Biodiversity.....the vital ingredient in our food

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...the vital ingredient in our food...

This year is the International Year of Biodiversity[1]. It is intended to be an opportunity to recognise the vital role biodiversity (the diversity of animals, plants and microbes) plays in sustaining life on Earth, to understand what is happening to biodiversity and why, and to share experiences about what people are trying to do to combat biodiversity loss. 2010 is also a year in which we are becoming increasingly concerned about food security[2]. This is a complex issue, but essentially boils down to concerns about how we are going to feed an increasing human population in the face of climate change and other pressures on how we use land.

At first sight biodiversity and food security seem separate issues. Conserving biodiversity seems to be mainly about protecting charismatic, endangered wildlife such as pandas and tigers; whereas food security seems to mainly concern how we increase the efficiency with which we use land for food production. Perhaps it is not surprising we tend to see these as separate issues. Our dependencies on wild nature are often poorly understood by many people and frequently overlooked. So, what are the relationships between biodiversity and our food, and why are they so important?

We are what we eat and we eat biodiversity. Wild nature directly provides food. For example, marine fisheries are a significant source of protein for nearly half the world's people. Our crop and livestock farming systems are based on domesticated animals and plants derived from wild relatives. These are relationships with biodiversity that we probably all recognise. What is often less obvious are the indirect roles biodiversity plays in food production. Biodiversity is also intimately involved in a whole range of processes that support our food production systems. Many crops rely on insect pollinators, to some extent, for their production (see highlighted text), and on insect predators and parasites to control crop pests. Soil organisms and plants play critically important roles in the nutrient and water cycles upon which many crop and livestock production systems depend. The complete list of services provided by biodiversity is extensive.

© National Fruit Collection

Apple orchard in flower

© Duncan Westbury

Wood mouse

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Wild solitary bee, Osmia rufa, on an apple flower

Since biodiversity is so important for our food production, it would seem reasonable to assume that we manage our food production systems to protect biodiversity. Worryingly, the opposite seems to be true. Agriculture is the major cause of biodiversity loss globally, in Europe and in the UK. One consequence of this is that food production systems often cause the loss of the very biodiversity on which they depend. Examples include current declines in pollinating insects (see highlighted text) and the widespread declines in soil fertility that threaten food production in many developing countries. Without biodiversity, we are forced to rely on artificial surrogates such as honey bees to pollinate crops, chemical herbicides and pesticides to control pests and diseases, and chemical fertilisers to provide nutrients. This strategy is risky if the artificial systems fail and wild nature is unable to plug the gap.

There is evidence of significant current risk to these artificial systems: honey bees are declining in North America and Europe, raising concerns about

Pollination services to UK agriculture

Many of the UK's crops rely, at least in part, on insect pollinators for their production and include oilseeds, apples, strawberries, tomatoes, beans and cucumbers among many others. This pollination service is provided by a wide variety of wild bees, such as bumblebees and solitary bees, managed honeybees and other insects, and has an estimated value to UK agriculture of £440m per year[4]. Pollinating insects also ensure that many forage crops, such as clover, are pollinated and these make an important contribution to the healthy diets of our cattle. The demand for insect pollination services is expected to increase as the area of pollinator-dependent crops continues to increase (38% since 1989), and this may accelerate further if predicted demands for new fruit and bioenergy crops are realised. However, in stark contrast to the increasing demand for pollination services, there have been severe losses of the insects that provide them. For instance, the UK has more than 250 species of wild bee, which are important pollinators of crops and many wild flowers, yet in more than half of British landscapes their diversity has massively declined since 1980[5]. The managed honeybee, which also contributes to pollination, has declined too: since 1985, colony numbers have dropped by 54% in England, 23% in Wales and 15% in Scotland[6]. As the supply and demand for pollination services continues to diverge, the need to protect and effectively manage the providers of this ecosystem service is a priority concern for UK agriculture. The ability of the UK to produce a wide variety of products reliant on insect pollination underpins consumer choice, contributes to our healthy diets (many of our 'five a day' rely on pollinators) and helps ensure our food security. Pollinators are a key component of UK biodiversity and important for many sectors of society.

crop pollinations services; resistance to herbicides and pesticides is increasing, threatening their ability to control pests and diseases; chemical fertilisers are an important source of environmental pollution, particularly in river and lake systems. Part of the solution to these problems is to enhance the biodiversity value of our agro-ecosystems. In the long term, it is essential to ensure that we continue to have the biodiversity available that our food production systems require. It is standard practice in engineered systems from aeroplanes to buildings to design systems that minimise the risk of failure. We need the same approach to food production systems and their associated biodiversity.

All of this discussion seems remote from the traditional interests of biodiversity conservationists. Much of existing conservation action is targeted towards rare species or species that have recently experienced significant declines in abundance. These efforts are, however, linked to our food because agriculture is the major cause of unfavourable conservation status.

Recent work has shown that around two-thirds of over 400 species of UK animals and plants have declined over the last 40 years due to the way we manage our crop and livestock production systems[3]. Although some of these species are potentially important to our food production (eg. bees), most are not. The conservation of these other species is largely motivated by their cultural importance. Ignoring these other biodiversity values would, however, be unwise. The foot-and-mouth crisis in 2001 showed us that the cultural value of the countryside, through tourism, was in monetary terms more significant than the livestock systems under threat from the disease. This tells us that when considering the relationships between biodiversity and our food we need to be mindful of all the beneficial services biodiversity provides not just those that directly affect food production.

We need 21st Century food production systems to provide a secure and sustainable food supply for a growing human population in the face of climate change. Biodiversity has an enormously important role to play in helping us achieve this, and hence needs to be a fundamental component of research, policy and practice relating to food security. To realise this potential, we need to recognise the full range of values and benefits that biodiversity provides. If we do so, we will ensure that food production systems continue to receive key services from biodiversity; but we will also ensure that food production systems are designed to minimise adverse biodiversity impacts. Biodiversity affects what we eat; what we eat affects biodiversity. Remember this next time you are pushing your trolley through the supermarket.

1 www.cbd.int/2010/about

2 www.foodsecurity.ac.uk

3 Butler, S. J. (2009). A cross taxonomic index for quantifying the health of farmland biodiversity. J. Appl. Ecol., 46, 1154-1162

4 POSTnote 348 Insect Pollination. Parliamentary Office of Science and Technology: www.parliament.uk/parliamentary_offices/post/pubs2010.cfm

5 Biesmeijer J C et al. (2006). Parallel declines in pollinators and insect-pollinated plants in Britain and the Netherlands. Science 313, 351-354

6 Potts S G et al. (2010). Declines of managed honeybees and beekeepers in Europe. Journal of Apicultural Research 49, 15-22

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