers have developed or inherited farming systems well adapted to local farming conditions that are in general highly diverse. These traditional/indigenous practices can help to conserve both wild biodiversity and agricultural biodiversity, as well as support and reward the stewardship of natural resources, sustain rural economies and help communities resist pressures from outside which could undermine their way of life.

Organic agriculture is thus committed to the conservation of biodiversity within agricultural systems, both from a philosophical perspective and from the practical viewpoint of maintaining productivity. To this end the importance of biodiversity as part of a well-balanced organic system is enshrined within the operating standards that have been developed worldwide for organic farming (see Appendix 1).

Throughout the world many farms are certified for organic production. Generally, these farms are producing for a premium price market on farms either in developed countries or producing goods for markets in developed countries. More than 20 million hectares of land is certified for organic production worldwide. The figure for the number of farms using organic techniques but not certified is unknown but likely to be much larger than for land under certified production. Generally these farms are in developing countries producing primarily for home consumption or for local sale, where there is no need for the guarantees of a certification system.

This paper draws primarily from examples and research carried out on certified organic farms, as the certification system guarantees that certain standards of production have been met. This is not to say that non-certified organic farms do not meet these standards, but is rather a practical solution to reviewing a mass of information from around the world.

How can organic farming help protect and enhance biodiversity?

To appreciate the role that organic agriculture, in particular, can and does play in the conservation of biodiversity, it is necessary to understand the relationship between organic agriculture production methods and the natural environment.

Farming is an immensely diverse activity. At the regional level, the type of agriculture (*e.g.* arable crops, dairy farming, coffee production, subsistence) and the area which is cultivated (*e.g.* mountain pastures, grasslands, forests) are the main determinants. At a landscape level, patterns of land cover, plot/field-size and types of boundaries all effect biodiversity. At the farm level, land use management (*e.g.* crop succession, rotations and tillage, agroforestry) is a key factor. At the plot/field level, different production practices determine habitat quality and associated biodiversity. At each level, different ecological processes affect species distribution.

Similar complexities arise when discussing levels of biodiversity. Although biodiversity is often measured simplistically by counting species, the variety of species is also important. Introducing new, exotic species might increase the local species count, but does not increase overall biodiversity. On the contrary, introducing exotics, disturbing a habitat, or invasion by weed species can come at the expense of native species that may be rare, threatened or very localized in their distribution (endemic), leading to a net loss in overall biodiversity (Pagiola *et al*, 1997).

Biodiversity is generally assessed at three distinct levels - genetic diversity, species diversity and ecosystem diversity. These levels are used in the following sections to discuss the links between biodiversity and organic agriculture.

Genetic diversity

Whereas agriculture was once at the centre of preserving and encouraging genetic diversity, today the adoption of high-yielding, uniform cultivars (cultivars are varieties produced by cultivation) and, in some cases, regulation of approved varieties has led to a considerable reduction in the number of genetically viable species used in agriculture.

This loss was clearly illustrated by a survey of 75 US crop species, carried out by the Rural Advancement Fund International (RAFI), which found that 97 per cent of the varieties given on old United States Department of Agriculture lists are now extinct (Fowler and Mooney, 1990).

Rice production provides an example of the extreme level of cultivar uniformity, with 75 per cent of rice varieties grown in Sri Lanka being descended from one maternal parent, a genetic uniformity mirrored in Bangladesh, where 62 per cent of the rice varieties coming from one maternal parent, and Indonesia, where 74 per cent is from one parent (WCMC, 1992). In fact, indigenous wheat, rice and many other food crop varieties have virtually disappeared from their original centres of diversity in areas of Europe, the Middle East, Africa and Asia (WCMC, 1992). Internationally, concern for this rapid loss of genetic resources led to the establishment of the International Board for Plant Genetic Resources (IBPGR), which co-ordinates a global network of gene banks (Altieri and Merrick, 1988). A further threat to genetic diversity, and biodiversity in general, is the possible effects of the release of genetically engineered organisms into the environment (Soil Association, 1999).

Systems and Genetic Diversity in the High Jungle of Peru

Naturally pigmented cotton is one of man's oldest industrial crops, and still survives today as a backyard cultivar among many peasant and indigenous peoples of the tropics.

With the support of international organisations, private foundations and Peruvian government agencies, the Native Cotton Project has pioneered the documentation and recovery of native cotton cultivation in the high jungle of northern Peru. The project concept holds that the most efficient, economical and lasting strategy to maintain genetic diversity is to sustain indigenous agricultural systems, through local consumption trade with external markets that place added value on organic textile fibres.

Since 1993, the Project has contracted over one hundred families in the jungle to grow certified organic cotton. With a commercial linkage to European, North American and Japanese markets, native and organic cotton products accounted for some US$25 million dollars of exports from Peru in 1998 (Vreeland, 2000).

Plant breeding has been concentrated in recent years on producing varieties that grow well in farming systems reliant on chemical inputs, irrigation and monoculture. Organic producers, on the other hand, are looking for productive varieties that are suited to their local climatic and soil conditions and are not susceptible to disease and pest attack. Research has shown that in some cases these characteristics are more likely to be found in the older native cultivars. For example, conventional wheat grown in an organic system can have reduced protein content, whereas the selection of a variety suitable for the particular growing conditions will provide higher protein, and thus higher baking quality wheat can be grown (Woese *et al*, 1997). In Ethiopia , research found that local varieties grown using animal manure as opposed to chemical fertilisers tolerated moisture stress and resisted disease and pest infestation better than the improved varieties (Teshome, 2000). Research has also indicated that yields and disease resistance are better in native cultivars as opposed to modern varieties for vegetables (tomato, cucumber and melon) grown in an organic system (Jani and Hallidri, 2000). Similar experiences have been found with native animal breeds, many of which are now considered endangered. Indeed, in the early 1990s the FAO estimated that at least one breed of domestic animal becomes extinct each week, and that 390 of the 1,433 listed domestic breeds were at risk (UN, 1993). As with native plant varieties, rare animal breeds can be appropriate for organic systems in part due to their suitability to local conditions (for example, Wanke, 2000).

There are many schemes and projects worldwide working to conserve seed banks and indigenous varieties, many of which are linked to organic agriculture projects (Cooper *et al.*, 1992 and LEISA, 1999). For instance, the Sustainable Agriculture and Rural Development Project (SARDI) in Kenya is working with communities in the Gilgil district to develop organic systems to increase food security through a community indigenous seed conservation programme. Indigenous seeds have been shown to perform better in the harsh drought conditions and within two years had increased food security for those farmers taking part by over 80 per cent (Wairegi, 2000).

Species diversity

As noted above, organic farms are likely to have higher agro-biodiversity with greater crop rotation diversity, integration of livestock and number of cultivated crops. Long-term research projects have accumulated substantial evidence that organic systems are also beneficial to non-agricultural species biodiversity.

Many studies of both botanical composition and animal species present on farms confirm these findings (Frieben and Köpke, 1996, Stolze *et al,* 2000). These benefits have been recognised by organisations concerned with the conservation of individual species or habitats, which are increasingly turning to organic management regimes on farmed areas.

Biodiversity on lowland organic farms

An overview of research findings from 23 European research projects concluded that organically farmed areas had a much higher level of biodiversity than conventionally farmed areas. A summary of the results found that organic farms had:

	Abundance	Diversity
Plants	Five times as much biomass of wild plants in arable fields, including more rare and declining arable plants	On arable fields, 57 per cent more wild plant species, two times as many rare or declining wild plant species and several rare species found only on organic farms
Invertebrates	1.6 times as many of the arthropods that comprise bird food; about three times as many non pest butterflies and one to five times as many spiders in the crop area	One to two times as many spider species in cereal fields
Birds	25 per cent more birds at the field edge, 44 per cent more in-field in autumn/winter, 2.2 times as many breeding skylarks and on average more breeding yellowhammers.	

The study also concluded that:

- Distribution of the biodiversity benefits: though the field boundaries had the highest levels of wildlife, the highest increases were found in the cropped areas of the fields.
- Quality of the habitats: both the field boundary and crop habitats were more favourable on the organic farms. The field boundaries had more trees, larger hedges and no spray drift; the crops were sparser, with no herbicides, allowing more weeds; there was also more grassland and a greater variety of crop types.
- Organic farming was identified as having many beneficial practices, reversing the trends in conventional farming that have caused the decline in biodiversity: crop rotations with grass leys, mixed spring and autumn sowing, more permanent pasture, no use of herbicides or synthetic pesticides and use of green manuring (Azeez, 2000).

Ecosystem diversity

An ecosystem is made up of the organisms of a particular habitat, such as a farm or forest, together with the physical landscape in which they live (WRI, 1992). Although little research has been carried out comparing agro-ecosystem diversity in different farming regimes, many of the principals of organic farming are likely to have a positive impact on ecosystem diversity (Stolze *et al*, 2000).

Productive forest areas, whether natural or planted, and areas which have been formally protected to preserve biodiversity offer examples of how organic systems can be part of an ecosystem or landscape approach to biodiversity conservation.

Agro-forestry systems can sustain high levels of biodiversity and generate multiple benefits. Examples of agro-forestry systems that embrace organic production include oranges produced in traditional Mayan tree gardens in Mexico (Neugebauer and Ek, 2000), the production of organic *Illex paraguariensis* (Yerba Mate) and *Euterpe edulis* (heart of palm) in the Guayaki biological reserve in Paraguay, an area of high quality Atlantic Forest – and one of the most endangered forest systems in the world (Pryor, 2000), organic cacao in Belize (Sams, 1997) and organic bananas in Costa Rica (Soto, 2001). In Tamil Nadu, India, shade trees (e.g. *Grevilla robusta*, *Erythrina lithosperma* and *Gliricidia sepium*) are cultivated at the Singampatti Group of Estates organic tea plantation along with commercial bush and tree species like cinchona and cardamom, creating habitat for endangered animals, including tigers, the lion-tailed Macaque, and the Malabar squirrel (WRI, 1997). In Europe, one third of the 1,000 ha of chestnut woods that occur in the Parnon Mountains in Greece, an area of extraordinary biodiversity that has over 80 endemic plants and many threatened and rare species, are certified organic (Moussouris and Regato, 1999).

Coffee, trees and biodiversity

Coffee grown under a canopy of shade offers a particularly good surrogate of natural forest for many faunal species (Perfecto et al., 1996; Greenberg, 1998; Smithsonian Migratory Bird Center, 2001). For example, Finca Irlanda in the state of Chiapas in Mexico, one of the oldest organic and biodynamic coffee estates in the world, grows more than 40 varieties of leguminous trees providing both shade and nitrogen. Indigenous wild animals that are threatened with extinction, such as puma, wild boar, pheasants and toucans, are protected on the plantation. Other animals, such as the ocelot and gray fox, are used as natural predators to control pests such as rodents (WRI, 1997).

Protected areas as defined by the World Commission on Protected Areas are areas *especially dedicated to the protection and maintenance of biological diversity*. However, protected areas are not always strict nature reserves. Instead, they can fulfil many functions *alongside* biodiversity conservation. As a result, people living in and around protected areas are being encouraged to, and in some cases rewarded for, maintaining lifestyles that minimise environmental damage and help to enhance natural biodiversity. IUCN The World Conservation

Protected areas and rural development

The Ampay Forest Sanctuary in Peru represents an outstanding biological resource of more than 800 plant species, some of which are endangered. Since the establishment of the reserve in 1987, the Instituto de Desarrollo y Medio Ambiente has been implementing a rural development programme focusing on organic agriculture, directed at small farmers living in the buffer zone and inside the protected area. There are more than 800 families using the natural resources and farming in the area.
The project has established that the pressure on natural resources can be diminished and the objectives of the protected area management achieved if clear support strategies are established. Field studies carried out indicate successful projects need to incorporate concrete actions designed to strengthen the awareness of farmers, students and the local population and authorities in general, in the form of training in organic farming and environmental education, and the need for incentives for farmers adopting organic farming, such as technical assistance and credit. (Flores-Escudero, 2000)

Union has identified a globally recognised system of categories that defines the management activities of the various forms of protected areas worldwide (IUCN, 1994). Organic agriculture has the potential to offer an important agricultural management option in several of these protected area categories, although an increased emphasis on ecological and landscape preservation may necessitate modifications to organic systems.

Organic farming is also being utilised as a tool for biodiversity conservation within ecosystem planning in buffer zones - the areas that border protected areas. Buffer zones are by their nature areas where land management aims to help maintain the integrity of the ecosystem of the core protected area. Where agriculture is a dominant land-use in buffer zones, the detrimental effects of farming systems can be reduced by conversion to organic systems (see case studies on the MesoAmerican Biological Corridor).

What is the scientific evidence of the positive role organic farming plays in biodiversity conservation?

The vast literature on the link between agriculture and biodiversity loss has been complemented in recent years by a growing scientific effort to characterise and develop methods of agriculture that sustains and even increases biodiversity. This research effort is however still in its infancy. In general research has been led by specific interest groups. Initially, the research was carried out by agronomists, as there is a clear correlation between a healthy soil and agricultural output. Latterly this body of work has been complemented by agricultural researchers wishing to show the positive link between specific agricultural production systems, such as organic methods, and benefits to biodiversity and conservationists, in particular ornithologists, keen to develop and promote biodiversity conservation outside protected areas. This research has been concentrated in Europe and North America, with additional areas such as Central America being the focus of specific research efforts such as the role shade-grown crops can play in the protection of bird species.

Floral diversity

Due to the great diversity of flora (flowering plants), comprehensive research into the extent and range of threats being faced by plants is still in it infancy. However, research carried out to date indicates that as with other major groups floral diversity is under threat. In the USA, for example, research by The Nature Conservancy (TNC) found that one third of the country’s 15,300 native flowering species are threatened with extinction (Hilton-Taylor, 2000).

The increasing use of herbicides in agricultural production has had an inevitable effect on the diversity of arable flora. It would therefore stand to reason that floral diversity would benefit from a system that does not allow the use of chemical herbicides. In Greece, for example, floral species diversity and biomass were found to be higher in organic vineyards and olive-groves when compared with conventional systems (Kalburtji *et al*, 2000). Similarly, a two-year study comparing the diversity and abundance of plant species on neighbouring organic and conventional farms in England, found that the organic farms supported a substantially greater number of rare and declining arable plant species. Out of 21 ‘target’ species present, eleven were found only on the organic farm and eight were found on both but were more common on the organic farm. At the field and crop margins of the organic farm, the diversity of threatened species was twice that of the conventional fields (Azeez, 2000).

Although studies such as these provide evidence that organic production can increase floral diversity, the effects of different management and production techniques can have as much influence as production method. For example, German research on some 100 organic grassland sites showed that floral diversity decreased significantly as productivity increased, due to higher proportions of white clover (Wachendorf and Taube, 1996). Similarly, applying organic fertilisers can reduce the number of herbs and incorrect organic fertilising strategies can have further negative effects on biodiversity (Svensson and Ingelög, 1990). Thus some of the observed benefits of organic farming may be more influenced by the fact that the farms involved are traditional and have undergone less of the changes associated with conventional farms than on the organic production systems per se.

Faunal (animal) diversity

Invertebrate (insect) diversity

The physical, chemical and biological characteristics of the soil are greatly influenced by soil fauna (Coleman and Crossley, 1995). In arable crops, beneficial arthropods play an important role in the regulation of various pests (Luff, 1983; Nyffeler and Benz, 1987) and certain arthropods, especially carabids (ground beetles), are considered indicators of habitat quality (Matthey *et al*, 1990; Steinborn and Heydemann, 1990).

There have been several research projects on the effects of organic and conventional farming on the abundance and diversity of the most important soil faunal groups (Pfiffner, 2000). Comparative research has concentrated on two invertebrate groups, arthropods (i.e. insects and spiders), and earthworms – both of which are widely distributed and often play a key role in agro-ecosystems. Investigations of on-farm sites as well as in trial plots have found a higher faunal diversity and abundance in organic systems compared with conventional farming systems. This is most pronounced for beneficial arthropods whilst only a few taxa have been found to be more abundant in conventional sites. The arthropod populations in organically cultivated fields are characterised not only by a higher diversity and abundance, but also generally by a more even species distribution (Pfiffner and Niggli, 1996).

The reasons for higher arthropod diversity and abundance in organic systems are mainly related to organic plant protection management, low input organic fertilisation, more diversified crop rotations and more structured landscapes with semi-natural habitats and field margins (Pfiffner, 2000). The maintenance of natural areas or the planting of vegetation adjacent to crops, i.e. plant corridors, is common in organic systems as they provide alternative food and refuge for many insect predators. A study carried out in organic vineyards in California with and without flowering corridors, found higher levels of insect species in vineyards with flower corridors, but higher levels of pest insects in vineyards without the corridor (Nicholls *et al*, 2000). The quality and amount of food is also a key factor in the survival of arthropod populations, thus higher weed diversity and abundance in organic fields provides a more suitable habitat (Frieben and Köpke, 1994). Indeed, research carried out in tomato plots on the effects of weed control on surface-dwelling arthropod species (ground beetles, ants and spiders) found the abundance of species clearly influenced by weed biomass. Species numbers were lowest where mulching with rye straw was controlling the weeds. However, removing weeds within 20 cm of each plant reduced weed biomass but retained higher arthropod populations than in the plots treated with herbicide or mulch (Yardim and Edwards, 2000). Similarly, research carried out in the US noted that tillage disturbance tends to have a negative effect on soil life (Werner and Dindal, 1990).

Effect of different farming practices on beneficial arthropods	
Treatment	**Effects**
Tillage	– spring tillage is more favourable than autumn (overwintering) – minimal tillage is more favourable than traditional – heavy machinery can lead to soil compaction (reduction of larvae) – reduced abundance of hunting spiders, carabids and staphylinids
Fertiliser	– high input enhances disease and certain pests species – organic manures favourable for microarthropods as food resource of macroarthropods – less dense stands enhance xero-/thermophilous species – high doses of inorganic fertilisers seem to be harmful
Crop rotation	– multi-cropping is more favourable than monocropping – grass-clover leys allow 'regeneration' of soil animals
Pesticides	– effectiveness and susceptibility of pesticides are species specific – the effects of insecticides depend on application time and reproduction cycle – spiders and carabids are particularly vulnerable during mating and reproduction – reduction of prey and/or their contamination can lead to lower fecundity of predators – biocontrol has the lowest impact on non-target organisms, herbicides are mostly less harmful (but there are indirect effects on flora diversity with a decrease of 'prey items')
(Adapted from Pfiffner, 2000)	

Earthworms are good indicators of soil fertility. Due to their biology, earthworm populations can indicate the structural, microclimatic, nutritive and toxic situation in soils (Christensen, 1988). Populations of earthworms are also strongly influenced by different cultural practices, such as soil tillage, use of pesticides, fertilisation and crop rotations (crop residues). Studies on the effects of organic and conventional farming systems on earthworms are numerous. Generally, organically managed soils exhibit a higher biomass, abundance and number of earthworm species compared to conventionally managed plots or farms (Pfiffner, 2000).

Researchers have found greater diversity and abundance of many other invertebrate species in organic farming systems (Frieben and Köpke, 1996, Stoltze *et al*, 2000). For example, an English study comparing spider communities in organic and conventional winter wheat fields found the abundance and diversity of spiders greater on the organic fields. Researchers concluded that the results were directly affected by the increased levels of understorey vegetation (i.e. broad-leaved and grass species) in the organic fields (Feber *et al,* 1998). The same researchers also studied the levels of pest and non-pest butterflies (Feber *et al*, 1997). Significantly more non-pest butterflies were recorded on organic farms than conventional farms, there was however no significant difference in the abundance of pest species. The difference in non-pest species was around three times greater in the organic cropped areas. Cropping patterns effected species diversity. Pest species were particularly attracted to oilseed rape and linseed crops, cereal crops attracted similar numbers of pest and non-pest species and grass leys attracted more non-pest species. No oilseed rape or linseed was recorded on organic farms, but grass leys were six times higher than on the conventional farms.

Bird diversity

A review of the conservation status of European birds carried out by BirdLife International identified 195 (38 per cent of European birds) as Species of European Conservation Concern (SPECs). Most declines in populations were linked to changes in land-use, with agricultural intensification being the most common threat, affecting some 42 per cent of SPECs (Tucker and Heath, 1994). The greater abundance and frequency of invertebrate species, plant food sources, habitat and farming practices all have a direct effect on the number and diversity of bird species on organic farms.

The skylark *(Alauda arvensis)* has been the subject of several research projects. It is a ground-breeding bird whose breeding success depends on the management of legume-grass crops and has thus been badly effected by changes in farming systems and is declining over much of its range. In the UK, the British Trust for Ornithology (BTO) studied the breeding and over-wintering patterns of birds on 22 paired organic and conventional farms. The breeding densities of skylark were significantly higher on organic farms (BTO, 1995). Bird densities of all species studied were also higher on organic farms, as were invertebrate and food sources (Chamberlain *et al*, 1996). In Germany, researchers found higher percentages of skylarks and other ground-breeding birds on legume-grass crops in the Schorfheide-Chorin biosphere reserve in the state of Brandenburg (Saacke and Fuchs, 1998). Further research on a biodynamic farm within the reserve showed that set-aside strips in the fields appeared to have a number of positive effects on ground-breeding birds in general. For species such as the Whinchat (*Saxicola rubetra)* and Yellow Wagtail (*Motacilla flava*) they provided potential nest and food habitats as well as song and rest sites; for ground-breeding birds they provided shelter from agricultural operations and predators and for arthropods important retreat areas were present after cutting (Stein-Bachinger *et al*, 2000). A three-year study in Denmark concentrated on non-crop habitats, such as hedgerows, of conventional and organic farms and their effects on bird populations (Brae *et al*, 1988). The abundance of birds was 2 – 2.7 times greater on the organic farms. In total, 24 species were more prevalent on organic as opposed to conventional farms, of these 11 species had declined in number in Denmark since 1976.

In the coffee producing countries of Latin America, growing organic coffee and cacao under shade can have a major impact on biodiversity. Research carried out by the Smithsonian Migratory Bird Centre in Colombia and Mexico identified over 90 per cent fewer bird species in sun-grown coffee plantations as opposed to shade-grown coffee (Smithsonian, 1994). Although organic standards do not explicitly state the need for coffee to be grown in the shade, shade-grown practice is recommended as it fulfils requirements to enhance soil fertility, pest and disease control and expands crop production options (Rice and Ward, 1996). It has been noted, however, that many potential biodiversity benefits of shade-grown coffee and cacao will not be fully realised in organic production unless specific biodiversity conserving measures are stipulated (Alger, 1998).

How are links between organic farming and biodiversity conservation being made?

The role that organic farming can play in biodiversity conservation can only truly be realised when research and theory are developed into practices in the field. Although the projects and examples detailed below represent only a fraction of the initiatives that are taking place worldwide, they do provide evidence that the creation of positive links between organic agriculture and biodiversity conservation is a growing trend.

Buffer zone management – organic agriculture in the MesoAmerican Biological Corridor

The use of organic farming in protected area buffer zones has been explored in the MesoAmerican Biological Corridor, a projected complex of protected areas and sustainable management stretching over seven countries and involving over a hundred NGOs and a thousand communities. The initiative envisages a range of sustainable land uses within the buffer zones and linking areas (the so-called Corridor (Connectivity) Zones and Multiple-Use Zones), including certified forest management and organic agriculture, perhaps with an additional label to show that the products come from the biological corridor (Salas, 2000).

The Talamanca area of Costa Rica, provides an example of how organic production can have a role in conserving biodiversity within the biological corridor. In theory, the area is well protected with three national parks, a wildlife management reserve, and five indigenous reserves, yet as with many of Costa Rica's protected areas these reserves are relatively isolated from each other due to exploitative agricultural policies outside the reserves. As a result of the need to interconnect protected areas, the Talamanca-Caribbean Biological Corridor has been created. This corridor stretches from Parque Internacional La Amistad in the highlands toward the lowland Caribbean sites of Parque Nacional Cahuita and Gandoca-Manzanillo Wildlife Refuge .

Areas outside the reserves are predominantly composed of small cacao farms that are increasingly turning to certified organic production. In 1997, the US-based TNC began to study and utilise the shaded cacao agro-ecosystems of the area to enhance conservation efforts in the Talamanca District. In order to ensure that conservation decisions and actions were based on the best available science, TNC set up a project to test their hypothesis that cacao provides habitat for both Neotropical migrant and resident birds, as well as forest-restricted species, because it resembles the natural structure of the forest. Results to date show that cacao habitats can harbour high species richnesses equivalent to that of forest (Parrish *et al*, 1998). Today, 1,500, largely indigenous, farmers in the Talamanca region are producing organic bananas, ginger and 20 per cent of the world's organic cacao (Miller *et al*, 2001).

Re-introducing grazing to the meadows of the White Carpathian Mountains, Czech Republic

The Carpathian mountains are valued for their species rich habitats, which have been created over centuries by extensive farming systems that use meadows for hay-making in June and July and provide grazing in the Autumn. However, in recent years the number of farm animals has decreased dramatically and grazing has ceased. Although grass cutting has been carried out by volunteers for nature conservation purposes, this provides only basic maintenance as the absence of grazing, natural seeding of trees and bushes and a slow increase in nitrogen in the soil is resulting in changes in species composition.

In 1997, The Czech Union of Nature Conservationists launched the project 'Sheep grazing as a tool for nature and landscape conservation in Southern Walachia'. A flock of Romney sheep was introduced permanently to graze the pastures. The flock is kept by two organic farmers and the funds to purchase the sheep were raised locally as part of a community supported agriculture scheme (the participants receive three lambs and one sheep over a six year period). Local benefits from the project have included temporary employment opportunities as shepherds, and closer farmer-consumer relationships. All production is sold locally and a local carpet factory uses the wool.

The project has been monitoring the species composition of the grazed meadows since 1999. The results show that carefully managed organic grazing systems can contribute to the survival of the typical species-rich meadow agro-ecosystems of the region (Ulãák *et al,* 2000).

International NGOs' support for organic farming

Policies encouraging the further development of biodiversity considerations into organic farming practices have also been developed by National and International NGOs. Conservation organisations, such as TNC (The Nature Conservancy), BirdLife International and Greenpeace are supportive of organic initiatives. In 1999, a joint workshop in Vignola, Italy (organised by IUCN – The World Conservation Union, IFOAM and AIAB, the biggest Italian organic farmer organisation) was held to exchange ideas and information and draw up a joint action plan for both the conservation and organic movements.

The resulting Vignola Declaration begins by stating that: '*IUCN should inform its members about the value of organic agriculture for biodiversity, encourage all conservationists to consume organically grown products, and expand its project activities linking organic agriculture with biodiversity – working in partnership with IFOAM members wherever possible – and include these issues into policy considerations within IUCN'*. (Stolton *et al*, 2000). IUCN's membership includes states, government agencies and a diverse range of non-governmental organisations. A series of follow-up collaborations is being undertaken.

Organic conservation guidelines in the UK

Organic farmers in Britain have been shown to have a highly positive attitude toward conservation management (Stopes *et al*, 2000a). The Soil Association (the largest certifying body in Britain) pioneered the development of specific conservation and environmental protection standards in the 1980's (Soil Association, 1990). This was welcomed by the conservation agencies. However, it was recognised that:

- the full potential value of these standards might not always be realised in practice;
- some aspects of organic production might conflict with conservation and environmental objectives; and
- the understanding of farmland ecology has progressed, providing new insights into the relationship between farming practices and protection of the environment.

In view of this, a comprehensive review of the Soil Association Organic Conservation Standards was initiated in 1998. The review involved the active participation of the major UK environmental and conservation organisations. Final recommendations included five main action points:

- further research and development of organic whole farm conservation planning and the application of organic systems for the maintenance and restoration of lowland and upland grasslands;
- training and information for producers on the interpretation, implementation and potential costs of conservation standards;
- the development of advisory services on conservation and environmental protection for organic producers;
- the integration of organic farming standards and other agri-environment incentive schemes; and
- the harmonisation of agricultural conservation standards between all organic sector and government bodies (Stopes *et al*, 2000).

Planning for biodiversity in Sweden

In Sweden, a working group made up of organic farmers, nature conservationists, government agencies and universities has been working together since 1997 to strengthen the links between organic agriculture and biodiversity conservation. The main objectives have been:

- to help organic agriculture develop in such a way that it enhances biodiversity;
- to start co-operation and dialogue between the nature conservation and organic agricultural movements; and
- to spread knowledge about biodiversity in organic agriculture.

Initially the group concentrated on exchanging information on the different parties' main areas of concerns, i.e. nature conservation and organic agriculture, and to discuss different standpoints. From there, the discussions developed into a planning exercise leading to proposals for changes to the country's main organic standard (run by KRAV), to require all organic farmers to have a plan for the management of biodiversity on their farms from 2001.

The group has clearly identified that it is crucial not to force the farmer to work with biodiversity, instead they need to be made more aware and interested in the subject with increased information and advice.

The group is now working on producing educational material on biodiversity in organic agriculture and is arranging courses for agricultural advisors and consultants on the subject (Mattsson and Kvarnbäch, 2000).

Investing in biodiversity in Latin America

Terra Capital Investors, run by the US-based Environmental Enterprises Assistance Fund (EEAF), developed the first investment fund created to support biodiversity-linked industries in 1998. Terra is a ten-year fund set up with US$ 15 million. Its target sectors including organic agriculture, sustainable forestry, nature tourism, sustainable harvesting of non-timber forest products and aquaculture, and investments are centred on projects in Latin America.

Terra has developed biodiversity guidelines that are intended to provide a starting point from which to identify and assess specific biodiversity linkages and performance indicators for every investment. As the most developed of Terra's target sectors, organic agriculture, is expected to comprise a large percentage of the total portfolio. Terra have noted however that making these investments would be easier if there existed certification for biodiversity, as without specific reference to biodiversity, organic certification alone does not fully address sustainability. To do this, certifiers would need to take a more ecosystem approach, looking not only at the inputs and growing processes but also at the whole farm's contribution or harm to biodiversity (Doliner and Janetzko, 2000).

Following in the footsteps of the Terra Capital fund, several similar funds have been established to provide venture capital to environmentally and socially responsible business, such as organic production, including the EcoEnterprises Fund run by TNC aimed at projects in Latin America and the Caribbean and the Kijani Initiative run by IUCN and the International Finance Corporation, which targets projects in Africa.

The International Policy Agenda

In the last twenty years there has been a gradual move towards the creation of policies and mechanisms aimed at encouraging and exploiting the links between organic agriculture and biodiversity conservation, both at a governmental and non-governmental level. Much of the impetus for these initiatives comes from the 1992 Convention on Biological Diversity (CBD).

Recognising the role of organic agriculture worldwide the FAO Committee on Agriculture (COAG) adopted a report in January 1999, which concluded among other things 'that many aspects of organic farming were important elements of a system approach to sustainable food production' and recognised 'the environmental and potential health benefits of organic agriculture and its contribution of innovative production technologies to other agriculture systems and to the overall goals of sustainability' (IFOAM, 2001).

In Europe, the *Biodiversity Action Plan for Agriculture,* part of the European Community's (EC) activities to fulfil its commitments under the CBD, published in spring 2001, makes consistent mention of organic agriculture as a means of promoting farming methods which enhance biodiversity and calls for an increase in the share of farmers practising organic farming (EC, 2001).

The implementation of targeted agri-environmental measures over the whole of the European Union (EU) is the core of the Community's environmental strategy. To date, agri-environment measures are being applied to 20 per cent of the agricultural land in the EU. Agri-environment programmes allow for agricultural land to be used in ways that are compatible with the protection and improvement of the environment. The scheme offers payments to farmers who, on a voluntary and contractual basis, undertake an environmental service for a 5 year period. So far, organic agriculture has played a central role in many countries' national agri-environment policy. The main reason for this policy support has been the perceived positive environmental effects of organic agriculture (Stolze *et al*, 2000, Haas *et al*, 2001). In 1997, for instance, EU expenditure on organic farming through agri-environment programmes was 261 million ECU, just over 10 per cent of the total EU agri-environment budget (Lampkin *et al,* 1999). In Belgium, Denmark, Greece and Italy, over 20 per cent of the total expenditure of the agri-environment budget is on organic farming (Stolze *et al,* 2000). One drawback of the scheme however is that it lacks precise objectives, targets or indicators of performance. Production that conforms to organic standards, particularly if these standards were developed to meet more stringent biodiversity strategies, could provide the basis for filling this lack of outcome monitoring, whilst the agri-environment payments could provide the mechanism for increased attention to biodiversity conservation on organic farms.

Conclusions: How can we further develop the links between organic farming and biodiversity conservation?

The aim of this paper was to discuss the evidence for the role organic agriculture can play in maintaining and enhancing biodiversity. It is clear that there is considerable research and a wide range of initiatives that confirm the contribution organic agriculture can make to biodiversity conservation. The accumulated evidence is now strong enough to encourage organic farmers and organisations to ensure biodiversity conservation is at the heart of the organic system. It is also, however, clear that these positive contributions to conservation do not necessarily guarantee the protection of individual threatened or endangered species, particularly where the agricultural policy climate stresses the economic necessity of land use intensity.

Conversion to organic farming can thus be seen as a first step towards a modern system of agriculture that not only produces commodities but also increases biodiversity. To continue along this path several more steps need to be taken. Organic agriculture itself needs to develop policies and approaches that maximise diversity and suitability of farm habitats. Standards and directives can be *one* vehicle in this direction. Another can be to identify and act upon a number of changes to farming practice, support and policy areas to ensure that these interactions between farming and conservation are achieved.

Action plan for supporting organic farming and biodiversity conservation

Ensuring that the joint aims of organic agriculture and biodiversity conservation are met and expanded will require changes at many levels, from policy to education and training; actions that could help bring about this change include:

1. Increased research into organic management regimes that influence biodiversity (in both positive and negative ways).
2. Increased monitoring of biodiversity to develop understanding about the interactions between biodiversity and organic farming and subsequent development of policies that maximise benefits to biodiversity.
3. Provision of compensatory mechanisms for loss of production caused by changes in farming practice to optimise biodiversity.
4. Increased provision and funding for agricultural education, training and advisory services that provide information on developing organic farming systems to meet biodiversity conservation goals.
5. Continued and intensified dialogue between nature conservation organisations and institutions and the organic movement, to enhance understanding of the goals of biodiversity conservation and organic agricultural systems.
6. Development of specific guidelines within the IFOAM basic standards that emphasise biodiversity conservation and landscape preservation, and promotion of these to standard setting bodies.
7. Targeted policies developed to encourage the uptake of organic agriculture in areas of high conservation priority (i.e. areas with species-rich meadows, areas associated with high numbers of threatened species, protected areas and buffer zones).

There are also some major threats to organic agriculture and biodiversity which need to be checked. Most notable are the patents on life and the introduction of Genetically Modified Organisms (GMOs). The increasing consolidation of multinational corporations in the seed, agro-chemical and food processing industries has further concentrated the control over seeds, seed choices and ultimately, food security into the hands of a few corporations, and out of the hands of the farming communities. The imposition of patent rights over biological resources and traditional knowledge unfairly deprive communities of their rights over, and access to, the resources they have nurtured and conserved over generations. GMOs are being introduced in agriculture despite their possible threats to human health, negative and possibly irreversible environmental impacts, violation of farmers' fundamental property rights and endangerment of their economic independence. Through genetic pollution and lack of separation, farmers (organic and others) who reject the technology are unlikely to be able to ensure their production system is not compromised by GMOs.

As discussed above the term biodiversity comprises ecosystem diversity, as well as the diversity of species. As ecosystem diversity is a pre-condition for species diversity, the key to increasing linkages between organic farming systems and biodiversity conservation should perhaps first and foremost be to develop habitats – within farms and as part of the wider landscape – which realise their potential for biodiversity conservation. Criteria and indicators for evaluating sustainable rural landscapes have been defined in the EU-concerted action project: '*The nature and landscape production capacity of sustainable/organic types of agriculture*', co-ordinated by the Department of Ecological Agriculture of the Wageningen Agricultural University (Van Mansvelt and Van der Lubbe, 1999). Other tools that could be used for this purpose, include the WWF/IUCN Landscape Approach, which seeks to integrate the aims of broad-scale conservation with those of sustainable development (Maginnis *et al*, forthcoming) and The Nature Conservancy – Measures of success system, which is designed to assess the success of landscape-scale conservation projects in terms of their conservation impact (The Nature Conservancy, 2000).

As well as recognising the range of actions needed to enhance the role organic agriculture can have in conserving biodiversity, there is a need to identify activities that can help further develop the effectiveness of these actions and/or that help create the right market conditions to have maximum impact. Supporting strategies such as these include:

- Indigenous knowledge systems: many indigenous groups already have an expert knowledge of biodiversity in their own areas and, given the correct support, can be the best available source of information on biodiversity. Traditionally, these groups have been excluded from such activities as data collection and policy analysis but it is increasingly recognised that these are the very groups that should be most closely involved.
- Cost internalisation: arguments for investment in and encouragement of organic production can be helped by full cost accounting that shows the real costs (including costs of environmental damage, social loss etc) of all alternatives, thus highlighting hidden costs in intensive farming practices. However, it should be noted that life cycle analyses are poorly developed and some have important inherent limitations.
- Information and problem awareness: many examples from around the world show that farmers are often prepared to change practices to help biodiversity conservation once they are in full possession of facts about threats to and opportunities for biodiversity. Whilst the role of education is sometimes presented in a simplified and patronising way, information plays a key role in building a constituency for biodiversity conservation in everyday life.
- Creating a supportive policy environment for promoting agriculture methods that contribute to biodiversity conservation: including eliminating incentives for uniform varieties, GMOs and for pesticides, and implementing policies for secure tenure and local rights to plant genetic resources – is vital for agricultural biodiversity enhancement and for food security.

Organic farming *in combination* with management strategies aimed at biodiversity conservation could play an important role in a sustainable enhancement of biodiversity worldwide. The result should be that organic farming becomes part of a system for landscape protection and improvement, contributing to agro-ecosystem conservation and to the maintenance, enhancement and management of the landscape and its related biodiversity.

To give the closing words to Vandana Shiva (Alternative Nobel Price Laureate from India): *"Not till diversity is made the logic of production can diversity be conserved. If production continues to be based on the logic of uniformity and homogenisation, uniformity will continue to displace diversity*" (Shiva, 1996).

Principles of Organic Farming

The International Federation of Organic Agriculture Movements (IFOAM) has developed *Basic Standards* for organic agriculture that have provided a framework for almost all the national regulations and for the international WHO/FAO *Codex Alimentarius* on organic agriculture (IFOAM, 1996).

The principal aims of organic agriculture, which are summarised in the *IFOAM Basic Standards for Organic Agriculture and Food Processing,* are:

- to produce food of high nutritional quality in sufficient quantity;
- to interact in a constructive and life enhancing way with all natural systems and cycles;
- to encourage and enhance biological cycles within the farming system, involving micro-organisms, soil flora and fauna, plants and animals;
- to maintain and increase long-term fertility of soils;
- to use, as far as possible, renewable resources in locally organised agricultural systems;
- to work, as far as possible, within a closed system with regard to organic matter and nutrient elements;
- to work, as far as possible, with materials and substances which can be reused or recycled, either on the farm or elsewhere;
- to give all livestock life conditions which allow them to perform the basic aspects of their innate behaviour;
- to minimise all forms of pollution that may result from agricultural practice;
- to maintain the genetic diversity of the agricultural system and its surroundings, including the protection of plant and wildlife habitats;
- to allow agricultural producers a life according to the UN human rights, to cover their basic needs and obtain an adequate return and satisfaction from their work, including a safe working environment; and
- to consider the wider social and ecological impact of the farming system.

Reflecting increased interest in an internationally agreed definition, the FAO/*WHO Codex Alimentarius* Commission adopted 'Guidelines for the Production, Processing, Labelling and Marketing of Organically Produced Foods' in June 1999 (*Codex Alimentarius* Commission, 1999).

The definition states that organic agriculture refers to: a holistic production management system which promotes and enhances agroecosystem health, including biodiversity, biological cycles, and soil biological activity. It emphasises the use of management practices in preference to the use of off-farm inputs, taking into account that regional conditions require locally adapted systems. This is accomplished by using, where possible, cultural, biological and mechanical methods, as opposed to using synthetic materials, to fulfil any specific function within the system.

The Codex Guidelines further specify that an organic production system is designed to:

- enhance biological diversity within the whole system;
- increase soil biological activity;
- maintain long-term soil fertility;
- recycle wastes of plant and animal origin in order to return nutrients to the land, thus minimising the use of non-renewable resources;
- rely on renewable resources in locally organised agricultural systems;
- promote the healthy use of soil, water and air as well as minimise all forms of pollution that may result from agricultural practices;
- handle agricultural products with emphasis on careful processing methods in order to maintain the organic integrity and vital qualities of the product at all stages; and
- become established on any existing farm through a period of conversion, the appropriate length of which is determined by site-specific factors such as the history of the land, and type of crops and livestock to be produced.

European Union Council Regulation 2092/91 sets standards and regulations for the production and labelling of organic products within the EU. The Regulation defines principles of organic production at the farm level, materials that are authorised for use, inspection requirements, and requirements for processed food. Under the Regulation, each EU member country has established a national system for inspection and certification, conducted by public or private bodies, or both.

References

Alföldi, T, W Lockeretz and U Niggli (2000); *Proceedings 13th International IFOAM Scientific Conference,* IFOAM, Germany

Alger, K (1998); The Reproduction of the Cocoa Industry and Biodiversity in Southern Bahia, Brazil, paper presented at Cacao Workshop in Panama (March 30-April 2 1998); Smithsonian Migratory Bird Center, http://natzoo.si.ed/SMBC/Research/Cacao/cacao.htm

Altieri, M A and L C Merrick (1988); Agroecology and in situ conservation of native crop diversity in the Third World, in E O Wilson *Biodiversity*, National Academy Press, Washington, USA

Azeez, G (2000); *The Biodiversity Benefits of Organic Farming*, Soil Association, UK

Brae, L, H Nohr and B S Petersen (1998); *Fuglefaunen pa konventionelle og okologiske landbrug.* Miljoprojekt 102, Miljominsteriet, Miljostyrelsen, Copenhagen, Denmark

British Trust for Ornithology (1995); *The Effect of Organic Farming Regimes on Breeding and Winter Bird Populations: Part 1. Summary report and Conclusions*, BTO Research Report, NO 154, BTO, Thetford, UK

Carey, C, N Dudley and S Stolton (2000); *Squandering Paradise?*, WWF, Gland, Switzerland

Chamberlain, D, R Fuller and D Brooks (1996); The effects of organic farming on birds, *EFRC Bulletin 21*, Jan 1996, Elm Farm Research Centre, Berkshire, UK

Christensen, O. (1988); Lumbricid earthworms as bio-indicators relative to soil factors in different agro-ecosystems. In: Veeresh, G.K., Rajagopal, D. and Viraktamath, C. A. (eds*.): Advances in Management and Conservation of Soil Fauna*. Oxford and IBH Publishing, India

Codex Alimentarius Commission (1999); *Guidelines for the Production, processing, labelling and marketing of Organically Produced Food,* CAC/GL 32

Coleman, D.C. and Crossley, D.A. (1995): *Fundamentals of Soil Ecology*. Academic Press, San Diego and London

Cooper, D, R Vellvé and H Hobbelink (1992); *Growing Diversity: Genetic resources and local food security,* IT Publications, London, UK

de Bach, P (1974); *Biological Control by Natural Enemies*, Cambridge University Press, UK

Doliner, J D and C Janetzko (2000); Investing in Biodiversity, in Stolton *et al*

EC (2001), *Biodiversity Action Plan For Agriculture: Communication From The Commission To The Council And The European Parliament*, Com (2001) 162 Final, Volume III 27.3.2001 Commission Of The European Communities, Brussels

FAO (1999); *Report: Sustaining Agricultural Biodiversity and Agro-ecosystem Functions*, FAO, Italy

Feber, R E, J Bell, P J Johnson, L G Firbank and D W Macdonald (1998); The effects of organic farming on surface-active spider (Araneae) assemblages in wheat in southern England, UK, *The Journal of Arachnology*, 26:190-202

Feber, R E, L G Firbank, P J Johnson and D W Macdonald (1997); The effects of organic farming on pest and non-pest butterfly abundance, *Agriculture Ecosystems and Environment*, 64:133-139

Flores-Escudero, P (2000); Conservation of a forest sanctuary in Peru by implementing an organic agriculture and sustainable development programme for small farmers in the buffer zone, in Alföldi *et al*

Fowler, C and P Mooney (1990); *The Threatened Gene - Food, Politics, and the Loss of Genetic Diversity*, The Lutworth Press, Cambridge, UK

Frieben, B and U Köpke (1994); Bedeutung des organischen Landbaues für den Arten- und Biotopschutz in der Agrarlandschaft, in *Integrative Extensivierungs- und Naturschutzstrategien.* Forschungsberichte der Universität Bonn No. 15, Germany

Frieben, B and U Köpke (1996): Effects of farming systems on biodiversity. In: Isart, J. And Llerena (eds.): Biodiversity and Land Use: The Role of Organic Farming. Proceedings of the first ENOF-Workshop Bonn, 1995. 11-21.

Gemmill, B (2001); *Managing Agricultural Resources for Biodiversity Conservation: A Guide to Best Practices*, Environmental Liaison Centre International, Nairobi, Kenya

Greenberg R (1998); Biodiversity in the Cacao Agroecosystem: Shade Management and Landscape Considerations; Smithsonian Migratory Bird Center, http://natzoo.si.ed/SMBC/Research/Cacao/cacao.htm

Haas, G, F Wetterich and U Köpke (2001): comparing intensive, extensified and organic grassland farming in southern Germany by process life cycle assessment. Agriculture, Ecosystems and Environment 83. 43-53.

Hilton-Taylor, C (2000); *2000 IUCN Red List of Threatened Species*, IUCN, Gland, Switzerland

Hoffmann, L B (Ed) (2000); *Recommendations for the EC-Agricultural Action Plan on Biodiversity: Stimulating Positive Linkages between Agriculture and Biodiversity*; ECNC

Technical report series, European Centre for Nature Conservation (ECNC), Tilburg, The Netherlands

IFOAM (2001); Position Paper Sustainability and Organic Agriculture for the WSSD prepcom January 28 to February 8 in New York

IFOAM (1996); *Basic Standards for Organic Agriculture and Processing and Guidelines for Coffee, Cocoa and Tea; Evaluation of Inputs*, IFOAM, Germany

IUCN (1994); *Guidelines for Protected Area Management Categories*, IUCN, Switzerland and UK

Jani, S and M Hallidri (2000); Comparison between native and modern cultivars in organic and conventional vegetable production, in Alföldi *et al*

Kalburjti, K L, A P Mamolos, A Nikolaidou, O Bakirtzi, P Sklavou and M Filippidis (2000); Weed species diversity and weed biomass in organic and conventional agro-ecosystems, in Alföldi *et al*

Koziell, I (2001); *Diversity not Adversity*, International Institute for Environment and Development, London

Lampkin, N (1990); *Organic Farming*, Farming Press, UK

Lampkin, N, C Foster, S Padel and P Midmore (1999); *The policy and regulatory environment for organic farming in Europe. Volume 1: Organic farming in Europe: Economics and Policy,* University of Hohenhiem, Germany

LEISA (1999); Seeds for agrobiodiversity, *LEISA – ILEIA Newsletter for low external input and sustainable agriculture,* vol 15, no 3-4, ILEIA, The Netherlands

Luff, M. L. (1983); The potential of predators for pest control. *Agriculture, Ecosystems and Environment*, 10, p. 159-181.

Maginnis, S, W Jackson and N Dudley (eds) (forthcoming); *Guidelines for the development of a landscape approach to forest conservation,* WWF/IUCN, Gland, Switzerland

Matthey, W, J Zettel and M Bieri (1990): Wirbellose Bodentiere als Bioindikatoren für die Qualität von Landwirtschaftsböden. *Bericht 56 des Nationalen Forschungsprogramms Boden*, Liebefeld-Bern, Switzerland

Mattsson E and O Kvarnbäch (2000); A Swedish project for co-operation between nature conservation and organic agriculture organisations, in Stolton *et al*

Miller, K, E Chang and N Johnson (2001); *Defining Common Ground for the MesoAmerican Biological Corridor*, World Resources Institute, Washington DC, USA

Moussouris, Y and P Regato (1999); Forest Harvest: Mediterranean woodlands and the importance of non-timber forest products to forest conservation, *Arborvitae supplement*, WWF and IUCN, Gland, Switzerland

Myers, D and Stolton S [editors] (1999); *Organic Cotton: From Field to Final Product*; Intermediate Technology Publications, London

Neugebauer B and A M Ek (2000); Trees for People – A Mayan strategy towards organic agriculture, in Alföldi *et al*

Nicholls, C, M Parrella and M Altieri (2000); Establishing a plant corridor to enhance beneficial insect biodiversity in an organic vineyard, *Organic Farming Research Foundation*, Winter 2000, No. 7, Santa Cruz, USA

Nyffeler, M. and G Benz (1987); Spiders in natural pest control: A review. *J. Appl. Entomol*., 103, p. 321-339

Pagiola, S and J Kellenberg with L Vidaeus and J Srivastava (1997); *Mainstreaming Biodiversity in Agricultural Development Toward Good Practice*, World Bank Environment Paper Number 15, World Bank, Washington

Parrish, J, Reitsma R and R Greenberg (1998); Cacao as Crop and Conservation Tool. Lessons from the Talamanca Region of Costa Rica, paper presented at Cacao Workshop in Panama (March 30-April 2 1998); Smithsonian Migratory Bird Center, http://natzoo.si.ed/SMBC/Research/Cacao/cacao.htm

Perfecto, I, R A Rice, R Greenberg and M E van der Voort (1996); Shade coffee: a disappearing refuge for biodiversity. *BioScience* 46: 598-608

Pfiffner, L (2000); Significance of organic farming for invertebrate diversity –enhancing beneficial organisms with field margins in combination with organic farming in Stolton *et al*

Pfiffner, L. and U Niggli (1996); Effects of bio-dynamic, organic and conventional farming on ground beetles (*Col. Carabidae*) and other epigaeic arthropods in winter wheat. *Biological Agriculture and Horticulture*, 12, p. 353-364.

Pimentel, D, U Stachow, D A Takacs, H W Brubaker, A R Dumas, J J Meaney, J A S O'Neil, D E Onsi and D B Corzilius (1992); Conserving biological diversity in agricultural/forestry systems. *BioScience* 42:354-362.

Pryor, A (2000); Organic certified products as a basis for sustainable management of biological reserves: Case study of Guayaki biological reserve in Paraguay, in Alföldi *et al*

Rice, R and J Ward (1996); *Coffee, conservation and commerce in the Western Hemisphere*, Smithsonian Migratory Bird Center and Natural Resources Defence Council, Washington DC, USA

Saacke, B. and S. Fuchs (1998): *Ornithologische und entomologische Erhebungen zu den Auswirkungen eines modifizierten Produktionsverfahrens, insbesondere Verbesserung der Dichte und des Bruterfolges der Feldlerche, auf biologisch-dynamisch bewirtschafteten Feldfutterschlägen im Biosphärenreservat Schorfheide-Chorin*, Studie im Auftrag der Biosphärenreservatsverwaltung Schorfheide-Chorin

Salas, A (2000); The Mesoamerican Biological Corridor, Abstract prepared for the *Beyond the Trees* conference, WWF, Switzerland

Sams, C (1997); Integrating the social agenda: benefits to business, in Soil Association (1997); *The Future Agenda for Organic Trade*, proceedings of the 5th IFOAM International Conference on Trade in Organic Products, Soil Association, Bristol, UK

Shiva, V (1996); Towards a biodiversity-based productivity framework, *ILEIA Newsletter*, December 1996, **12**:3, the Netherlands

Smithsonian Migratory Bird Center (1994); *Why Migratory Birds are Crazy for Coffee*, Fact sheet 1, Washington DC, USA

Smithsonian Migratory Bird Center (2001); *Shade Management Criteria for... "Bird Friendly®" Coffee*, Washington DC, USA

Soil Association (1990) *Guidelines for Conservation*, Soil Association, UK

Soil Association (1999); *Briefing paper: Genetic Engineering – the impact on environment and wildlife,* Soil Association, Bristol

Soto, G (2001); Conservation or farmers' well-being, *Ecology and Farming* No 28*,* IFOAM, Germany

Stein-Bachinger, K, B. Saacke, S. Fuchs, N. Sperzel, H. Petersen, M. Flade and J. Peil (2000), Nature preservation strategies on leys (legume-grass crops) – effects on ground-breeding birds, fodder quantity and quality for ruminants of organic farming within the Schorfheide-Chorin biosphere reserve, in Stolton *et al*

Steinborn, H. and B Heydemann (1990); Indikatoren und Kriterien zur Beurteilung der ökologischen Qualität von Agrarflächen am Beispiel der Carabidae Laufkäfer. *Schriftenreihe Landschaftspflege und Naturschutz*, 32, p. 165-174, Germany

Stolton, S, B Geier and J McNeely (eds) (2000); *The Relationship between Nature Conservation, Biodiversity and Organic Agriculture*, IFOAM, Germany

Stolze, M, A Piorr, A Häring and S Dabbert (2000); *The Environmental Impacts of Organic farming in Europe. Volume VI Organic Farming in Europe: Economics and Policy*, University of Hohenhiem, Germany

Stopes, C, M Redman and D Harrison (2000); The organic farming environment; *Ecology & Farming*, 23: Jan-April 2000, IFOAM, Germany

Stopes, C, M Redman and D Harrison (2000a); Enhancing the environment through improved organic standards – UK proposals and organic farmer response, in Alföldi *et al*

Svensson, A and T Ingelög (1990); Floran I dagens och morgondagens jordbrukslandskap – hot och möjligheter, in H Åström (ed), *Fakta Mark/Växter*, 14:4, Uppsala, Sweden

Teshome, T (2000); Resource Conserving Technologies for Ethiopian Poor Farmers, in Alföldi *et al*

The Nature Conservancy (2000); *The Five-S Framework for Site Conservation: A practitioner's handbook for Site Conservation Planning and Measuring Conservation Success.* Arlington, Virginia, USA, or see www.consci.org/scp

Tucker, G and M Heath (1994*); Birds in Europe: Their Conservation Status*, BirdLife International, UK

Ulãák, Z, K Vincenecová and R Trávníãek (2000); Organic agriculture and landscape management – does the public care?, in Alföldi *et al*

UN NGO Liaison Service (1993); *Go Between* number 43, December 1993, quoting the FAO's *First World Watch List for Domestic Animal Diversity*, Geneva, Switzerland

Van Mansvelt, J D and M J Van der Lubbe, M.J., (eds.), (1999): Checklist for Sustainable Landscape Management. Final report of the EU concerted action AIR3-CT93-1210: *The Landscape and Nature Production Capacity of Organic/Sustainable Types of Agriculture*. Elsevier, Amsterdam

Vreeland, J (2000); Systems and Genetic Diversity in the High Jungle of Peru, in Stolton *et al*

Wachendorf, M and F Taube (1996); *Agronomische und ökologische Aspekte einer Grünlandbewirtschaftung im ökologischen Landbau.* Versuchsbericht ökologischer Landbau, Landwirtschaftskammer Schleswig-Holstein, Germany

Wairegi, F (2000); Biodiversity conservation of indigenous food crops to improve household food security and poverty alleviation, in Alföldi *et al*

Wanke, D (2000); The chances of survival of a local rare and endangered cattle breed – the Hinterwälder cattle in the southern Black Forest, in Alföldi *et al*

Werner M R and D L Dindal (1990); Effects of conversion to organic agriculture practices on soil biota, *American Journal of Alternative Agriculture*, Vol 5, No. 1

Wiseman, R and Hopkins, L (2001); *Sowing the seeds for sustainability: Agriculture, Biodiversity, Economics and Society*, IUCN, Gland, Switzerland

Woese, K, D Lange, C Boess, and K-W Bögl (1997); A Comparison of Organically and Conventionally Grown Foods - Results of a Review of the Relevant Literature*, Journal of the Science of Food and Agriculture,* Pages: 281-293, Volume 74, Issue 3, UK

World Conservation Monitoring Centre (WCMC) (1992); *Global Biodiversity: Status of the Earth's living resources*, Chapman & Hall, London

World Resources Institute (1992); *Biodiversity Glossary of Terms*, Washington DC, USA

World Resources Institute (1997); *Building Complementaries*, Washington DC, USA

Yardim, E N and C A Edwards (2000); The effects of weed control practices on surface-dwelling arthropod predators in tomato agroecosystems, in Alföldi *et al*

About IFOAM

IFOAM, with some 750 members in over 100 countries, unites and represents the worldwide organic agriculture movement. The federation's main function is to coordinate the international organic movement. **IFOAM** is a democratic federation with all fundamental decisions taken at its general assemblies.

Major aims and activities are:

- *To provide authoritative information about organic agriculture, and to promote its worldwide application.*
- *To exchange knowledge (e. g. via conferences, trade-fairs, and publications).*
- *To represent the organic movement at international policy making forums (IFOAM has for example consultative status with the UN and FAO).*
- *To make an agreed international guarantee of organic quality a reality.*
- *To establish, maintain and regularly revise the international "IFOAM Basic Standards" (translated so far into 20 languages!) as well as the "IFOAM Accreditation Criteria for Certifying Programmes".*
- *To build a common agenda for all stakeholders in the organic sector, including producers, farm workers, consumers, the food industry, trade and society at large.*

What IFOAM has to offer

IFOAM offers many platforms for information exchange e.g. at the Organic World Congress and numerous other international, continental or regional IFOAM events. The magazine "Ecology and Farming", conference proceedings and other publications are also important information and networking tools. **IFOAM**'s international lobby activities give the organic movement a voice and influence. **IFOAM** is implementing a four year project programme known as "I-GO" (IFOAM - Growing Organic) supporting organic movements in developing countries.

Benefits for IFOAM affiliation

IFOAM, as a federation of organic "movements", offers affiliate status to associations, institutions, traders and others that are active in the organic sector. Organisations whose activities are predominantly organic are granted voting rights. Others may join as associates while individuals are invited to join IFOAM as supporters.

Some General benefits:

- *To participate in IFOAM's internal organisation.*
- *To benefit from and contribute to IFOAM's international lobby activities.*
- *To influence and contribute to the standard setting process for the IFOAM Basic Standards and the Accreditation Criteria.*
- *To increase market access via the IFOAM International Organic Guarantee System, which includes the Accreditation Programme and the IFOAM Seal.*

Direct benefits:

- *Subscription to one of the IFOAM's magazines (English or German).*
- *The Newsletter " IFOAM- in Action" (English, Spanish or French).*
- *20% discount on IFOAM publications and discount at IFOAM events.*
- *Listing in the IFOAM Directory and a free copy.*
- *Free copy of the IFOAM Basic Standards.*

For more information visit our website **www.ifoam.org** or contact:

IFOAM Head Office, c/o Ökozentrum Imsbach, D-66636 Tholey-Theley

Phone: +49-6853-919890 Fax: +49-6853-919899 Email: headoffice@ifoam.org