Canolfan Organig Cymru
Organic Centre Wales

# Environmental and biodiversity impacts of organic farming in the hills and uplands of Wales

Organic Centre Wales

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# EXECUTIVE SUMMARY

1. Organic farming is based on principles of co-existence with natural systems, the minimisation of pollution and damage to the environment, and the promotion of the health of soil, plant and animal to produce healthy food with high standards of animal welfare and respect for the wider social and ecological impacts of the agricultural system.
2. Organic Farming has become an important aspect of EU agri-environment policy. Since the implementation of EC Reg. 2078/92 the EU promotes organic farming explicitly on its positive effects on the environment.
3. The environmental and biodiversity benefits of organic systems in the lowlands for mixed farming is generally accepted (Shepherd, 2003) but similar benefits for upland systems have not been identified. This report has been produced by OCW with funding from CCW to address this gap. Where relevant, means to ensure the beneficial impacts through changes to agri-environment schemes, organic standards, and education and dissemination are identified.
4. Hill and uplands are characterised as areas over 200m above sea level where the physical landscape results in production constraints.
5. Biodiversity losses linked to changes in hill and upland agriculture include the erosion of genetic diversity in farmed livestock and crops as well as in wildlife and flora, a reduction in habitat, soil and wildlife diversity and the loss of local knowledge and farming culture.
6. The organic approach to sustainable agriculture in hill or upland systems is through the use of multi species swards and mixed stocking.
7. The report identifies potential points of difference between organic and conventional management practices with regard to hill and upland farming and highlights research requirements to confirm or explore those potentials.
8. Conventional farms can adopt any or all of the practices of the organic farming system, but the engagement with the entire system and annual inspections are specific to the organic farmer.
9. The impacts are not just determined by the system of organic regulations and but also by the management ability and technical skills of the farmer and workers.
10. The practices on **organic livestock** farms identified that may differ from conventional and have direct biodiversity or environmental impacts are: lower stocking rates (overall manure loading maximum of 170kg/N/ha/yr); an adjustment of the stocking balance (increasing ratio of cattle to sheep); keeping indigenous breeds and strains adapted to the environmental conditions on the farm; limitation on products to control external parasites; reduction and restriction on the use of prophylactic veterinary medicines; the use of forage-based diets; storage and use of slurries, manures and composts, and constraints on the import and export of nutrients.
11. Organic practices in management of **grassland and crops** identified that may differ from conventional and have direct biodiversity or environmental impacts are: cessation of N fertiliser use; restriction on P & K use; use of lime to maintain pH; use of clovers and herbs in grass leys; cessation of use of chemical pesticides and all herbicides; mechanical and manual weed control and sensitive

and timely cultivations; the use of mixed farm systems and rotations on in-bye land; the use of cover crops and undersowing; the use of green manures.

12. Organic regulations do not require habitat creation, but standards state, “that concern for the environment should manifest”…“in high standards of conservation management throughout the organic holding”.

Discussion

13. Apart from practices that impact directly on biodiversity or the environment, each management decision on the farm will have knock-on effects that have their own consequences, for example welfare standards for livestock require bedding materials and greater housing space.
14. Organic farms operating solely in the hills and uplands can only be part of a system. Use of in-bye land or having a relationship with lowland holdings to provide winter-feed and forage is necessary to comply with regulations. This will increase the amount of lowland managed organically, bringing widely recognised environmental benefits.
15. Organic agriculture is, by legal definition, a system of production and is based on principles and uses practices adopted to optimise the health of the system. Any farmer may adopt individual practices, and the Tir Gofal scheme provides an opportunity for farmers to provide positive conservation measures, whether conventional or organic. Farming under the EU Regulation defining Organic farming provides assurance to the end consumer that the system used to produce or process the food product was according to that system. This provides a reliable means for consumers to support a system of agriculture that fits more closely with their expectations than intensive systems.
16. Any advantages of lower stocking rates and mixed stocking will only be maintained while organic farms are viable. Organic labelling provides an opportunity for consumers to make a positive choice for high welfare, environmentally benign systems; however the difficulties of marketing, the lack of consumer awareness of food production issues and unwillingness to pay are barriers to access to premium markets for many producers.

Conclusions:

17. The potential benefits of individual practices outlined in the document are often clear, but there are currently few data to confirm the extent of some of the practices that may have most beneficial impact. The need for data on actual practices of the organic farmers in the hills and uplands is therefore highlighted.
18. Few Standards changes are recommended, however the monitoring of derogations to standards and use of restricted veterinary inputs is recommended.
19. Research and development needs, technical, education and dissemination, and agri-environment policy issues which may establish, ensure, or enhance the environmental and biodiversity impacts of organic farming in the hills and uplands are outlined.
20. Infrastructure work to integrate hill and upland and lowland systems is necessary to facilitate organic farming in the uplands; this may assist the viability of lowland organic holdings: the environmental benefits of which are established.

# 1 INTRODUCTION

## 1.1 Background

This desk study has been produced by Organic Centre Wales with financial support from the Countryside Council for Wales and the Welsh Assembly Government. The aim of the report is to identify the extent of environmental and biodiversity impacts of organic farming in the hills and uplands, to inform future decision making with respect to agri-environmental (including organic farming) schemes, and to identify research priorities and standards and to help identify extension needs of upland and hill organic farms.

The impact of farming practices, both conventional and organic, on agricultural and non-agricultural biodiversity and the environment has been the subject of a substantial body of research carried out by numerous governmental and conservation bodies in recent years. However, research on organic farming has concentrated on lowland arable and stock farming (Shepherd et al., 2003). There is a growing awareness from this research of the beneficial effects of organic farming practices on biodiversity and the environment, as well as the potential cost effectiveness of an organic approach. It is unclear, however, how this work can be applied to the situation in the hills and uplands, and whether the environmental benefits of organic farming will be as great in this context. It is therefore necessary to identify approaches and practices adopted by organic farmers that contrast with conventional practices and which may have different impacts on the environment. Additionally, as increasing numbers of farmers in the uplands are adopting organic methods that were designed around lowland systems, there is a need to look at the applicability of standards and consider where there is a need for changes.

## 1.2 Objectives of the Report

To achieve the aim of the project set out above, the following objectives have been defined:

- To examine the body of existing research into the environmental and associated biodiversity impacts of organic farming on upland habitats.
- To assess the transferability of impacts, processes and practices based on studies of organic lowland agriculture and to identify gaps and weaknesses in existing knowledge. The most recent and comprehensive UK review of studies of the environmental impact of organic agriculture is Shepherd *et al*.(2003).
- To identify other potential impacts that may be expected to result from organic farming in upland and pastoral situations or from research on general (conventional) agriculture.

On the basis of the above,

- To make a preliminary assessment of the extent of any differences in environmental impact that might be expected from organic farming relative to conventional systems.
- To ensure that the environmental benefits identified are achieved in practice and enhanced where possible and to make specific recommendations for:
    - conditions to be applied in organic farming agri-environmental schemes
    - priorities for future research

- recommendations for organic standards development
- recommendations for education and dissemination.

## 1.3 Policy context

Organic farming has become an important aspect of European agri-environment policy. Since the implementation of EC Reg. 2078/92, the EU promotes organic farming based explicitly on its positive effects to the environment (Stolze et al., 2000)

The potential for positive environmental impacts resulting from organic farming is also widely recognised at UK and Welsh levels, both by the inclusion of organic farming as an environmentally benign system in agri-environmental, rural development and quality policy measures, and by the Welsh and English Action Plans (DEFRA, 2002; WOAD, 1999). The Welsh Assembly Government's Farming for the Future (National Assembly for Wales, 2001) report noted that progress towards the 'new direction' would in part be monitored by the proportion of agricultural land in 'organic or in conversion to organic status' and the National Assembly's Agriculture and Rural Development Committee's report *The Future of Organic Farming in Wales* (National Assembly for Wales, 2002) concluded that "organic faming is an important part of the Assembly's drive to make Welsh agriculture environmentally and economically sustainable".

### 1.3.1 Policy Support in Wales

Policy support for organic farming was introduced in England and Wales in 1994, with an increasing acceptance of the biodiversity benefits of organic farming.

The Organic Farming Scheme (OFS) was launched in November 1999, following the closure and review by MAFF (now DEFRA) of the previous England & Wales Organic Aid Scheme (1994-1998). The original OAS scheme had attracted limited uptake due to the very low level of financial support, with most land in Wales only qualifying for LFA payment rates. Like the OAS scheme, in the new Organic Farming Scheme farmers were required to commit themselves to organic management for a five-year period, with tapered payments front-loaded to compensate for income foregone during the conversion period.

The Organic Farming Scheme payments represented a substantial increase on the previous situation, and the new scheme coincided with the strong interest in conversion as a result of high prices (compared with conventional) for organic meat and milk. This meant that many producers started conversion simultaneously in late 1999.

The Organic Conversion Information Service (OCIS) Wales was launched in October 1996, aiming to provide farmers considering conversion with the information they needed to make an informed decision. Since its launch in Wales some 3,657 farmers have registered with the service (13% of the total number of holdings in Wales) and nearly 3,000 advisory visits have been delivered to 2,000 farmers. The majority of farms visited were beef and sheep farms followed by dairy (OCW, 2003).

New organic maintenance payments under the Organic Farming Scheme for Wales were announced in February 2003 as one of the 'agri-environment' payments to farmers for managing their land for wildlife and wider benefits to the environment. These payments will be available to all registered organic producers for an initial period of five years.

### 1.3.2 Agri-Environment reform

In 2003, the Welsh Assembly Government issued a consultation on reform of Agri-environmental policy in Wales. This document proposed a new tiered approach to agri-environment schemes, with Tir Gofal in the middle band, and co-operative actions at the top, with an 'Entry level' which would be accessible to most producers at the base. The consultation document included specific questions relating to organic producers, and indicated diagrammatically that organic farmers would have access to funding at the 'Entry level' only. Organic Centre Wales' consultation response (available at: http://www.organic.aber.ac.uk/policy/#agenv ) stressed the need for a re-worked organic farming scheme to be available at all levels of the proposed new schemes; at entry level, at Tir Gofal level, and for wider co-operative actions. This review provides a potential route for integrated support for organic farming within a suite of agri-environment schemes.

### 1.3.3 Environment Impact Assessment regulations

NAW Regulations introduced in August 2002 provide guideline criteria on operations that would be subject to the Environmental Impact Assessment regulations for cultivating previously uncultivated land and semi-natural areas, which apply to both organic and conventional farmers. These guidelines confirm that the intention is to apply these regulations to the following situations:

All semi-natural areas including:

- Mountain, heath, moorland and cliff-top rough grazing,
- Traditional herb-rich "wild flower" hay meadows, wet rough pastures with rushes and enclosed semi-natural rough grazing.
- Scrubland,
- Wetlands, including bogs, marsh, fens, and saltmarsh
- Wildlife habitats on farms including watercourses, ditches, open water and ponds, especially where there are adjoining semi-natural areas.

The EIA Regulations do not apply to arable land, grass leys nor other improved land that has been regularly cultivated and fertilised, nor to woodland.

The Regulations apply to projects that will significantly change the way that land is farmed in semi-natural areas and uncultivated land. They cover all projects where the aim is to farm such land more intensively.

Examples of activities that are affected include:

- Moorland or hill land improvement by surface cultivation and reseeding;
- Introduction of livestock or significantly increasing stocking rates on hill land;
- Moorland gripping;
- Reseeding traditional herb rich "wild flower" hay meadows or using them for silage;
- Drainage of rushy hollows, flushes or traditional meadows by installing open or closed ditches, moling, subsoiling or under-drainage;
- Straightening streams and watercourses in ways that permanently damage surrounding semi-natural vegetation;
- Infilling ponds and rushy hollows and land levelling operations.

### 1.3.4 Environment Opportunities Review

A further opportunity to improve environmental impacts of farming was launched in December 2003 as part of the Farming Connect (Welsh Objective 1 Programme) Farm Business Development Plan (FBDP) in the form of Environmental Opportunity Reviews. At the time of writing it appears that this review will only be available to Welsh farmers requesting an FBDP through Farming Connect, but this scheme provides external assistance in identifying potential negative impacts of business changes using trained ecologists.

### 1.3.5 Farming and Wildlife Advisory Group

FWAG exists to provide farmers, landowners and other clients with the best opportunity for environmental gain through cost effective, quality solutions. Although there was a FWAG presence in Wales until 1991, more recently it only maintained staff in in England and Scotland, but since 2002 regional officers operate within Wales.

FWAG provides farmers and landowners with practical advice on making adjustments to farm operations and enhancing farm features in order to support wildlife, landscape, archaeology, access and other conservation issues (http://www.fwag.org.uk/). FWAG therefore provides a potential route for increasing environmental and conservation awareness and assistance with habitat identification.

FWAG advice is based on:

- a whole farm approach since all parts of the farm are important for conservation;
- tailor-made conservation plans designed to suit the farm type, location and the farmer's aspirations, commitment and pocket;
- a partnership with the farmer, conservation bodies, farming organisations and government agencies;
- zero/low cost management options where possible (conservation need not be costly);
- identification of appropriate grant sources;
- the understanding that conservation need not compromise the farm's commercial objectives.

Source: http://www.fwag.org.uk/ accessed 2/12/03.

The FWAG website also has pages on environmentally responsible farming.

### 1.3.6 Priority BAP Habitats in the Uplands of Wales

The Biodiversity Action Plan (BAP) is a UK government initiative to maintain and enhance biodiversity. The statutory conservation agencies including Countryside Council for Wales, English Nature and other organisations from across all sectors are committed to achieving the Plan's conservation goals over the next 20 years and beyond (DoE, 1994). Many of the BAP objectives are supported by existing projects such as the designation and management of Sites of Special Scientific Interest (SSSIs) and the protection of priority species through initiatives such as the Species Recovery Programme (English Nature only).

# 2 METHODOLOGY

## 2.1 Assessing the Environmental Impacts of Organic Farming

Any manipulation of an area of land will affect the ecological and biological processes that the land maintains. Thus there are inevitable impacts of organic farming methods on the environment, both positive and negative, and the impacts are not just determined by the system of organic regulations and their interpretation in Organic Standards (see section 4.2.1) but also by the management ability and technical skills of the farmer and workers.

The environmental impacts of organic farming, whether positive or negative, may be direct or indirect consequences of organic farming standards and organic farming scheme requirements. To the extent that specific practices are prescribed or prohibited and their implementation monitored by inspection procedures, the environmental impacts can be expected with a high degree of certainty and be directly attributable to organic management.

Other indirect impacts may be highly significant, and are normally expected consequences of organic management, but with no guarantee that they will in reality occur. For example, the restrictions on herbicide use in organic farming may lead arable farmers to increase the proportion of spring to winter cereals for husbandry reasons, benefiting farmland birds. This would normally be expected on organic arable holdings, but an increase in the proportion of spring cereals is not a specific requirement of organic standards.

It is also important, when making comparisons with the environmental impacts of conventional farms, to recognise that all practices used by organic farmers can also be used by conventional farmers. This has led to an over-simplistic argument that there are no *intrinsic* benefits to be expected from organic farming that could not also be achieved by conventional farmers. What is at issue, however, is whether the practices are formally required or normally expected under organic management, but only optional and not normally typical of conventional management. In addition, while individual practices may be transferable to conventional systems, the combination of many changes in a whole farm system approach under organic management can result in a synergy and result in additional environmental impacts; the whole being greater than the sum of the parts.

## 2.2 Approach taken in this report

### 2.2.1 Systems and setting

The hill, upland and associated lowland systems to be discussed are characterised, and set the context of the development of hill farming in Wales and the pressures for change.  The organic approach is then outlined, summarising the legislative and policy framework, the policy support in Wales, and current environmental requirements associated with policy support.

### 2.2.2 Principles into practice

How the principles of organic farming are translated into practice in the hills and uplands is set out in some detail; these practices, where they differ from conventional practice and are likely to have environmental impacts, are later examined in detail in Section 5 (livestock practices) and Section 6 (forage and cropping).

The impact of organic approaches and practices on the non-farmed or ‘wildlife’ component (including field margins, hedgerows, other non-cropped areas, woodlands and unimproved permanent pastures/SNRG) as well as the ‘farmed’ component within the whole organic system are also considered.

It should be noted that some organic practices that may not immediately suggest environmental impacts but are likely to have indirect impacts are not considered using the same process because of the complexity of interlinked practices. An example is the livestock health and welfare requirements in the Organic Standards. These set minimum requirements for adequate space, prohibit the permanent tethering of animals and require the use of appropriate bedding materials. This means that no more than half of the housing area may be slatted (UKROFS, 2001) Chapter 1B, reg. 8.3.5). These standards tend to favour the production of farmyard manure (FYM) rather than slurry, and may mean larger buildings are required and straw to be imported. They also favour more hardy, traditional breeds rather than breeds that require long periods of housing.

One aim of the report is to anticipate the impact of converting intensive conventional hill systems to organic farming; therefore Section 4.3 looks at the conversion process and changes.

### 2.2.3 Impacts

Each of the organic farming practices is set out and the key impacts assessed under the following headings:

**Biodiversity**: Pollution effects, habitat loss/degradation, loss of genetic diversity, loss of species, reduction in species populations
**Soil quality**: Pollution effects, leaching, erosion, degradation
**Air quality**: Pollution effects
**Water quality**: Pollution effects,
**Non- renewable resource use**: Fossil fuels and water use, sustainability

Where headings are not shown under individual practices in Sections 5 and 6, either no information is available or no impact is expected.

### 2.2.4 Frequency and extent of practices

The frequency and extent of the adoption of the organic farming practices discussed in this report is difficult to quantify. One approach is to develop the scoring system used in the ADAS Review of the Environmental and Socio-Economic Effects of Organic Farming. This attempted to assess the extent to which systems of organic farming benefit key species and habitats that have been identified in the UK Biodiversity Action Plan by reviewing the regulatory framework of organic farming and relating it to actions within the UKBAP to which the (then) National Assembly for Wales Agriculture and Rural Affairs department (now Department for Environment Planning and Countryside) committed itself as an actionee.

Following this approach, it is possible to identify four distinct levels of organic regulation in Wales at which environmental benefits may accrue. In this exercise, each organic farming practice is assessed and scored between 1- 4 against the above levels of environmental prescription. The position is summarised in Table 2.

**Table 1 Levels of Environmental Prescription**

| *Level* | *Prescriptions / Standards* | *Score* |
|---|---|---|
| 1 | Those arising specifically from the implementation of baseline EU/UK organic farming standards, *e.g.* prohibition on the use of chemical pesticides and herbicides | EU/UK standards to which all organic farmers must comply scores 4 |
| 2 | Those arising from the implementation of sector body standards that include environmental prescriptions not required by UK baseline standards, e.g. Soil Association Certification standards, Organic Farmers and Growers standards | Sector Body standards to which only their licensees must comply scores 3 |
| 3 | Those arising from the specific environmental management prescriptions in the Organic Farming Scheme Wales, *e.g.* prohibition on the cultivation or application of manures within one metre of boundary features. | Organic Farming Scheme Prescriptions to which only beneficiaries must apply scores 2 |
| 4 | Those arising from general organic farming recommendations *e.g.* changes in the direction of mixed farming, but which are not mandated by organic standards | Recommendations by organic bodies which are not mandatory scores 1 |

The scores are an indication of the extent to which each organic farming practice may be frequent and widespread amongst hill and upland organic farmers in Wales. The approach could be developed by weighting the scorings to reflect, for example, the relative numbers of organic farmers certified by each sector body in Wales, and by the number in the Organic Farming Scheme. In this initial exercise such weighting is not considered worthwhile as it is unlikely to alter the results.

Each positive correlation between an organic farming practice and a level of environmental regulation / recommendation is given an appropriate score between 0 and 4. A zero score indicates that the practice is unlikely to apply to the majority of hill and upland farms, although the practice may be more widespread on associated lowland farms.

**Table 2 Extent of Organic Farming Practices**

| *Organic farming practice* | *UK/EU Standard* | *Sector body standard* | *OFS prescription* | *Recommended but non-mandatory* | *Comment* |
|---|---|---|---|---|---|
| 1. Reduction in stocking rates (Maximum stocking rate) | 4 (UKROFS Reg 1B7.1) | | | | Maximum stocking rate defined by nitrogen loading (170 kg N/ha/yr) |
| 2. Adjusting stocking balance | | | | 1 | Low score, but likely to occur for reasons outlined |
| 3. Keeping indigenous breeds | | | | 1 | Low score, but positive evidence on its frequency |
| 4. Cessation of use of OP dips | 4 | | | | Mandatory indicating widespread adoption |

| *Organic farming practice* | *UK/EU Standard* | *Sector body standard* | *OFS prescription* | *Recommended but non-mandatory* | *Comment* |
|---|---|---|---|---|---|
| 5. Reduced use of vet/meds | 4 | | | | Mandatory indicating widespread adoption |
| 6. Use of forage based diets | 4 | | | | Mandatory indicating widespread adoption |
| 7. Storage, use of slurries & manures | 4 | | | | Mandatory indicating widespread adoption |
| 8. Cessation of N use | 4 | | | | Mandatory indicating widespread adoption |
| 9. Restriction on P & K use | 4 | | | | Mandatory indicating widespread adoption |
| 10. Use of clovers and herbs in grass leys | | | | 1 | Low score, but likely to occur for reasons outlined |
| 11. Use of lime | | | | 1 | Low score, but likely to occur for reasons outlined |
| 12. Cessation of biocide use | 4 | | | | Mandatory indicating widespread adoption |
| 13. Mechanical and manual weed control | | | | 1 | Low score, but likely to occur for reasons outlined |
| 14. Use of timely cultivations | | | | 1 | Low score, but likely to occur for reasons outlined |
| 15. Sensitive use of machinery | | | | 1 | Low score, but likely to occur for reasons outlined |
| 16. Use of mixed farm systems and rotations (arable/grass**)** | (on associated lowland) | | | 0 | Unlikely to apply to hill farms and only to a limited number of upland farms |
| 17. Use of cover crops and undersowing | (on associated lowland) | | | 0 | Unlikely to apply to hill farms and only to a limited number of upland farms |
| 18. Use of green manures | | | | 0<br>(1 on lowland) | Unlikely to apply to hill farms and only to a limited number of upland farms |
| 19. Creation of New Habitats | | | | 1 | |
| 20. Conservation Plan | | 3 | | | Will be adopted by 95% of organic farmers |
| 21. Maintenance of habitats | | | 2 | | Additional practices required by OFS |
| 22. Maintenance of field boundaries | | | 2 | | Additional practices required by OFS |

Of the 22 organic farming practices in this exercise, on the hill and upland elements:

8 scored 4 because they are mandatory on all certified organic farms, indicating widespread adoption

1 scored 3 because they are additional practices required by certification bodies with standards higher than the baseline. These will be adopted by the 95% of organic farmers in Wales who are certified by the two main sector bodies

2 scored 2 because they are additional practices required by the environmental prescriptions of the Organic Farming Scheme Wales. As noted above, as farms that converted before the scheme came into operation join the Organic Maintenance Scheme, the number of organic farms to which these prescriptions will apply will increase closer to 100%.

8 scored 1 because they are practices recommended but not mandated by organic standards. As the notes record, in practice most will be widely adopted since organic farming is unlikely to be successful without them.

3 scored 0 because they are unlikely to apply to organic farming in the hills and have little application in the uplands. They would however be adopted on some upland in-bye land and on associated lowland farms.

A boxed paragraph under each practice heading in the following Sections is used to indicate the frequency or likelihood of that practice in the hills and uplands of Wales.

### 2.2.5 Recommendations

Under each practice heading in Sections 5 & 6, recommendations are made to help ensure that the environmental benefits identified are achieved in practice, these comprise: suggestions for conditions to be applied in organic farming agri-environmental schemes; recommendations for future research and data collection, for organic standards development and for effort on information dissemination or education.

### 2.2.6 Discussion and Conclusion

The final section brings together the issues raised during analysis of the practices and their impacts, as well as looking at less direct environmental impacts of the organic system as a whole. General recommendations are collated and conclusions are drawn on the next steps in developing organic farming systems in the hills and uplands and ensuring their benign environmental impact and positive contribution to biodiversity.

# 3 SYSTEM CHARACTERISATION:

## Summary


1. The hills and uplands of Wales, for the purpose of this study, can be defined as agricultural land covered by Less Favoured Areas (LFAs) and areas of traditionally stock-based hill farming and their associated lowland pasture.
2. Hill farms typically have 60-95% of the land in semi-natural rough grazings (SNRG), often with access to common lands, whereas Upland farms have >30% of enclosed sown pastures.
3. The gradual change from hafod and hendre traditional farming, where hill farms were used for summer pasturage of cattle and rarely for finishing stock to the increasingly intensive sheep monoculture is noted.
4. Modern hill and upland systems are characterised by: predominantly sheep systems with stocking levels dependent on improved pasture and in-bye land relying on NPK fertilizers to maintain ryegrass/clover swards for grazing and forage conservation; the use of supplementary feeds to maintain stocking levels beyond those sustainable by the farm's production; regular use of prophylactic medicines to maintain stock health; regular mixing and moving of stock; the move to silage production from hay, and the loss of housing facilities for cattle.
5. Although the negative environmental impacts of intensive lowland farming are widely recognised, there is a common perception that modern hill farming has remained 'natural', however studies have shown overgrazing on 1/3 of common lands (which comprise 10% of Wales), that increasing sheep numbers reduce biodiversity.


## 3.1 Hill and Upland farming

Most hill farms, and a high proportion of upland farms, are located in the Less Favoured Areas (Article 3.4 EEC Directive 268), which are defined as suitable only for extensive livestock farming and where, although the conservation of landscape and habitats is a priority, there is danger of rural depopulation.

LFAs are defined as: "mountainous areas or other areas where the physical landscape results in higher production costs" (EEA, 1999). There are further distinctions between Severely Disadvantaged Areas (SDAs - generally land over 200m with limitations the effect of which is substantially to shorten the growing season,) and Disadvantaged Areas (other land within the LFA). LFAs were established in an EU directive of 1975 No. 268/75, and enlarged in 1984. There were two reasons for LFA designation:

1. to support local economies and prevent depopulation
2. because farming was seen as necessary for the environmental protection of these areas.

The hills and uplands, generally regarded as land over 200m above sea level, represent 53% of the total land area of the UK. In northern and western regions, and in Wales and Scotland, this figure rises to more than 80%. These areas sustain approximately 60% of breeding ewes and suckler cows, with many traditional and indigenous breeds concentrated, like the Pedigree Welsh Mountain or the Herdwick in Cumbria, in particular geographical areas.

Hill farms tend to have a high proportion of their land (typically 60% - 95%) in semi-natural rough grazing (SNRG), whereas upland farms have a higher proportion (30% or more) of enclosed sown pastures. Rights of access to common grazing are more often a feature of hill farms than upland farms, and flocks of ewes are often maintained in hefts, where sub-flocks habitually graze a particular part of the hill.

Figure 1 shows LFA DA & SDA boundaries; and Figure 2 shows OFS registered holding boundaries in Wales.

## 3.2 The Development of Hill Farming in Wales

In the hills and uplands of Wales, a traditional system of farming was based on the practices of ‘hendre’ and ‘hafod’ in which hill farms were utilised for summer pasturage, predominantly for cattle which were the mainstay of the rural economy, and rarely for finishing stock (Davies, 1979; Davies, 1980; Moore-Colyer, 1998). This historic system of transhumance, where hill farms produced calves and lambs that were sold to lowland farms for finishing, was replaced by an integrated system of production. Since the war, Welsh Hill farmers have put immense efforts into increasing output and hence income through pasture improvement. Developments of new systems at Pwllpeiran were eagerly taken up by the industry, aided by favourable grants and a first class agricultural advisory service to disseminate the information effectively.

The predominance and increasing monoculture of sheep is a much more recent development. In recent years, with the collapse of the store market for mountain lambs, there has been a tendency for hill farmers to specialise and to concentrate on either beef or sheep. In Wales, the emphasis has been on sheep-only hill farms where lambs are kept on to finish. Moreover, to maintain income, stocking levels were increased on these farms.

This increase was further encouraged by the introduction of the Less Favoured Area Directive (LFA) in 1975 and the associated Hill Livestock Compensatory Allowance Scheme headage payments, later supplemented by other headage payments for beef and sheep following the 1992 CAP reform. In 2000, the HLCA headage payments were replaced by area payments under the Tir Mynydd scheme in Wales, but the other headage payments were retained. (These now look likely to be replaced by single farm payments under the 2003 CAP reform agreement, providing a significant opportunity for farmers to reduce stocking again which may offer opportunities for organic production without the loss of financial support that would previously have been entailed.)

The combined effects of these trends was to produce hill and upland farming systems characterised by:

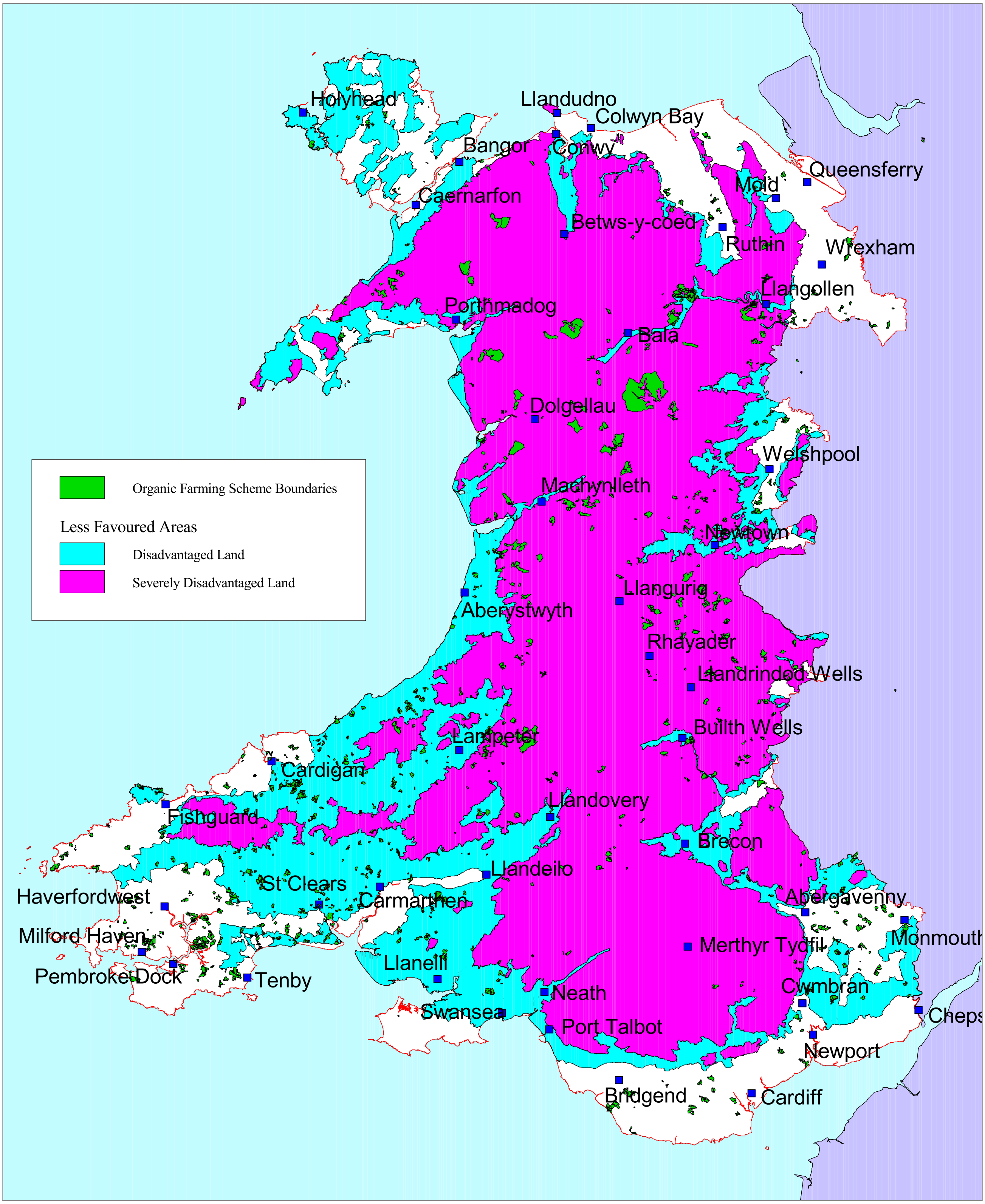
- High stocking levels, and large scale hill land improvement to increase grassland production
- An emphasis on sheep-only systems, or sheep and beef systems where beef are the minority stock on the holding

- Reliance on annual use of N, P and K fertilisers to maintain *Lolium perenne* swards for grazing and forage conservation
- Purchase of supplementary livestock feed (including forage, as hay or big bale silage, and concentrates) to provide winter keep for the high stock numbers that could not be sustained by the farm's own limited production and to finish stock
- Regular use of prophylactic allopathic medicines, to maintain stock health, particularly where large numbers of a single species led to high incidences of intestinal parasites. This in turn allowed a more set-stocking approach as opposed to rotational grazing within enclosed land.
- Regular mixing and movement of stock with 20% purchased replacements and use of common land
- Dereliction of facilities to house cattle
- Increase in size of fields and degradation of traditional field boundaries and of dry stone walls and hedgerows as traditional grazing management practices disappeared to be replaced by extensive ranching type practices.

The effect of these developments has been seriously detrimental to biodiversity and the environment; many habitats and species have been lost through pasture improvement with associated heavy application of N fertiliser which also facilitated changes in agricultural practice such as the move from hay to silage production.

# Less Favoured Areas and Organic Farming Scheme Boundaries (6/2/03)

Llywodraeth Cynulliad Cymru
Welsh Assembly Government

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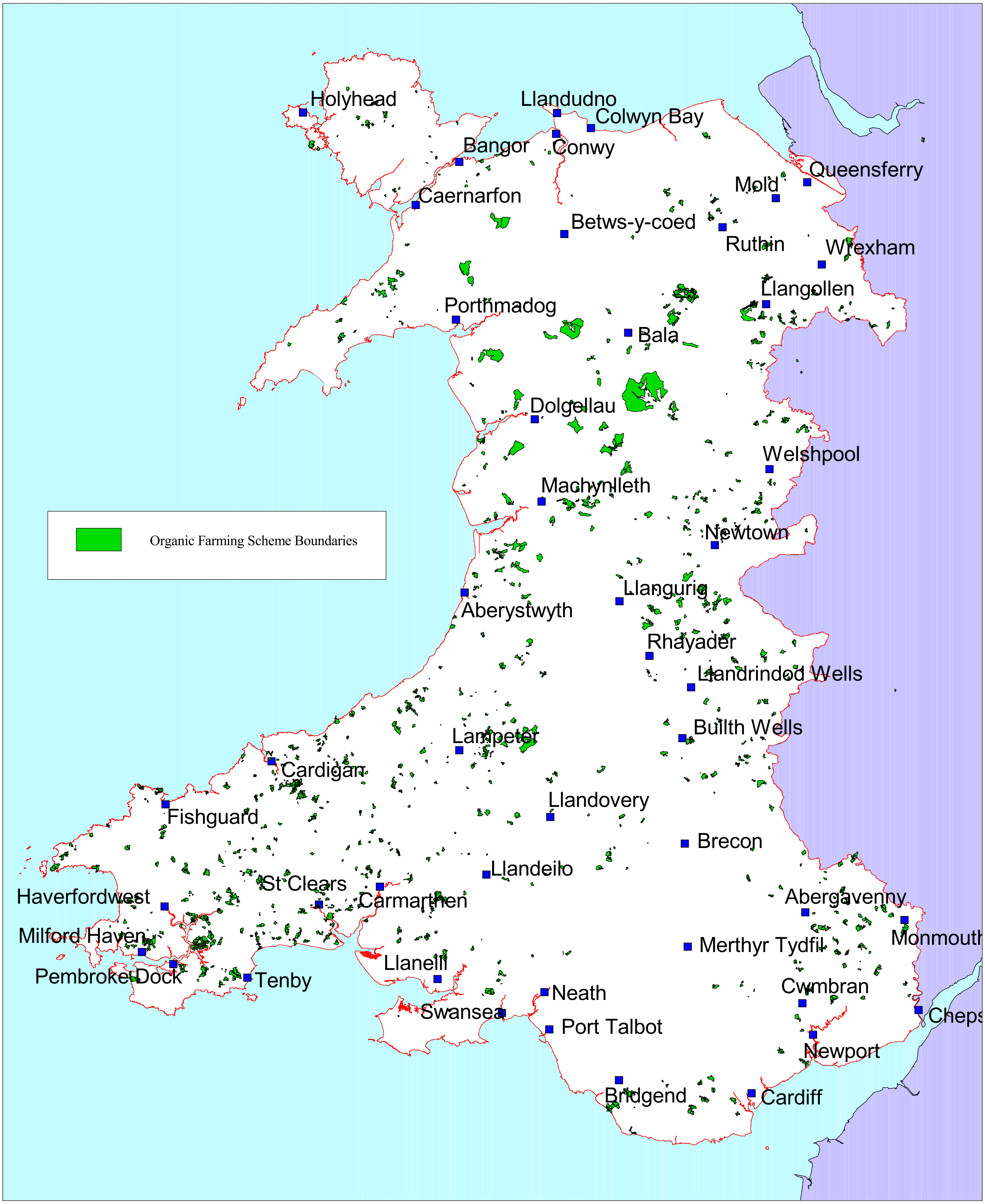
# Organic Farming Scheme Boundaries (6/2/03)

Llywodraeth Cynulliad Cymru
Welsh Assembly Government

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The primary causes of biodiversity losses identified by Thrupp, 1997 linked to agriculture are shown in Table 3.

**Table 3 Causes of Biodiversity losses linked to Agriculture**

<table>
<tr><th>Problems</th><th>Proximate Causes</th><th>Underlying Causes (for all problems)</th></tr>
<tr><td>Erosion of genetic resources (livestock and plants)<br>• Leads do disease/insect pest attack<br>• Loss of insect diversity</td><td>Spread of high yielding varieties (HYV) and monocultures<br>Biases in breeding methods through selection on phenotype rather than genotype<br>Weak conservation methods</td><td rowspan="7">Demographic changes<br>Industrial/Green Revolution Model that stresses uniformity<br>Disparities in resources distribution and in control of land<br>Pressures and influences of seed/agrochemical companies<br>Policies that support HYVs' uniformity and chemicals (subsidies, credit, market standards)<br>Producers/companies focus on short-term return to neglect of longer-term social factors<br>Disrespect for local knowledge and structural inequities</td></tr>
<tr><td>Threat to wildlife species. Decreases in populations</td><td>Reduction in area and condition of habitats</td></tr>
<tr><td>Erosion of insect diversity and structure</td><td>Heavy use of pesticides<br>Development of monocultures<br>Loss of organic material</td></tr>
<tr><td>Erosion of soil diversity<br>• Leads to fertility loss<br>• Productivity decline</td><td>Heavy use of agrochemicals<br>Poor tillage practices<br>Use of monocultures</td></tr>
<tr><td>Reduction in soil quality:<br>• Compaction<br>• Shrinkage, change in soil moisture levels</td><td>Heavy grazing<br>Drainage</td></tr>
<tr><td>Erosion of habitat diversity</td><td>Extensification into marginal land<br>Drift/spillover from chemicals</td></tr>
<tr><td>Erosion of indigenous systems optimising agro-biodiversity</td><td>Replacement by uniform species</td></tr>
</table>

(Adapted from Thrupp, 1997)

## 3.3 Organic by Default?

There is a widespread assumption that upland and hill farming is, to a large extent, organic by default. This assumption arises partly from the generalised, and rather simplistic, concept of organic farming as a system of agriculture that does not use agro-chemicals, particularly ‘sprays’. It is also based on the perception of hill and upland farming as traditional, pastoral and natural; whereas in reality intensification and associated pasture improvement means that this is far from the case. This is in marked contrast to lowland farming with the perception of cereal mono-cropping, agro-chemical dominated horticulture; and intensive agri-business dairy and livestock production. Parallel to this is the perception that whereas lowland organic farming results in environmental benefits because the withdrawal of pesticides and herbicides has a beneficial impact on biodiversity, the adoption of organic farming in the hills and uplands has very limited implications for the environment.

## 3.4 Pressures for Change in Hill and Upland Farming

Historically, hill farming has been a marginal economic enterprise. The Hill Farming Act, 1946 and the Livestock Rearing Act, 1951 provided for special financial aid for farmers in hill and upland regions in order to support their local economies. The EU extended this with the establishment of Less Favoured Areas.

For centuries cattle were the backbone of the upland rural economy; it is only in more recent times that there has been a move to sheep, exacerbated by the production oriented era of farming in the hills which was aided by favourable government policies and led to stocking rates and increasing monocultures as farmers sought to achieve economies of scale through specialisation. Traditional pastoral farms became increasingly over-stocked and, as a result, over-grazed. A decline in biodiversity resulted from pasture improvement and intensive grazing. Although re-seeding and overgrazing reduces biodiversity, high stocking levels, maintained by the use of synthetic N, P and K fertilisers, can further suppress some species of grassland flora. Heather particularly suffers from heavy grazing in the autumn and is increasingly replaced by grasses when hills are grazed continuously at high stocking levels.

Government response was a move away from support for production *per se* to support for more traditional farming systems through agri-environment policies. As Hughes (1996) has shown, agri-environment policies provided, and continue to provide important support to Welsh farming. These policies have enabled farmers to maintain their incomes to some extent; although they are disadvantaged in many aspects of agricultural production, they have a comparative advantage in the production of environmental conservation: they own and farm some of the most attractive and desirable parts of the countryside in the UK.

Even with public financial support, hill and upland farming has suffered financially from the decline in popularity of red meat and price competition from imports, especially lamb from New Zealand and beef from South America.

The detrimental impacts of increased production have been highlighted in an ADAS review of the effects of organic farming systems, which concluded that inorganic N fertilisation and herbicide treatments of conventionally managed grassland has reduced the floral diversity of permanent pastures and maintained the low diversity of re-seeded pastures, greatly reducing their value as wildlife habitats (Unwin et al., 1995).

A study by (Aitchison, 1997) of grazing levels on common land, which comprises 10% of Wales, estimated that overgrazing was occurring on about 1/3 of commons over 1ha.

In a report for the RSPB, Thomas (Thomas, 1999) states that higher sheep numbers has led to an increase in carrion feeding species such as foxes and carrion crows which predate ground nesting birds.

The carrying capacity of a hill used to be based on the winter carrying capacity. Undergrazing in summer resulted in increasing biomass on the hill, sections of which were periodically burned to keep structural diversity and good vegetation quality.

Undergrazing can be equally detrimental to wildlife as it can allow coarse vegetation and scrub to dominate, changing the ecology of an area, as can uncontrolled burning to remove coarse vegetation and leaf litter from heather and forage grasses. Some conservation objectives may require targeted low, or no grazing to allow regeneration of scrub and or woodland.

## 3.5 The Organic Approach

In lowland situations organic farmers argue that the reliance on chemical fertilisers encourages a production system that is independent of self-regulating processes and which becomes heavily dependent on non-renewable resources. They argue that this results in a biological erosion of soil organic matter, and that chemical fertilisers should be replaced by such methods of nutrient management as crop rotation, recycling of organic matter, and the integration of animals and crop production (Rundgren, 2002).

Clearly not all organic methods from the typical mixed lowland situation are fully applicable to hill and upland systems. The absence of crop rotations with fertility-building green manure breaks, the lack of opportunity to grow arable crops, the difficulties of growing legumes such as clover and the shortages of farmyard manure, organic fertilisers and farm produced feed all represent distinct difference between hill and upland compared to lowland farms.

A key element of an organic agro-ecological approach is the use of diversity and complexity to achieve self-regulation. In lowland UK agriculture, diversity and complexity of interactions between different elements in the system is achieved through rotations, but in permanent grass or hill systems, diversity would be achieved in terms of multi-species swards and mixed stocking, thus applying the underlying principles of organic farming in a non-rotational upland context.

# 4 GENERAL AIMS, OBJECTIVES AND APPROACH OF ORGANIC FARMING

## Summary


1. Organic farming is an approach to agriculture where the aim is to create integrated, humane, environmentally and economically sustainable production systems.
2. The EU passed a Regulation (2092/91) limiting the use of the term ‘organic’ to regard to food production to inspected and regulated farms and processing facilities. A set of standards was agreed covering the maintenance of soil fertility, pest, disease and wee control, conservation and the positive health and welfare of livestock. Farms converting to organic production must undertake a conversion period before products may be described as organic. Certification bodies may impose stricter standards; the national standards are the regulatory minimum standards.
3. In the UK UKROFS registered and licensed 15 private companies to inspect and certify organic farms and processing facilities. UK minimum standards include guidance with regard to conservation and the environment that is effectively seen as a compulsory supplement to EU regulation-based national standards. The OFS incorporates these as environmental prescriptions for the duration of the 5 years of conversion payments.
4. Financial support for conversion to organic farming in Wales started in 1994 but the major uptake was in 1999/2000 following a review of the scheme and increased rates of payment for LFA land.
5. A scheme to provide access to information and technical advice was made available in Wales in 1996. Since then nearly 3,000 advisory visits have been delivered to 2,000 farmers; the majority of which were to beef and sheep farms.
6. A review of agri-environment schemes in 2003/ 4 provides opportunities for integration of a revised OFS scheme with new base-level (Entry-level) support designed to be accessible to most farmers, as well as refining the integration of the OFS with Tir Gofal. March 2004 saw the provision of organic maintenance payments continuing after the initial 5 years of conversion payments.
7. The UK Biodiversity Action Plan and the introduction of EIA regulations and increased environmental focus of Farming Connect provides additional imperatives for environmental awareness for all farmers and land managers.
8. The organic system in the uplands depends on the promotion of livestock health through appropriate breed selection, high quality husbandry, appropriate diet and the avoidance of overstocking. 60% of the daily dry matter of ruminants must be provided as fresh or conserved forage, and 60% of the feed should come from the unit or linked units. Until August 2005 a small proportion of non-organic feed is allowed. This system requires the production of winter feed on associated lowlands or in-bye lands.

9. On organic farms the control of endo-parasites is likely to be one of the biggest challenges. There are three main strategies to achieve control, one or more of which are usually employed; diversification of enterprises, increasing the resistance of the farms stock, and clean grazing. The use of avermectin-based products known to be harmful to soil fauna is prohibited by the Soil Association standards. Ecto-parasites can also be a problem, good practices and biosecurity can mitigate attack, but limited conventional treatments are used when necessary. Organo-phosphates are prohibited in organic production.
10. The toxicity of synthetic pyrethroid sheep dips to aquatic organisms is of concern. Results of a specially commissioned study are reported which indicates that organic farmers use SP dips less frequently than conventional farmers, and are unlikely to pose a disproportionate risk.
11. The housing of livestock provides farmyard manure, an important source of nutrients and compost for the organic farmer. The provision of adequate housing, manure storage and the bedding requirements for organic cattle may pose capital demands.
12. The number of organic holdings in Wales has increased such that by the end of 2002 there were 46,500 ha of land under fully organic management in Wales, involving 618 farms, the majority of which is in West Wales and 71% of which is in permanent grass with 7% in crops and cereals. Organic cattle numbers have risen fourfold over four years to 5,700 in 2002/03 and ewe numbers from 20,000 in 1998/99 to 115,000 in 2002/03. In 2002/93 38% of organic farms in Wales had organic beef and sheep enterprises, 25% of which also grew cereals. Around 70% of organic farms are with an LFA, of which 30% are Severely Disadvantaged.
13. Around half the organic and converting farms in Wales in 2003 were also participating in Tir Gofal. Management agreements on semi-improved pastures are an issue on hill and upland farms with very limited land available for forage conservation; the quantity of which is the key determinant of the overall stocking level and number and type of stock that can be kept in winter housing.

## 4.1 General Aims and Objectives

"Organic" in the context of organic farming refers to the concept of a farm as an organism and not to the types of inputs used. Organic farming is an approach to agriculture where the aim is to create integrated, humane, environmentally and economically sustainable production systems (Lampkin et al., 2002).

Environmental protection is key to the practices involved in organic production and emphasis is placed on the use of locally or farm-derived renewable resources that operate within closed, self-regulating ecological and biological cycles. External inputs are reduced as far as possible to maintain the ecological balance of the farm system. International organic farming standards are underpinned by the following **principles**:

- To co-exist with, rather than dominate, natural systems
- To minimise pollution and damage to the environment

- To protect the farm environment with particular regard to wildlife
- To consider the wider social and ecological impact of agricultural systems
- To maintain or develop valuable existing landscape features and adequate habitats for the protection of wildlife, with particular regard to endangered species
- To ensure the ethical treatment of animals.

(IFOAM, 1998a)

These principles are translated into the following **practices**:

- Integrated, humane, sustainable farming methods
- Maximum reliance on self-regulating agro-ecosystems, local or farm–derived renewable resources
- Management of ecological and biological processes and interaction
- Reduced dependence on external inputs
- Crop rotations
- Nutrient re-cycling

The main features of closed systems with minimal external inputs are the recycling of nutrients around the farm and fertility building breaks in the cropping rotation. Such closed systems can deliver many environmental advantages such as reducing atmospheric and aquatic pollution, and are in line with EU water and Nitrate Directives (Stockdale et al., 2001). In upland situations the N fertility is developed by maintaining or increasing the clover contents in swards.

What was originally a manual of recommended farming practices covering all aspects of farm management to ensure a sound and sustainable farming system has been incorporated into legislation to produce organic farming **standards**; the following points outline the approach taken.

- Soil fertility: The focus is on crop rotations and the use of animal manures and compost to maintain natural soil fertility without the use of artificial/synthetic fertilisers.
- Pest, disease and weed control: This is achieved through rotation, choice of varieties, timings of cultivations and habitat management to encourage natural predators. All herbicides are prohibited. Where direct intervention is required a small range of approved inputs like sulphur may be used in a controlled manner.
- Conservation: Farm management should encourage the development of a healthy environment, enhancing landscape features, wild plants and animal species by, for example, maintaining hedges as an important wildlife habitat.
- Livestock: The emphasis is on a positive system of livestock management to maintain healthy stock and a balanced system.

## 4.2 Legislative Framework

### 4.2.1 Organic Standards

EU Regulation 2092/91 made it a legal requirement that all food sold as organic must be certified as such, and products must be processed by licensed processors to ensure traceability and retention of the products' organoleptic quality. The regulation defines the legal minimum standards of production and processing and the requirements for control and policing and requires annual inspections of all license holders. The United Kingdom Register of Organic Food Standards (UKROFS) was the government body responsible for implementing this EU regulation in the UK, but the responsibility was taken into Defra in 2003, and a non-departmental public body, the Advisory Committee on Organic Standards (ACOS) was set up.

In the UK, currently 15 private companies are licensed to carry out organic inspections and certification. In most cases, these certification companies use the UKROFS minimum standards (soon (2004) to be the ACOS compendium), but other bodies including the Soil Association and the Biodynamic Farming Association specify additional requirements.

The Soil Association standards contain 'recommended' practices, setting out the context for the following standards and highlighting good organic practice. They also describe 'required', 'permitted', 'restricted' and 'prohibited' practices. Restricted practices usually require permission from (and justification to) the certifying body.

Organic standards cover all aspects of livestock and crop production including fertility building, crop rotations plus record keeping and inspection requirements. The livestock standards cover livestock conversion, animal feed, housing and stocking densities, veterinary treatments and animal welfare. Ideally, organic livestock should be fed 100% organically grown feed, but until 2005 there are allowances for the use of 'in conversion' and approved non-organic feeds. Standards also specify that the use of genetically modified organisms (GMOs) and their derivatives are strictly prohibited at every stage of production.

There are specific requirements for farms to convert to organic production; a conversion plan covering all aspects outlined above is required, and almost all farms will first need to go through a two-year conversion period where the land is managed organically, but crops and livestock may not be marketed as organic. From the start of conversion all animals, including those not covered by organic standards (such as tack sheep/cattle, livestock not yet in conversion such as dairy cows, and horses, farm-yard poultry etc.), must be fed GM-free feed while on the holding.

### 4.2.2 Standards Development

Within the framework of the EU regulations, Organic Standards development within the UK is largely driven by from the ground up; certification bodies apply with recommendations of changes to the National Certifying Authority (UKROFS, at the time of writing, shortly to be Defra). National Certifying Authorities take varying approaches to standards modification; UKROFS has enforced standards higher than the EU minimum, and was willing to consider further tightening standards in the UK, but any modification seen to be lowering standards must be authorised by the Commission, and representations made to the Article 14 committee; changes thus take a considerable time to enact. More recently, it has been decided that the UK authority should not set higher standards than the EU regulation, but that individual certification bodies may do so. The most pro-active certification body in the UK is Soil Association Certification Ltd, which uses standards set by the Soil Association. The Soil Association Standards department runs eleven standards committees (made up of members, licensees, researchers, advisors and other experts in their field) that meet regularly to review and recommend changes to standards, and explore the setting of standards in new areas, for example textiles and cosmetics and beauty products (these non-food items are not covered by the Regulation). The Soil Association Agriculture Standards Committee currently has a working group considering modifications needed for hill and upland farming standards.

A certification body may unilaterally tighten standards; however any moves to relax standards within the UK have to be approved by the UK authority (was UKROFS, now Defra). Clearly unilateral tightening brings added burdens to those producers certified with that body. As certification is a competitive business, the commercial pressure is to maintain the status quo, and bodies like the Soil Association and Demeter that are more driven by principles have to tread a careful line in improving standards.

A new advisory body to replace UKROFS was initiated in 2003 by Defra. The new body is the Advisory Committee on Organic Standards (ACOS). ACOS is a non-executive non-departmental public body that advises Ministers on matters related to organic standards, the approval of organic certifying bodies and research and development needs of the organic sector.

### 4.2.3 Environmental Requirements

The EU Regulation, and the standards based on it, contains a number of requirements that impact both directly and indirectly on the environment. However, these were considered to be inadequate in some aspects and UKROFS introduced additional environmental guidelines. These prescriptions are effectively a compulsory supplement to the EU regulation-based national standards. The guidelines and further requirements were incorporated as specific prescriptions in the Organic Farming Schemes in Wales and England. Any farmer entering into the OFS must follow the 10 environmental prescriptions in Table 1 for the full period of undertaking.

The introduction of maintenance payments as part of the Organic Farming Scheme in March 2004 provides an option for all certified organic farmers to enter into the scheme and hence be under the environment prescriptions (this will include farmers that converted to organic production prior to conversion schemes and therefore without previous financial support).

**Table 1 – Environmental management Prescriptions for the Organic Farming Scheme in Wales**

1. The beneficiary shall not plough, reseed or improve, by use of drainage, manures or liming agents, any heathland or grassland of conservation value, including species-rich grassland. The beneficiary shall not graze any of these semi-natural habitats so as to cause poaching, overgrazing or undergrazing affecting the conservation value of these habitats.
2. The beneficiary shall avoid localised heavy stocking in the nesting season on areas of semi-natural vegetation, including heathland, species rich grassland and rough grazing.
3. The beneficiary shall not carry out field operations such as harrowing and rolling, on species rich grassland or rough grazing during the nesting season.
4. The beneficiary shall not cultivate or apply manures within one metre of any boundary feature such as fences, hedges and walls.
5. The beneficiary shall retain traditional farm boundary features, for example, hedges and walls. He shall carry out hedge trimming in rotation, but not between 1 March and 31 August. The beneficiary shall maintain any stock proof boundaries using traditional methods and materials.
6. Ditch maintenance shall be carried out in rotation but not between 1 March and 31 August.
7. The beneficiary shall maintain streams, ponds and wetland areas.
8. The beneficiary shall retain any copses, farm woodland or groups of trees.
9. The beneficiary shall ensure that in farming the land he does not damage, destroy or remove any feature of historical or archaeological interest, including areas of ridge and furrow.
10. The beneficiary shall abide by the Codes of Good Agricultural Practice for the Protection of Soil, Air, Water and, where applicable, Pesticides, published by MAFF and the Assembly's Code of Good Farming Practice.

## 4.3 Factors Involved in the Conversion of Hill and Upland Holdings to Organic Farming

A combination of soil type, topography and climatic conditions restricts most hill farms in Wales to sheep and cattle production and many such livestock farms have relatively low fertilizer and chemical inputs when compared to lowland livestock farms. It may appear therefore, that conversion of such farms to full organic status might not involve major changes in farming practice. Even in these extensive upland situations, conversion to organic farming is, however, a complex undertaking requiring system changes and a paradigm shift in thinking away from an input approach to a whole-system approach.

The major change required is likely to relate to the stocking rate. The stocking level (the 'natural carrying capacity') will be determined by the winter carrying capacity, which will be determined by the type of SNRG available, plus how much forage can be conserved, which in turn will be determined by the amount of land on which hay and/or silage can be made. In non-organic systems this 'natural carrying capacity' can be exceeded by (a) buying in extra winter forage and concentrates and (b) heavy N fertiliser use on the land available for forage conservation or (c) off-wintering on leased land or on outlying parcels of the farm in the lowlands. The former practice is limited and the second is prohibited on organic farms, the third is limited by the availability of organic land.

The questions asked most frequently by farmers contemplating conversion to organic farming usually derive from the 'input farming' paradigm. Typically the questioner begins by asking "What do I use instead of…(fertilizer/weed killer/wormer)" (Frost et al., 2002). In the 'whole system' paradigm, however, such questions do not arise in this form. Rather the issue becomes how to design a farming system in which there is no need for such inputs.

Changes include:

a. Reducing stocking levels to the natural (sustainable and self contained) carrying capacity of the farm

b. Adjusting stocking, usually by increasing the ratio of cattle to sheep. Conflicts can arise with agri-environment schemes, as although more cattle may be desirable, where 6.6 sheep need to come off for every cow put on it may not be attractive financially for farms with substantial areas of SNRG

c. Rearing own replacements in closed herds/flocks to reduce risks of importing disease and to ensure organic status of young stock for meat production

d. Cessation of N fertiliser use and increased reliance on clovers in improved pastures

e. Restrictions on bought-in feeds from conventional sources (on both a daily and annual basis)

f. Adoption of a forage based husbandry system where 60% of the annual feed is forage produced mainly on the holding

g. Reduction in the use of allopathic veterinary medicines for treatment of disease, although treatments must be applied on welfare grounds to prevent prolonged illness or suffering

h. Abandonment of the use of prophylactic allopathic veterinary medicines, although some, such as permitted sheep dips and anthelmintics, may be used on a restricted basis.

Further changes that are involved in the conversion of hill and upland farms, and which accompany any reduction in stocking rate include:

i. Restrictions on the use of bought-in sources of P and K

j. Cessation of use of chemical herbicides and almost all pesticides

k. Adoption of manure handling methods to promote efficient nutrient recycling and avoid pollution

l. Introduction of arable crops on upland farms, where the soil type, topography and climatic conditions are suitable, and particularly on associated (or linked) lowland farms.

m. Improvement of field divisions for controlled grazing

n. Improvement/addition of winter housing for cattle

## 4.4 The Whole-System Approach in Practice

The rotation is the pivot of a successful mixed organic farming system; the purpose of the rotation being to:

- Improve soil fertility (by establishing legumes in the rotation and resting land from cultivation)
- Maintain soil organic matter and soil structure
- Minimise weed, pest and disease problems
- Produce sufficient crops and forage for the farm enterprises
- Thereby promoting health in soil, plant and animal.

In the hills and uplands, arable cropping is rarely possible and most farms are all-grass with a large proportion of permanent pasture and semi-natural rough grazing (SNRG). In the hills, where a farm may be wholly permanent pasture and SNRG, there is little possibility of establishing a rotation, and the farming system must rely on good grassland and grazing management to control livestock parasites and to maintain pastures in good productive heart. On upland farms with a proportion of in-bye land that can be ploughed, it may be possible to make more intensive use of in-bye fields by growing arable silage or a forage crop of roots or brassicas.

There are four practices that guide disease prevention in organic farming - breed selection, high quality husbandry, appropriate diet, and avoidance of overstocking. Ideally

> **ADAS Pwllpeiran Research Unit** is a 1,240 ha resource is located in the heart of the Cambrian Mountains Environmentally Sensitive Area in mid Wales. Its primary aims are to develop sustainable agricultural systems relevant to the UK uplands, and establish a focal point in Wales for agricultural, agri-environmental and agri-food research. It is also home to one of the organic demonstration farms set up in Wales - 10% of land area is under organic management. An important element of work at Pwllpeiran is knowledge transfer, and information is disseminated to farmers, land managers, land surveyors, other researchers, policy makers, conservation bodies and students.

indigenous breeds adapted to the local conditions are chosen rather than breeds developed to produce returns under intensive systems.

### 4.4.1 Livestock Management - Nutrition

Livestock feed standards have been developed to provide appropriate nutrition for the species and to promote good health and vigour. For ruminants, organic livestock farming is a forage-based system. For all organic ruminants 60% of the daily dry matter must be fresh or conserved forage and 60% of the feed should come from the unit or from linked units (see Table 2). At ADAS Pwllpeiran, where an organic hill beef and sheep unit was established in 1993, ninety-five percent of the required livestock feed has been provided from within the unit (Frost, 2001). Until 2005, there is also a derogation that permits the feeding of approved non-organic rations. These allowances for purchased and non-organic feeds are derogations from the ideal standards that will become more rigorous with time. Currently imports of feed in the uplands are generally as a supplement to offer a higher plane diet at specific times of year, for example pre-lambing (Powell, *pers. comm*.)

**Table 3 Summary of organic feed regulations**

- Feed is intended to ensure quality production rather than maximising production.
- Fattening practices are authorised in so far as they are reversible at any stage of the rearing process. Force-feeding is forbidden.
- Livestock must be fed on organically produced feedingstuffs. By derogation (expiring 2005), a limited proportion of conventional feedingstuffs is authorised where the farmer is unable to obtain feed exclusively from organic production. The maximum percentage of conventional feedingstuffs authorised per year is 10% in the case of herbivores and 20% for other species.
- For ruminants, a minimum of 60% of the feed, calculated over a calendar year, should be obtained from the unit, or from linked units.
- Up to 30% of the feed formula of rations on average may comprise in-conversion feedingstuffs. When the in-conversion feedingstuffs come from a unit of the own holding, this percentage can be increased to 60%.
- The feeding of young mammals must be based on natural milk, preferably maternal milk.
- Post-weaning rearing systems for herbivores are to be based on maximum use of pasturage according to the availability of pastures in the different periods of the year. At least 60% of the dry matter in daily rations is to consist of roughage, fresh or dried fodder, or silage.
- Roughage, fresh or dried fodder, or silage must be added to the daily ration for pigs and poultry.
- Only products listed in the Standards can be used as additives and processing aids in silage.

Source: UKROFS (2001)

The selection of stock and system depends on the balance of land-types and an appropriate balance of in-bye or lowland, or a relationship with a lowland holding. The role of associated organic lowland farms is important; linked farms may provide keep for away wintered stock, purchase young stock to finish, and produce sufficient concentrates and conserved forage to supply hill and upland farms.

Hill and upland farms without adequate in-bye land can find it difficult to be completely self-sufficient in feed. The current allowances (for bought-in feed and for conventional feed) are usually adequate for breeding flocks and herds, but as the derogations are phased out, there will be increased emphasis placed on home produced feed due to the higher cost of bought-in organic feed.

### 4.4.2 Livestock - Health and Welfare

The aim is to develop a pattern of health promotion and disease control that is appropriate to the particular farm, and to allow for the development of a farming system that is progressively less dependent on allopathic veterinary medicinal products. Organic livestock standards restrict the use of allopathic veterinary medicinal products and antibiotics, and prohibit animal treatment products involving the use of organophosphates.

It is a requirement of the organic standards that organic livestock conversion plans and plans for continued organic livestock husbandry must include programmes for disease control and positive animal welfare. Promotion of positive health and welfare is achieved through regular review of the animal health plan and a dynamic programme for disease prevention.

Many hill farms have soils that are inherently deficient in trace elements such as copper, cobalt and selenium. These elements are required not only for their nutritive value, but also to maintain an animal's resistance to disease. Deficiencies are associated with poor animal growth rates and breeding problems. Normal good practice, as demonstrated at the Adas hill and upland organic units at Pwllpeiran and Redesdale, is to rake sheep between improved and native grassland to improve mineral intakes. Mineral supplementation is allowed by organic standards where a deficiency has been established by soil, forage and blood tests.

**Lake Vyrnwy farm** is situated at the southern end of the Berwyn Hills in mid-Wales, and is managed by RSPB Cymru and Severn Trent Water. The 4,700-hectare farm has been fully organic since August 2001 and sells its organic lamb mainly through the local co-operative, Graig Farm Organics. Animal welfare is an important issue, and the farm also uses the local abattoir in Llanidloes only 15 miles away, benefiting the local economy and reducing the impact of transport on climate change. A balance of modern farming operation and conservation priorities is sought. This includes improved management of the heather moorland, a return to a mix of arable and livestock farming and the provision of a clean water supply. Stocking numbers of sheep have been reduced to improve the condition of the heather moorland. This has encouraged moorland birds such as hen harrier and black grouse. On the lower ground, the organic cereal fields provide valuable food for finch flocks. The site is used to demonstrate good practice and is visited by a wide range of agricultural and environmental organisations that are interested in promoting green Welsh farming.

### 4.4.3 Parasite Control

On hill and upland farms endo-parasite control is likely to be one of the biggest challenges to the organic system. In organic farming the ideal is to avoid the systematic anthelmintic use that occurs in conventional farming.

The alternatives usually involve a combination of one or more of the three main strategies to reduce internal parasite challenge: diversification of the enterprise, increasing resistance of the farm's stock, and safe grazing. Reducing the reliance on anthelmintics may also involve using alternative remedies. These include,

(a) Providing a wide range of plant species in grassland including plants known to have vermifugal properties (such as those with high concentrations of condensed tannins)

(b) Ensuring there are no mineral deficiencies

(c) Herbal and homeopathic remedies

(d) The use of natural enemies of parasites.

On many hill farms, because of the land type, topography, a general shortage of in-bye land etc. a clean grazing system is not possible (Powell, 1999), and despite precautions, the evidence is that most organic sheep farmers have to resort to anthelmintics at some point (Keatinge, 1996). The use of avermectin-based products, which are known to be harmful to soil fauna, is allowed only in specific circumstances by the Soil Association standards, but not restricted by UKROFS standards.

Where fluke is a problem, wet areas of the farm can be fenced out to prevent stock being exposed to parasitic infection. Where this is not feasible, permission must be sought from the certification body for the use of a flukicide.

**ADAS Redesdale Research Centre** in Northumberland is a 1,591 hectares Pennine hill farm, some of which entered conversion to organic in 1991. It has 3,000 breeding ewes consisting of pure bred and crossed Scottish Blackface, pure bred Swaledale and commercial Mule flocks. The farm also has autumn and spring calving herds with 150 suckler cows. Research is undertaken on hill and upland livestock production, organic farming, genetic improvement, moorland management and animal health and welfare.

Ecto parasites can be a serious problem in certain situations in the uplands, e.g. ticks and keds and scab. Most ectoparasites (blowfly, headfly, sheep scab *etc*) can be controlled by using permitted products such as Crymazine (Vetrazin) or pyrethroids. Organo-phosphate dips are prohibited by organic standards because of their high mammalian toxicity and the implications for human health. Synthetic pyrethroids are allowed but these are highly toxic to aquatic life. Good practice involves sound external fences (ideally double fencing) and care when bringing stock onto the farm – including a quarantine period for all stock including rams and bulls. Bio-security measures should also extend to disinfection of contractors' machinery and equipment, most obviously in the case of contract shearing.

### 4.4.4 Housing

Housing for organic livestock must provide adequate space for animals to exercise their normal behaviour, and the standards specify minimum areas for different classes of stock. Adequate ventilation, supply of drinking water and suitable bedding are also covered by the standards. Bedding straw can be bought in from non-organic sources because surplus organic straw is not readily available. Alternatives include untreated sawdust and wood chip, and these are sometimes used in conjunction with straw. The need for cattle housing can be a significant issue on sheep-dominant farms trying to re-introduce cattle.

### 4.4.5 Manure Management

The in-wintering of livestock makes nutrient cycling more manageable as farmyard manure (FYM) can more readily be targeted on to silage or hay aftermaths. FYM is a highly valuable resource on the organic farm and the main aim of manure management is to conserve as much nutrient value as possible. This contrasts with the 'waste management' approach to manures and slurry that prevails in conventional agriculture. Good organic practice is to stack and cover FYM to avoid nutrient leaching during the winter. If manures are stacked outdoors, organic standards require that heaps must not be within 10 metres of watercourses or 50 metres of boreholes. Application of FYM and slurry must be timed to avoid leaching, especially in high rainfall areas. To bring conventional FYM onto an organic farm requires the permission of the certification body and it must be composted before use. All conventional animal manures that are brought on to an organic holding must be free of GMOs (imported FYM must come from animals which are either forage-fed only, or if they have been fed supplementary feed the rations must have a GMO-free declaration).

### 4.4.6 Common Grazing

The use of common grazing for organic livestock is at the discretion of the certifying body. The issues the certifying body will consider include whether or not the area grazed by the farm's stock is free of unacceptable inputs such as sprays, whether the common is over-grazed, if there is a co-ordinated approach to dipping to avoid re-infection and minimise dipping events and whether the other stock sharing the grazing come from extensive systems.

### 4.4.7 Agistment

Replacement ewes, or hoggs, are often away-wintered from the hill on lowland (often dairy) farms and in some areas there is a traditional practice of summer grazing cattle from lowland herds on hill and upland farms. Organic standards require that organic animals can only graze on organic land, and there are some instances where appropriate organic land for away-wintering or summer grazing may be difficult to find. As more farmland is converted to organic status, and with the developing practice of farms combining organic farming with other agri-environment schemes, this is becoming less of a problem. Under organic standards it is permitted to graze conventional, non-organic, stock on organic land for no more than 120 days in any calendar year – providing that these are of a different species.

## 4.5 The Development of Organic Farming in the Hills and Uplands of Wales

Increases in the market demand for organic produce coupled with government support through the Organic Farming Scheme and the Organic Conversion Information Service (OCIS), resulted in an increased uptake of organic farming by hill and upland farmers in the late 1990s. 388 holdings in Wales entered into organic conversion between 1996 and 2001 encouraged both by the Organic Farming Scheme and by the availability of high premiums for organic produce in the market place (Frost et al., 2002). Since 2000, the scheme has had a budget of over £3m a year and the Assembly has provided the funding necessary to support all the farmers who have applied to join.

Although North Wales continues to have a lower proportion of farms entering organic conversion compared with the rest of Wales, overall the greatest number of holdings going into conversion has been in the beef and sheep sector. Furthermore, 36% of in-conversion farms were in the 200+ ha category (Frost et al., 2002). The higher rate of take-up by large farms in Wales is consistent with the trend across the EU since the late 1980s for the average size of organic holdings to be larger than conventional farms (Padel, 2001).

The Organic Centre Wales report “Organic Farming in Wales 1998-2003” details the key recent developments in organic agriculture in Wales. By the end of 2002 there were 46,500 ha of land under fully organic management, a total of 618 farms, either fully organic or in conversion which amounts to around 3.7% of agricultural land in Wales. The majority of holdings are in West Wales (OCW, 2003) 71% of this land is under permanent grass, with an added 7% crops and cereals. The growth of organic livestock production has grown dramatically in the last 5 years. Organic cattle numbers have risen from 1400 in 1998/99 to 5700 in 2002/03, and ewe/lamb numbers have risen from 20,000 in 1998/99 to 115,000 in 2002/03.

Around half the organic and converting farms in Wales in 2003 (325) were also participating in Tir Gofal; 195 of whom were in Tir Gofal before entering the Organic Farming Scheme (Tir Gofal information from CCW and National Assembly for Wales, Sept 2003).

Until July 2003, when Quality Welsh Food Certification Ltd (UK13) was established, there were no dedicated Welsh organic certification bodies. The main bodies certifying Welsh farms were the Soil Association Certification Ltd (UK5) and Organic Farmers and Growers Ltd (UK2).

Of the organic farms registered with those two certifiers in Wales in 2002/03, 27% had dairy enterprises and 38% had both beef and sheep enterprises; in both groups 25% also grew cereals. Overall 23% of organic farms were registered for cereal enterprises.

Around 70% of registered holdings in Wales are within an LFA, 30% of which are within SDAs.

## 4.6 Organic Farming and other Agri-Environment Schemes

Many farmers incorporate other agri-environment schemes such as ESAs and Tir Gofal into their organic system. Farmers entering conversion may well see lower stocking rates as a compatible objective in both organic farming and other agri-environment schemes. However, recent experience (Powell, *pers. comm.*) indicates farmers are now questioning whether Tir Gofal is as compatible as they first thought, particularly as they become more confident with organic methods and their management skills improve.

When Tir Gofal is entered after conversion the additional payment from the scheme can help offset the reduction in output following a stocking rate reduction associated with conversion to organic farming. Moreover, where agri-environment scheme payments are available for fencing and other field boundary work as in Tir Gofal, this can contribute to the development and maintenance of a network of well-fenced enclosures - a prerequisite for rotational grazing systems and crop rotation on organic livestock farms.

There are divergences of emphasis, however, between organic farming and other agri-environment schemes[1]. Organic farming is a system of production, and agri-environment management prescriptions place restrictions on organic farming practices that have been adopted for environmental reasons, for example, several Tir Gofal arable options encourage the growth of arable weed seed for birds, whereas for the organic farmer is encouraged to undersow to control weeds and prevent soil erosion.

Agri-environment schemes for hill and upland farms may have the key objective of restoring or maintaining grassland floral diversity. One method of achieving this is a management agreement which reverts semi-improved pastures to hay meadows by restricting all fertility inputs including lime, by prohibiting pasture improvement and re-seeding and by delaying cutting dates. On many hill and upland farms the proportion of land area available for forage conservation is severely limited and the quantity of forage that can be produced on such land is the key determinant of the overall stocking level as well as the number and type of stock that require to be kept in winter housing (e.g. finishing stock or less hardy breeding cows). It is therefore very important that organic farms entering an agri-environment scheme (currently Tir Gofal is the only scheme open to new entrants) should carefully assess the effect of such management agreements on their level of production and financial performance. The interactions between agri-environment scheme prescriptions and organic farming are best discussed with CCW project officers and organic advisors before entering the Tir Gofal scheme.

A series of meetings concerned with the Organic Farming Scheme and Tir Gofal involving organic consultants, CCW Project Officers and farmer members of the Cambrian Organic Group raised a number of issues concerning the inter-relation of the two schemes (Collyer and Frost, 2002). These included, inter alia,

- Management of the soil and the prevention of soil erosion and nutrient leaching is fundamental to organic farming. In Tir Gofal, however, there are no prescriptions relating to prevention of soil erosion or leaching (e.g. need for cover crops) nor for promoting soil microbial activity, although this is likely to be a feature of CAP reform cross-compliance requirements.
- Undersowing a spring sown arable crop with a grass ley is good organic practice in many circumstances (see above) but this would preclude payment under the winter stubbles arable option in Tir Gofal.
- Animal welfare is not an issue in the Tir Gofal scheme but is a major issue for organic farming. This issue relates particularly to the question of mineral deficient soils and the implications for farm animal health on hill and upland farms.

The report concluded that in combination, the two schemes contribute to the twin goals of quality food production and environmental sustainability, but that blanket

[1] Reversion schemes favoured by Agri-environment schemes can be very restrictive and conflict with farming *per se*. Defra is continuing to support a long term study of the impact on floral diversity of a range of management practices on improved middle hill land with low pH status at Adas Pwllpeiran which is demonstrating that plots manged as traditional hay meadows with lime and aftermath grazing have the greatest range of diversity.

environmental management prescriptions represented a problem for some organic farms in Tir Gofal. It was felt that greater flexibility in the designation of environmental management schemes for organic farms would be helpful. A further general theme emerging from these meetings was the need for greater contact between the organic farming bodies and conservationists and the development of co-ordinated policies and practices that would benefit both organic food production and environmental conservation on the farms of Wales.

# 5 IMPLICATIONS OF THE FACTORS INVOLVED IN ORGANIC CONVERSION AND MANAGEMENT FOR BIODIVERSITY AND THE ENVIRONMENT - Livestock Management

## Summary

1. Conversion of hill and upland farms to organic generally includes a reduction of stocking levels and an increase in the cattle to sheep ratio, the cessation of use of fertiliser, herbicides and most pesticides and restrictions on purchased feeds, forage-based diets, the cessation of the use of prophylactic allopathic veterinary medicines and preparation of an animal health plan to ensure a reduction in the use of all veterinary medicines.
2. Specifically, the practices on organic livestock farms identified that may differ from conventional and have direct biodiversity or environmental impacts are:
    i. A reduction in stocking rates (overall manure loading maximum of 170kg/N/ha/yr)
    ii. An adjustment of the stocking balance (increasing ratio of cattle to sheep).
    iii. Keeping indigenous breeds and strains adapted to the environmental conditions on the farm.
    iv. Limitation on products to control external parasites
    v. Reduction and restriction on the use of prophylactic veterinary medicines
    vi. The use of forage-based diets.
    vii. Storage and use of slurries, manures and composts, and constraints in import/export of nutrients.

## 5.1 Reduction in Stocking Rates

*1*. Recommended practice – Widespread for reasons outlined.*

*See Table 2 page 7

A reduction in stocking rate is likely to be associated with any organic conversion of a farming system that has used significant amounts of purchased inputs. A reduction in forage yield is particularly likely during the period between when nitrogen fertilisers are removed and organic practices are fully established. This will have a major bearing on stocking rate; Sibbald (et al, 2003) monitoring sheep performance and pasture production in upland Wales concluded nitrogen fertiliser can only be reduced on upland sheep pastures if accompanied by reduced stocking rates (Sibbald et al., 2003). Ardeshir, (Ardeshir, 2003) found stocking rates of 0.84 livestock units per hectare (LU/ha) on the 30 baseline farms (converting farms) used to monitor the organic farming scheme in Wales, on sheep only farms stocking rates were only 0.53 LU/ha. These figures may reflect the reduction of stocking due to conversion; in the longer term stocking rates on an organic farm may increase after conversion and will tend to stabilise at the natural carrying capacity as defined above (see page 26).

Research on the live biomass of grass species in the uplands (Milne et al., 2002) found no correlation of production with weather variables, but soil density explained significant variation in annual production. The work on *Agrostis-Festuca* grassland confirmed evidence from *L.perenne* dominated pastures that gross production can be reduced by a combination of grass defoliation and treading, with the effects greatest on wetter soils (Wilkins and Garwood, 1986). This indicates there may be production benefits from reducing stocking, tending to confirm anecdotal evidence from farmers that did not re-stock after the foot and mouth disease restrictions of 2001.

### 5.1.1 Biodiversity Impacts: Flora

Many species-rich, semi-natural hill pastures have been lost to pasture improvement and overgrazing as stocking levels, particularly of sheep, have increased. Lower stocking rates reduce pressure on many features of the upland landscape that suffer from overstocking.

In general, it is accepted that moderately high to intensive grazing has adverse effects on grass, herbs and scrub diversity, whereas light or moderately low grazing has favourable effects on sward diversity. In one example, following removal of cattle from the Isle of Rhum in Scotland, a study showed positive effects of light grazing (0.02 cattle/ha) on nature conservation value of the sward (Gordon, 1988), suggesting there is a case for minimum as well as maximum stocking levels.

At ADAS Pwllpeiran, where management of the SNRG according to ESA grazing prescriptions is an integral part of an ongoing organic farming project, heather cover assessed in springtime fluctuated little during the period 1994 – 1999, remaining around 76%. Heather height showed greater variation with the suggestion that it may have been affected by:

- periods of excessive rainfall
- increases in sheep numbers (but still within ESA prescription recommended levels) (Powell, 1999).

At ADAS Redesdale, where vegetation monitoring has been carried out since the unit's conversion in 1991, (Adamson et al., 2002) concluded that from a conservation perspective, the most important effects on botanic composition were related to intensity of stocking rate, rather than any other aspect of organic management practice. On both organic and conventional heavily stocked units the wet heath and acid grassland communities became increasingly dominated by rough grasses and *Calluna vulgaris* declined. After stocking rate reductions on two organic hefts, changes detected were due to the recovery of *C.vulgaris* after burning the heathland on one heft; few changes were detected on the other.

### 5.1.2 Biodiversity Impacts: Fauna

Reducing the number of stock in pasture known to support breeding bird and ground nesting mammal species, such as brown hare, will reduce the incidence of nest trampling and disturbance. It also reduces the impact on sward structure, which is important as habitat for invertebrate species.

Overstocking is associated with the deterioration of important farmland habitats such as stone walls, small woodlands and hedgerows, especially where the maintenance of these features are neglected due to the demands of livestock husbandry, where farm labour is in short supply and where farm incomes are depressed (Frost, 2003).

Deterioration of such habitats will impact upon the fauna they support, therefore a reduction in stock levels will lessen the impact.

### 5.1.3 Soil Quality Impacts

The Welsh uplands benefit from less intensive land use than other parts of the UK with relatively fewer soil fertility problems (Chambers et al., 2000). Recent studies in the uplands of England and Wales have shown that overstocking is a major factor in erosion, and that increases and decreases in erosion rates corresponded to times when grazing is intensified and reduced respectively (McHugh et al., 2003). Although there is no specific data comparing conventional and organic farms, it can be assumed that grazing pressure and therefore erosion rates will be lower on organic farms in the uplands.

### 5.1.4 Air Quality Impacts

Having fewer stock will reduce levels of nitrogenous gases produced. $CO_2$ emissions, N surpluses and methane emissions tend to be lower in organic farming (Ball et al., 2002). Analysis of a number of German, Dutch and British studies indicate lower $CO_2$ emissions from organic farming on a per hectare basis in the order of 40% - 60% and lower $NH_3$ emission potential than for conventional systems (Stolze et al, 2000).

### 5.1.5 Resource Use Impacts

While overall use of energy and non-renewable nutrients such as phosphorus may be reduced due to the cessation of fertiliser and biocide inputs, reduced stocking rates may mean an increase in the use of energy resources per head (of livestock) as tractor operations etc. will not necessarily be proportional to stock numbers.

Overall, with reduced numbers there may be a reduction in the number of labour hours required for tasks such as shepherding and shearing; although stocking rate reductions do not normally result in a proportional reduction in labour use, so that labour use per animal may be higher, also because of other management practices required. Data from Fowler (Fowler et al., 2000) indicate a much higher labour requirement for organic lowland cattle and sheep farms compared with a matched conventional group (2.9 labour units per organic farm compared with 1.8 on conventional farms).

Anecdotal evidence from Lake Vyrnwy, where heather moorland is managed for bird conservation, suggests that the management has a beneficial effect on lamb quality coming off the hills due to greater dispersal of the flock over the moorlands, but it has increased the time requirements for gathering sheep (Walker, M. *pers.comm*).

### 5.1.6 Agri-environment Scheme Requirements

Reduction of grazing pressure to maintain and enhance heather on upland moorland has been a key objective in agri-environment policy, examples being the Environmentally Sensitive Areas (ESA) Scheme (introduced 1987), and schemes applicable to non-ESA areas; the Moorland Scheme (introduced 1995, England only), and in Wales, Tir Gofal (introduced 1999 as successor to Tir Cymen). It is also recognised in these schemes that undergrazing of upland rough pasture can lead to a *Molinia* dominated sward that suppresses other flora species. This may be remedied by an appropriate balance of cattle to sheep, but there may also be a need to specify minimum stocking rates.

### 5.1.7 Standards Changes

None identified. Although there are no fixed stocking rates due to the variability of land types, there is a nitrogen loading limit of 170 kgN/ha over the farm or linked farms that is roughly equivalent to 2 LU/ha.

### 5.1.8 Further Research

To be successful, organic systems operating without cattle will require much reduced stocking rates. Under-grazing, particularly in sheep-only systems will cause herbage changes which should be monitored.

One of the issues raised at the organic unit at ADAS Pwllpeiran is whether the stocking rate limits imposed on habitat/ESA/Tir Gofal land are too restrictive for effective organic management. There may be more of a case for research on lower rather than upper stocking limits on organic farms. More specifically, the constraints of winter feed supply on organic farms may lead to too low summer stocking rates, and research is needed to investigate how this can be addressed.

### 5.1.9 Education & Dissemination

A critical assessment of holdings takes place during OCIS visits (for converting farms) or during the inspection process (for existing organic farms). These assessments lead to a recommendation for the stocking of different species (stocking mix) and overall stocking rates. There is currently opportunity for further technical consultancy available through Farming Connect.

## 5.2 Adjusting Stocking Balance – Usually by Increasing Ratio of Cattle to Sheep

*1*. Recommended practice – Likely to occur for reasons outlined, but possibly not as widespread as expected.*

*See Table 2 page 7

To make maximum use of the grass and to minimise the build up of parasitic diseases it is recommended that an organic farm has mixed stocking. In mixed grazing systems, with sheep and cattle grazing the same pastures concurrently, there are benefits for both species if the grazing mix is in the range 40:60/60:40 (Frost, 2003). These effects can be achieved through concurrent grazing, but may be more efficacious if rotational grazing is practiced (sheep following cattle). Although this is partly due to a dilution of the parasitic burden, the main reason lies in the complementary grazing habits of both species and the better use of herbage. In many hill and upland situations, the re-introduction of a beef enterprise (finishing stores or suckler cows) to a sheep only system makes better use of the grass, dilutes the worm burden, and provides additional FYM from winter housing which will provide the potential to improve fertility through better control of manure recycling on a given holding.

The difficulties of re-introducing cattle to sheep only holdings include the need to provide winter feed and the capital cost issues of winter housing, manure management and the potential need for additional fencing, as well as the technical and management challenges of a different species for the farmer.

Overall stocking limits will mean that an increase in cattle numbers in upland organic farms will require sheep to be removed. This is often specified by agri-environment scheme requirements such as on ESA's where for every head of cattle introduced, six sheep had to be removed.

### 5.2.1 Biodiversity Impacts: Flora

Mixed grazing of uplands is more likely to result in structural diversity than grazing with single species, especially where that species is sheep. Traditionally cattle were regarded as a subsidiary enterprise on the higher hill farm and their main function was to act as pasture controllers for the benefit of the sheep enterprise. With a reduction in cattle numbers on the hills and uplands of Wales (and the corresponding increase in sheep numbers), the overgrazing of grasslands and heather moorland has been associated with increases in vegetation less palatable to sheep such as purple moor grass (*Molinia caerula)* and mat grass (*Nardus stricta)*, and increases in bracken and rushes. Overgrazing is generally considered to prevent the natural regeneration of trees and shrubs in the uplands. Increasing the proportion of cattle can assist the control of Molinia and other coarse vegetation and it can also reduce the rate of bracken spread in vulnerable areas. In the Mynydd y Ffynnon project in mid-Wales, three seasons of introduced cattle grazing created structural diversity in Molinia-dominated enclosures and provided conditions suitable for dwarf shrub communities to recolonise from residual banks (Wildig, 2001), and subsequently Calluna has started to re-appear.

Hoof-action may be instrumental in breaking up soils and providing areas for seeds to come into direct contact with the soil. Current research at Bronydd Mawr Research Station in the Brecon Beacons is examining the ecological processes controlling the invasion and spread of injurious weeds in grasslands. It will also provide an opportunity to examine the agronomic and ecological consequences of weed control measures by developing Integrated Weed Management Systems. These will establish the effects of stock density and the timing of grazing on dominating weed species such as creeping thistle (which will have implications for the spread of scarcer, less robust species in grazing pasture). Research will also aim to quantify any adverse impacts of weed control strategies on non-target flora and invertebrates.

The introduction or increase of cattle numbers in a system will increase the need to cut hay or make silage. This can affect flora (and fauna) dramatically compared to a predominantly grazing system. The re-introduction of hay making would have beneficial effects allowing seed setting, but the difficulties of doing so in Wales may require additional incentives from agri-environment schemes. The temptation to move to silage production would have negative impacts, immediately reducing the structural diversity within the sward and removing niches. The more frequent cutting of silage will also have detrimental effects on the invertebrate population (Mitchley, 1994). The production of haylage would get over many of the problems of silage production without the demands of hay production but specific training will be needed.

### 5.2.2 Biodiversity Impacts: Fauna

Cow dung, either straight from the animal or as FYM, is the preferred food source of many carabid beetle species and attracts larger invertebrate species which then provide food for birds and insectivorous mammals, particularly in winter (Pfiffner, 1990).

Hutton and Giller (2003) note the benefit to dung beetle diversity and hence dung decomposition from the patchy ecosystems characterized by a diversity of ungulate species.

Cattle and sheep sheds in the uplands can provide winter shelter for native birds, sparrows, robins, blackbirds etc and summer nesting accommodation for swallows, starling and pigeons etc (NSA National Sheep Association, 2003). The loss of farmland bird species, where declines have been monitored by the BTO common bird census has lead to the RSPB calling for increased organic farming (Thomas, undated).

### 5.2.3 Soil Quality

Constant, concentrated cattle hoof-action, around trace element blocks or feed and water troughs, can cause soil compaction if it occurs when the soil is wet, particularly during the early spring. This can lead to areas of bare earth where plants are unable to grow and may cause localised erosion and leachate problems.

### 5.2.4 Air Quality Impacts

Most published data on methane production by ruminants are in terms of total global production using measured relations between feed intake and methane yields (Crutzen et al., 1986). Methane is a byproduct of microbial breakdown of carbohydrates (mainly cellulose) in the digestive tracts of herbivore. Release rates by ruminants were found to be lower when fed with protein-rich diets and higher when fed with crude fibre. Yearly methane production of 65kg per animal (weighted mean for heifers and steers) compares with production rates of 8kg $CH_4$ per animal for sheep (Crutzen et al., 1986). For comparative livestock units, (0.8 LU/heifer or steer and 0.08 per ewe) published data suggest that sheep may produce more methane than cattle. These calculations may be based on a higher concentrate feed for the cattle than for sheep, which would normally be the case on an upland farm, but the difference in emissions from similar stocking of cattle or sheep is likely to be negligible.

Aerobic treatment of manures is actively encouraged by organic standards to reduce methane emissions and ammonia losses, as anaerobic conditions produce $CH_{4.}$

The other greenhouse gas of concern is $N_20$, as agriculture is known to be partially responsible for the rise in atmospheric concentration of $N_20$ observed in recent years (Chadwick et al., 1999). Complicating factors relating to emission calculations are treatment of excreta, length of housing, storage, method of spreading, conservation of grassland and tillage land. $N_20$ emissions from solid manures from cattle and sheep were both measured at 15.9 g $N_20t^{-1}$ by Chadwick *et al* (1999), suggesting that increasing cattle numbers is unlikely to impact on $N_20$ emissions. Chadwick *et al* (1999) also confirm the findings of other studies that the largest item is the $N_2O$ emissions from soils receiving mineral N fertilisers. Restriction on the time and rate of application of manures offers potential for reducing $N_20$ emissions. Chadwick recommends keeping soil mineral-N levels to an optimum level for crop production and reduced to a minimum when soil conditions favour denitrification, suggestions entirely in keeping with organic practices. Other suggestions to reduce $N_20$ emissions included a move from straw-based to slurry-based systems, but the authors acknowledge that this would be at the expense of increased methane emissions (Crutzen et al., 1986), and it would not be suitable on organic farms.

### 5.2.5 Water Quality

In areas where access to a watercourse is possible, grazing animals can reduce water quality by stirring up the streambed and defecating in the water. There is a danger of the spread of zoonoses and other diseases e.g. Leptospirosis and Johnes to other cattle in the area.

(McGechan, 2003) used a modelling approach to investigate the effect of grazing animals on phosphorus pollution of water draining from grazed fields. In addition to surface run-off (which may occur in some soil types and areas of fields subject to poaching such as around gates or water troughs causing P losses,) the main mechanism of transport identified was through phosphorus sorbed onto colloidal particles in the faeces of cattle flowing through water-filled macropores in wet soil. The model (based on dairy cows grazing on lowland drained fields) suggested that phosphorus pollution does not occur during grazing under dry conditions, so losses will remain low if animals are housed before the soil reaches field capacity.

Potential contamination of water-courses through increased cattle numbers may be countered by the concomitant decrease in sheep numbers and pollution incidents from dips.

### 5.2.6 Resource Use Impacts

If cattle on hills and uplands are housed there will be a requirement for bedding materials, possibly from bought-in sources, and labour and energy requirements to maintain and clean the housing. There will be benefits in terms of a reduced need for bought-in FYM. Increased cattle numbers also has implications for production or purchase of winter feed and resultant nutrient and energy demands.

### 5.2.7 Agri-environment Scheme Requirements

The capital requirements for livestock housing, fencing of sensitive areas, manure storage, plus the heavier labour requirement of cattle in winter are likely to discourage farmers from introducing or increasing cattle numbers. To achieve the husbandry and environmental benefits from a more balanced cattle/sheep ratio these disincentives need to be overcome.

Support through a revised organic farming scheme for mixed stocking would need to be sufficiently remunerative to overcome the difficulties; the most intractable of which may be the labour requirements of housed cattle. With an increasingly aged farming population and the dependence on off-farm income, labour shortage is not simply a financial matter.

If means are found to encourage a better balance of cattle and sheep, monitoring of the effects of increased cattle numbers relating to the above impacts, in particular manure storage will be necessary.

For the protection of particular habitats the intended grazing and cutting programme should be agreed, and sensitive areas (such as watercourse banks) noted. Seasonal stocking rate recommendations may be appropriate for special habitats although sensitive areas should be regularly monitored to ensure that management practices are producing the outputs required rather than relying on rigid adherence to prescriptions.

### 5.2.8 Standards Changes

None recommended, although the particular difficulties arising from sheep-only systems and the extent to which such systems can fully meet organic standards should be considered.

### 5.2.9 Further Research

Although systems for data collection are improving, there are no reliable sources of data for individual farms, which would provide data on the enterprise mix/stocking mix of organic farms in Wales. These data would greatly facilitate policy making and assessing the impacts of policies.

A major constraint in adding/increasing cattle to a system is the cost of suitable housing and feeding in winter, including the costs of conservation, storage and handling of forage. Research is required into low-cost, welfare and environment friendly semi-housed systems, e.g. field shelters, stand-off or feeding pads.

### 5.2.10 Education & Dissemination

Organic systems including fewer cattle and tending towards sheep-only systems require greatly reduced stocking rates for parasite and grazing control; it is essential that farmers and land managers understand the likely effects in vegetation and habitats present as well as the potentially drastic effects on income.

Organic systems generally have higher management requirements, leading to greater training needs, particularly in less than optimal situations. Training of safe-grazing management techniques, including FEC monitoring and analysis, feeding, breeding etc is needed. Training in importance of dangers of anthelmintic resistance and control when limiting drenching regimes and/or families of drench to be used in a system (ivermectin use is not allowed).

New ways of working are required to address the issue of labour requirements. The sharing of labour between farms and use of machinery rings for labour, or rotating duties between farmers should all be developed. Successful schemes need to be identified and demonstrated to other farmers.

## 5.3 Keeping Indigenous Breeds and Strains Adapted to the Environmental Conditions of the Farm

*1*. Recommended practice – Positive evidence of frequency.*

*See Table 2 page 7

Without recourse to the range of agro-chemicals used in conventional agriculture, organic producers are more dependent on plant varieties suited to their local climatic and soil conditions and which are less susceptible to disease and pest attack. These characteristics are more likely to be found in older plant (or crop) varieties rather than varieties bred to maximise production using agro-chemicals. Similarly, traditional and indigenous livestock breeds are more appropriate for organic systems, due in part to their suitability to local conditions and their capacity to thrive on a forage only diet (Wanke, 2002). Most rare livestock breeds declined during agricultural intensification, when livestock selection and management was directed towards high productivity, often to the detriment of longevity, disease resistance, ease of parturition, meat quality and efficiency of feed conversion. These are characteristics, which, together with a high degree of adaptation to local environmental conditions, are the strength of many rare breeds.

The concept of using locally adapted, indigenous breeds and cultivars is based on the theory that there is a closer match of production organisms to the local characteristics of the population environment. This can enhance natural hardiness and tolerance to environmental stresses and improve resource use and productivity without external inputs or excessive management. Keeping indigenous breeds and strains that have adapted to the environmental conditions on the farm influenced the choice of a traditional cattle breed (Aberdeen Angus) at a Scottish case study farm (Shell, 2001); cattle and sheep breeds (Welsh Black cattle and Hardy Speckle Face ewes) at the ADAS Pwllpeiran organic unit (Frost, 2001), and the choice of Lleyn ewes and Welsh Blacks at Frongoch (Powell et al., 1997).

In a study for the Countryside Council for Wales, (Yarwood and Evans, 2002) identified traditional Welsh breeds as an important component of Welsh landscape character, contributing positively to local identity. They argue that these breeds are a significant part of Wales' genetic resource. Tir Gofal recognises the importance of the keeping of indigenous breeds in its management agreements. Traditional breeds are also part of the genetic resource and their conservation is part of an EU Directive (Yarwood and Evans, 2002). There is, therefore, a commitment to conserving these breeds. There is a need for the development of a market for the output produced from the rare breeds; their survival, organic or not, depends on a viable market.

*In situ* conservation of an endangered breed and the suitability for incorporation into organic systems were examined in a project in the southern Black Forest, in semi-natural grassland of extensive pastures of high nature conservation and tourism value. Analysis of housing systems, pasture management, marketing concepts and farm viability were examined and future scenarios using Hinterwälder cattle were developed. Conclusions related to the doubtful viability of the farms due to difficulties of marketing and generating adequate returns from the livestock, and standards issues relating to tethering (Wanke, 2002).

### 5.3.1 Biodiversity Impacts: Flora

Traditional or indigenous breeds of livestock are generally hardy and better adapted to living on poor quality vegetation without supplementary feeding and are better able to live out all year, at low stocking rates. They are, therefore, well adapted to manage semi-natural vegetation in an environmentally sensitive way (Yarwood and Evans, 2002).

Research has clearly shown that modern breeds are unable to utilise semi-natural rough grazing effectively unlike their traditional counterparts (Frost, 2001).

Yarwood and Evans (2002) note that some traditional breeds of livestock are important in the conservation of specific habitats and that rare breeds have become useful in maintaining certain habitat conditions favoured by endangered plants and animals. They argue that grazing with rare breeds may be the most efficient option available for the farmer to maintain the nature conservation interest of a particular site. Very little is known about the precise effects that the grazing habits of individual breeds have on floral assemblages however, as conservation grazing becomes more common, knowledge about specific breeds is increasing. Small et al., (1999) conducted a questionnaire survey in 1998 of land managers of sites run by conservation bodies to collate information as part of the Grazing Animals Project

(GAP). The tables below, reproduced from Yarwood and Evans (2002) are derived from this work, and represent, in their opinion, the best analysis of breeds and conservation grazing available at the present time.

### 5.3.2 Biodiversity impacts: Fauna

Maintenance of indigenous breeds is of great importance for genetic diversity. There is otherwise a danger that selection geared to commercial expediency may discriminate against characteristics that might be of immeasurable value in the future (Alderson, 1994).

Faunal impacts will follow from changes in flora and sward structure.

### 5.3.3 Soil Quality Impacts

A reduced reliance on provision of trace elements blocks may reduce localised poaching, and poaching may be reduced due to the lighter weight of indigenous breeds.

### 5.3.4 Air Quality, Water Quality

No discernable difference in impact when compared to that of non-indigenous breeds and strains.

### 5.3.5 Resource Use Impacts

The lighter indigenous breeds require less dry matter from the pasture, which means that the vegetation on the ground lasts longer. Indigenous breeds adapted to the local environment are less dependent on winter housing and have less supplementary feed requirements than breeds selected for production maximisation. Otherwise no discernable difference in impact than that of non-indigenous breeds and strains.

### 5.3.6 Agri-environment Scheme Requirements

As Yarwood and Evans (2002) point out, most agri-environment schemes require farmers to follow management agreements and grazing with traditional breeds may be the most efficient method of maintaining the nature conservation interest of a particular site. Where it can be shown that traditional breeds would suit management of a particular habitat better than other types then a supplement could be offered for this choice over and above non-traditional breeds, see also the arguments in Yarwood and Evans (2002). Premium payments for grazing with Welsh Blacks are available in Tir Gofal.

### 5.3.7 Further Research

Suggestions that indigenous breeds are ‘fitter’ for particular environments, therefore producing a healthier animal with less environmental impact should be studied. In particular the suggestion that they are better able to thrive under particular trace element deficiencies should be studied, as this may be due to previously lower stocking and production expectations.

**Table 4 The Qualities of Welsh Sheep in Agri-Environmental Management**

| Usefulness in conservation grazing for management objectives | BREED – SHEEP | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Beulah Speck' Face | BSF x Suffolk | BSF x Welsh Mule | Black Welsh Mtn | Clun Forest | Lleyn | Lleyn x Bleu de maine | Welsh Mtn | Welsh Mtn X |
| bird conservation | | | | | | | | vg 1 | |
| butterfly conservation | av 1 | | | | | | | good 1 | |
| control bracken | poor 1 | | vp 1 | | | | | vp 1<br>poor 1 | |
| control invasive grass | poor 1<br>av 3<br>good 2 | poor 1 | av 1 | good 1 | good 1 | poor 1 | | av 1<br>good 1 | |
| control trees/shrubs invasion by taking seedlings | poor 1<br>av 2<br>good 6<br>vg 1 | good 1 | good 1 | | poor 1<br>vg 1 | av 1 | vg 1 | av 1<br>good 1 | good 1 |
| develop vegetation mosaic | poor 2<br>av 2<br>good 4 | good 1 | good 1 | good 1 | | good 1<br>vg 1 | vg 1 | good 3 | |
| dog-proof | | | | | | poor 1 | | | |
| elimination of trees and shrubs | poor 3<br>good 5 | good 1 | av 1 | | vp 1<br>good 1 | av 1 | | | |
| improve vegetation structure | poor 1<br>av 4<br>good 4<br>vg 2 | vg 1 | | good 1 | good 1 | av 1 | | av 1<br>good 3 | good 1 |
| increase amount of bare ground | poor 1<br>av 2<br>good 1 | | | | | poor 1 | | good 1 | av 1 |
| maintain vegetation structure | av 3<br>good 4<br>vg 3 | vg 1 | good 1<br>vg 1 | | good 1 | good 1<br>vg 1 | vg 1 | poor 1<br>good 1 | vg 1 |
| reduce fire risk | good 1 | | | | | av 1 | | | |
| single species management | | | | | | av 1 | | | |

**Key:** vp = very poor; vg = very good; av = average; The numbers refer number of times effect reported by surveyed graziers.

N.B No Welsh sheep breeds contributed to the following management objectives: aesthetic; dragonfly conservation; deforestation management; insect conservation.

**Table 5 The Qualities of Welsh Cattle and Ponies in Agri-Environmental Management**

| Usefulness in conservation grazing for management objectives | BREED – CATTLE / PONY | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Heref x Beef Short-horn | 'Black' Heref | Heref X Friesian | Heref | Heref x | Welsh Black | White Park | Welsh Pony |
| aesthetic | | | | | | good 1 | | good 1 |
| bird conservation | | | | | | | | vg 1 |
| control bracken | poor 1 | | | | vp 1<br>av 1 | good 1 | av 1<br>good 1 | good 4 |
| control invasive grass | vg 1 | av 1 | av 1<br>good 1 | av 1 | av 3<br>good 1 | good 1 | vg 1 | good 2 |
| control trees/shrubs invasion by taking seedlings | av 1 | | av 1<br>good 1 | av 2 | poor 1<br>good 1 | good 1 | poor 1<br>av 1<br>good 1 | good 1 |
| develop vegetation mosaic | good 1 | | good 2 | av 1<br>good 1 | poor 1<br>av 1<br>good 1 | good 1 | good 1<br>vg 2 | good 3<br>vg 2 |
| dog-proof | | good 1 | | | | | | |
| dragonfly conservation | | | | | vg 1 | | vg 1 | |
| elimination of trees and shrubs | poor 1 | | poor 1 | poor 1<br>av 1 | vp 1<br>poor 1<br>good 1 | good 1 | poor 1<br>good 1 | av 1<br>good 1 |
| improve vegetation structure | good 1 | good 1 | good 1 | av 1<br>good 1 | av 1<br>good 2 | good 1 | good 2<br>vg 1 | good 5<br>vg 2 |
| increase amount of bare ground | good 1 | av 1 | av 1<br>good 1 | av 1 | av 1<br>good 1 | good 1 | av 2<br>good 1 | good 3 |
| maintain vegetation structure | vg 1 | | av 1<br>good 1 | av 1<br>good 1 | good 4<br>vg 1 | | good 1<br>vg 1 | |
| reduce fire risk | | av 1 | | | av 1<br>good 1 | good 1 | av 2 | av 1<br>good 1 |
| single species management | | av 1 | | | av 1 | | | |

Key: vp = very poor; vg = very good; av=average; the numbers refer number of times effect reported by surveyed graziers.

N.B No Welsh cattle / pony breeds contributed to the following management objectives: butterfly conservation; deforestation management; insect conservation.

**Source: Yarwood and Evans, 2002 adapted from Small *et al.* (1999).**

A five year research project to examine the importance of livestock experience and breed type on foraging behaviour in unimproved grasslands is currently being undertaken by J R B Tallowin of IGER, North Wyke. This a 5 year project (2001-2005) funded by DEFRA.

## 5.4 Control of external parasites

*4*. Mandatory that OPs not used – also evidence of reduced use of pyrethroids*

*See Table 2 page 7

The organic standards ban organophosphorus and organo-chlorine (gamma HCH) compound dips and there are restrictions on synthetic pythrethroids and moxidectin use for scab control. If organo-phosphorus compounds are used to comply with statutory requirements then the animals must be permanently marked at the time of treatment and may not be used for organic meat production.

Organophosphate (OPs) based dips offer a broad spectrum control against all major parasites in the UK but are prohibited by organic standards due to the continuing controversy over their safety to dip operators and the environment and because of concerns about their effect on human health (Curl et al., 2002). Synthetic pyrethroids (SPs) have recently been shown to be more toxic to aquatic organisms than OPs. The environmental impact of synthetic pyrethroids is not limited to levels in dips but also to residues in wools. SPs may be removed from the wool by climatic conditions and then deposited in the local environment. Organic livestock farmers are currently permitted to use SPs for the treatment of ectoparasites.

Whilst there is a certain amount of risk to the environment associated with the dipping of sheep there is a further environmental risk associated with disposing of spent dip. After receipt of authorisation from the Environment Agency, it is permitted to spread spent dip on land either directly or after treatment with certain chemicals or after diluting the spent dip with water or mixing it with slurry.

Flumethrin (Bayticol) and Cypermethrin can be used as control measures where scab infection is known or suspected. Permission must be sought from the certification body before use and the withdrawal period required by the certifying body must be observed.

Note: Only dip and injectable products are approved by VMD for the treatment of scab. Pour-on products are not approved for scab but are approved for blowfly strike.

ADAS recently undertook a survey of dipping practices and their environmental impacts (McLean and Frost, 2003). This revealed that only a fifth of organic farmers used plunge dips to control ectoparasites, compared to over three-quarters of conventional farmers. Organic farmers were also less likely to dip more than once a year compared to non-organic farmers; a quarter of organic farmers dipped more than once a year compared to half of all conventional farmers surveyed.

A total of 134 questionnaires were completed in the ADAS survey: 96 being completed by conventional sheep farmers and the remaining 38 being completed by either in conversion or fully registered organic farmers. The use of pour-ons was higher amongst organic farmers with 54.5% using pour-ons as a treatment method compared to 16.4% of conventional farmers. Sheep showers were only used by just over 13% of both organic and conventional farmers. A higher proportion of conventional farmers (17.9%) used injectables compared to 9.1% of organic farmers. The higher use of pour-on products amongst organic farmers is a reflection of the treatment practices of organic farmers where 36.8% of farmers surveyed treat only for blowfly strike. 57.1% of organic farmers who treated for ectoparasites treated their flocks once a year compared to 41.2% of conventional farmers. 28.6% of organic farmers treated their flocks twice a year compared to 51.55 of conventional farmers. The most common months for dipping were July, August and September for conventional farmers whereas July and September were the most common months for organic farmers.

### 5.4.1 Biodiversity Impacts: Flora

No specific impacts identified.

### 5.4.2 Biodiversity Impacts: Fauna

Dips containing synthetic pyrethroids, although thought to be less harmful to human health, are 100 times more toxic to aquatic life than organophosphates (JNCC, 2003).

Organophosphates and synthetic pyrethroids caused around 1200km of ecological damage to rivers and streams in Wales in 1998, largely in the uplands (WAG, 2003). Any minimisation of this through improved management will be beneficial.

Poor management of dipping processes can lead to pollution of watercourses and ground water and can persist in the food chain in plant tissues.

The use of pyrethroids in sheep dip is a particular issue in Wales because of its high sheep density, however, a key finding of recent ADAS work (McLean and Frost, 2003) is that only 16% of organic sheep farmers use SP based dip products compared to 24% of conventional farmers and given that there are considerably fewer organic farmers this will mean that a relatively small number of farmers will be using SP dips.

### 5.4.3 Soil, Air, Water Quality Impacts

The lifespan of residual organophosphates in the soil is currently being researched by ADAS.

Pollution of watercourses and groundwater is the most significant risk of the increased use of pyrethroid-based dips and their impact not only on aquatic ecology but also on sources of drinking water, which is particularly pertinent in upland water catchment areas.

### 5.4.4 Resource Use Impacts

The only impact identified relates to the energy use in agro-chemical production.

### 5.4.5 Agri-environment Scheme Requirements

Dip/bath areas proposed for use should be examined on entry to the schemes to ensure they are not near watercourses or leaking and there is adequate holding space (see below). Capital payments should assist with the provision of adequate facilities so that failed systems can be condemned. If mobile dip facilities are to be used, their place of operation should be agreed.

### 5.4.6 Standards Changes

Use of pyrethroid dips is now a restricted practice for Soil Association Licensees. This means justification has to be given for its use, and other prevention measures must be in place. This should be extended to all organic producers.

### 5.4.7 Further Research

Organic farmers have been shown to use less frequent treatments. The success and efficacy of alternative fly-control opportunities e.g. fly lures, pheremone traps etc should be researched.

### 5.4.8 Education & Dissemination

Advice on storage, appropriate timing of use and disposal, particularly of pour-ons is required. The Environment Agency (Merriman, *pers. comm*.) have identified the major route of contamination of water by synthetic pyrethroids as occurring during the dipping process and if stock is returned to pasture immediately post dipping ; particularly if they cross water courses. Synthetic pyrethroids generally adhere poorly to the fleece, so stock wet from dipping and crossing a stream will cause contamination. To overcome this a hard standing area, draining back into the dip, should be used and sheep held until they are dry. Another obvious route is through poorly maintained baths. Leaking baths should be repaired and they should be covered when not in use to prevent water contained therein from freezing and cracking the structure.

McLean and Frost (2003) found evidence that farmers are using inappropriate products to treat ectoparasites. Training and education is needed to improve understanding of which products are appropriate and licensed for the treatment of specific ectoparasites.

## 5.5 Reduced and restricted Use of Prophylactic Allopathic Veterinary Medicines

*4*. Mandatory*

*See Table 2 page 8

The general objective of organic standards is to sustain farm animals in good health through effective management, with an emphasis on appropriate diets, high standard of stockmanship and the prevention of conditions where remedial action, particularly chemotherapy becomes necessary (UKROFS, 2000).

Routine prophylactic use of veterinary medicines is not allowed in organic agriculture but known farm problems may be addressed where all possible corrective measures are also taken, particularly including appropriate stocking rates and rotational grazing. From the start of organic conversion, the certification bodies require the preparation and implementation of an animal health plan in conjunction with a nominated veterinary surgeon. This identifies any known farm disease problems and indicates how blanket and regular prophylactic use of vet medicines is reduced under organic management.

During the conversion period at ADAS Redesdale, the nil worming policy resulted in livestock with generally good health and no serious outbreak of disease (Keatinge et al., 1993).

In the particular case of anthelmintic use to control internal parasites, there are also objections to the use of some treatments – particularly Avermectin-based wormers, the use of which is prohibited by the organic standards- because they leave environmentally damaging residues in animal faeces which are especially harmful to invertebrates and other soil fauna (Unwin et al., 1995). Avermectins is the collective name given to a range of animal health products which provide effective broad-spectrum control of gastro-intestinal nematodes and ectoparasites affecting farm livestock. The residues of these drugs retain their insecticidal properties after excretion in livestock faeces and a large volume of research has proven that these residues have adverse direct and indirect impacts on the invertebrates colonising the dung from treated animals for weeks after treatment (McCracken, 1995).

### 5.5.1 Biodiversity Impacts: Fauna

There is a lack of information in the public domain on the effects of prophylactic and allopathic treatments to the wider environment. Prophylactic allopathic veterinary medicines have been detected as residues in plant tissue and are therefore transferable up the food chain, causing potential build up to toxic levels in birds and mammals (Strong, 1992).

In organic farming, reliance on chemotherapy is contrary to basic principles, but there are also a series of practical objections relating to the implications for animal and human health. Many insectivorous birds and mammals, including bats, find a plentiful source of prey insects in dung, especially cow pats. Instead of rapidly returning to the soil through the natural erosion (as is the case with dung of smaller herbivores), the organic matter and minerals in cow-dung is reutilised by a community remarkably rich in species and individuals. Each cow pat produced will contain on average about 1000 inhabitants during the course of its life (McCracken et al., 1995). As each cow produces about 10 pats per day (or 3650 per year) then it could be said that each cow produces enough dung for 3,650,000 insects (the majority of which are fly larvae) each year (McCracken et al., 1995). The lethal effect on dung-feeding beetles reduces the amount of prey available to their predators, mainly insectivorous birds and animals. This would be alleviated by a reduced use of Avermectin wormers as on farms complying with organic standards (Strong, 1992).

In a study on the effects of intensification of agriculture on dung beetle communities in Ireland (Hutton and Giller, 2003) organic farming was found to have beneficial effects on dung beetle communities. Dung from organic farms held a significantly greater beetle biomass than the intensive and rough grazing dung. The authors note the importance of veterinary drugs (e.g. ivermectin) as detrimental to dung beetle biodiversity and dung decomposition.

### 5.5.2 Soil Quality Impacts

There will be a reduced risk of soil contamination by residual Avermectins in dung and therefore a reduced risk to soil fauna and their beneficial contribution to maintaining soil fertility.

### 5.5.3 Air Quality Impacts

No information available at the time of the report’s preparation.

### 5.5.4 Water Quality Impacts

Avermectins are toxic to aquatic invertebrates and their predators. There will be a reduced risk of accidental pollution of watercourses on organic holdings.

### 5.5.5 Agri-environment Scheme Requirements

Cross compliance with the requirement for a licence for dip disposal from the Environment Agency would seem appropriate. Also extending the restrictions on the use of wormers with residual actions on dung decomposition fauna to non-organic farmers in agri-environment schemes would be beneficial.

### 5.5.6 Standards Changes

Elements of animal health planning need to be strengthened, for example the monitoring and review process. There should be realistic measurable targets for assessing animal health (e.g. a 5 % incidence of a given condition in 3 years) so improvement can be measured. Animal health recording and best practice should be a requirement. At present there is no specific animal health standard for the quarantine of bought in stock – this issue needs addressing.

### 5.5.7 Further Research

Research into the effects of residual actions of currently licensed and new worming treatments would be advisable.

Research is also required into levels of use (particularly in conventional farming) of allopathic medicines and the effects on levels of use on the wider environment especially residues from antibiotics, hormone treatments etc.

### 5.5.8 Education & Dissemination

Many veterinary medicines are self administered by the farmer. Although the constraints of the inspection process may act as a deterrent from treatments and ensure care, there may be insufficient training to prevent the increase of resistance through mis-dosing for example. There is a great need is to educate farmers on the value of adopting and implementing a herd health plan.

Assistance should be provided to devise safe grazing strategies that work. Faecal Egg Count monitoring technologies are a useful decision making tool, which should be encouraged. The use of quarantine strategies for bought in stock should be advocated.

## 5.6 Use of Forage Based Diets

*4*. Mandatory*

*See Table 2 page 8

For all organic ruminants 60% of the daily dry matter must be fresh or conserved forage and 60% of the feed should come from the unit or from linked units (UKROFS, 2001). An increased forage requirement also directly contributes to reduced stocking rates.

Animals fed on a high concentrate diet are more likely to excrete acid-resistant E. coli bacteria that are threatening to man (Russell et al., 2000). The bacteria thrives in the ruminant stomach and can be returned to the environment through dung contact with the soil and is thus able to infect and re-infect grazing livestock.

### 5.6.1 Biodiversity Impacts – Flora and Fauna

The impact on floral and faunal diversity is directly influenced by stocking rates and ratios – see 5.1. and 5.2. Additionally, the need for forage conservation from the holding rather than buying in provides cropping diversity.

### 5.6.2 Soil, Air and Water Quality Impacts

Organic systems have potential to reduce E. coli in watercourses with a reduced risk to human health.

### 5.6.3 Resource Use Impacts

A reduction in the need to transport concentrates for feeding will directly impact on fuel requirements; however, concentrates are more portable for an equivalent nutrient value of forage and therefore there may be potential savings (on-farm) where concentrates are used.

### 5.6.4 Further Research

Current work at ADAS Pwllpeiran is exploring the possibility of growing alternative protein forages sources on organic mountain farms. It is hoped to extend this work in collaboration with IGER to include work on alternative forages from lowland farms.

Research is required to examine the different nutrient/microbiological content of forage compared to concentrate diets and the manure produced (this is currently the focus of a Framework 6 bid). Research would be helpful to study the ability of cattle on extensive systems to supplement their diet with micronutrients available from herbage and their ability (or not) to thrive without supplements.

Further work on dietary control of acid-resistant E.coli and contamination of watercourses is also recommended.

## 5.7 Storage and use of Slurries, Manures and Composts and constraints on Import/Export of nutrients

*1* Recommended – likely to occur for reasons outlined. Some elements mandatory.*

*See Table 2 page 8

FYM is a highly valuable resource on the organic farm and the main aim of manure management is to conserve as much nutrient value as possible. Export of FYM or slurries is clearly inadvisable for an organic farmer and manure imports are restricted in both amount and source and are rare due to practical reasons of bulk and cost.

For all agricultural systems, the Code of Good Practice for the Prevention of Environmental Pollution from Agricultural Activity provides advice on the storage and use of slurries, manures and composts. There are no additional standards prescribed for organic procedures at the present time. Best practice is to stack and cover FYM to avoid nutrient leaching during the winter and if manures are stacked outdoors the heaps must not be within 10 metres of watercourses or 50 metres of boreholes. Application of FYM and slurry should also be timed to avoid leaching especially in high rainfall areas. Manures should only be applied when crops are growing and able to take up nutrients, so spreading between mid September and mid February should be avoided.

Storage and handling methods are not likely to show a significant difference between conventional and organic farming (Frost, 2003) but the extensive nature of upland and hill farming will impact on manure and compost requirements. The main impact will arise from an increase in cattle numbers in the uplands as cattle are the main producers of storable manures (currently estimated at a value of £30/annum/cow)

(WAG, 2003). However, the reintroduction of cattle to the uplands with winter housing will increase requirements for straw, or other carbon-rich materials and the need for safe storage of manure.

### Do's and Don'ts of Manure Management on the Upland Organic Farm

- *Do* prevent surface water from getting into the manure heap and diluting it
- *Do* assess storage requirements
- *Do* prevent nutrient-leaching due to insufficient storage capacity
- *Do* cover the heap - to cut down on losses of potash and phosphate from rainwater leaching through the stack
- *Do* consider composting the FYM - helps kill off weed seeds such as dock
- *Do* target fields shut up for forage production or aftermaths

- *Don't* apply FYM at the wrong time of year - the ground should be warm enough for the soil to be active for maximum fixing of nutrients
- *Don't* over-apply FYM - heavy applications may lead to wastage
- *Don't* spread FYM at more than a maximum equivalent to 170-kg N per hectare per year over the whole holding.
- *Don't* stack manures in heaps within 10 metres of watercourses or 50 metres of boreholes

**Source: Guide to Organic Farming in the Uplands (ADAS Pwllpeiran)**

Amounts of allowed manure import are limited by the Organic Standards: the total amount of manure applied on the holding may not exceed 170 kg of Nitrogen per year per hectare of agricultural area used, which includes existing stocking. To bring conventional FYM onto an organic farm requires the permission of the certification body. Any such manures need to be composted for 3 months or stacked for 6 months (or in the case of poultry manure for 6 and 12 months respectively) before use. All conventional animal manures that are brought on to an organic holding must be free of GMOs. Thus imported FYM must come from animals that are either forage-fed only, or if they have been fed supplementary feed the rations must have a GMO-free declaration.

In Wales, environmental management prescriptions in the Organic Farming Scheme prohibit the application of manures within one metre of boundary features.

### 5.7.1 Biodiversity Impacts: Flora

Best practice storage will reduce rank areas of runoff and allow other species to flourish. Best practice applications will reduce run-off to water courses/ditches and reduce weed ingress typical of high fertility water-course loading e.g. nettles.

### 5.7.2 Biodiversity Impacts: Fauna

Best practice manure management will not compromise water course fauna and will enable composting or part composting – itself a promoter of bio-diversity from bacterial to mesofauna levels.

### 5.7.3 Soil, Air and Water Quality Impacts

The use of composted FYM has impacts on soil, air (emissions through stacking, turning and spreading) however the issue of FYM production rather than slurry is dealt with elsewhere (ADAS and EFRC, undated).

Considering the use of slurries, manures and composts, spring application reduces the risk of N leaching but may increase the risk of P and pathogen transfer to water (Unwin et al., 1995). The quantity of slurry or dirty water applied at any one time is usually less on organic farms because of the quantities available (reduced stocking) and the desire to maximise benefits to crop growth. The risk of subsequent run off problems is therefore reduced (Unwin et al., 1995). This is particularly important in upland water catchment areas that are vulnerable to leachate run off.

### 5.7.4 Resource Use Impacts

Conservation of nutrients and re-cycling within farms saves considerable resources in purchased nutrients. Awareness of the nutrient content of manures and slurries promotes good practice. Composting of FYM assists the building of organic matter in depleted soils.

### 5.7.5 Agri-environment Scheme Requirements

It is proposed that Waste Management Plans should become compulsory for organic farmers. It is also recommended, however, that there should be a change of name from <u>Waste</u> Management Plans, as this implies something that is surplus to requirement and useless.

The use of umbilical cord systems of slurry spreading in environmentally sensitive areas should be controlled as in the opinion of the Environment Agency they represented a pollution threat to water courses. These systems can be used in conditions when tractor pulled spreaders cannot operate and where, by their very nature: steepness, wetness and vegetation they should not be getting slurry spread on them, and are used in weather conditions which are likely to contribute to field run off and water course pollution (Merriman, *pers.comm*.).

### 5.7.6 Standards Changes

See above.

### 5.7.7 Education & Dissemination

Farm Waste Management Plans, which are presently a voluntary option for all farmers, were introduced specifically to protect water from slurry and manure pollution incidents. Incorrectly stored slurries, manures and composts will create potential pollution risk, whether on organic or conventional farms. See also comments on Umbilical Cord systems, above.

# 6 IMPLICATIONS OF THE FACTORS INVOLVED IN ORGANIC CONVERSION AND MANAGEMENT FOR BIODIVERSITY AND THE ENVIRONMENT - Crop Management

## Summary

Organic practices in management of grassland and crops identified that differ from conventional and have direct biodiversity or environmental impacts are:

i) Cessation of N fertiliser use.

ii) Restriction on P & K use.

iii) Use of lime to maintain pH.

iv) Use of clovers and herbs in grass leys.

v) Cessation of use of Chemical pesticides and herbicides

vi) Mechanical and manual weed control and sensitive and timely cultivations.

vii) The use of mixed farm systems and rotations.

viii) The use of cover crops and undersowing.

ix) The use of green manures.

## 6.1 Cessation of N Fertiliser Use

*4*. Mandatory – Some effect on hill, most impact on uplands and associated lowland*

*See Table 2 page 8

The use of mineral nitrogen fertilisers is prohibited by all organic standards. Conversion to organic farming can only begin after the last date of any application of N fertiliser, and cannot be completed until a minimum of 24 months has elapsed since the last application. One of the consequences of the cessation of N fertiliser use is that organic farmers need to maximise the benefit of their FYM, which requires efficient manure management practices. There is typically a reduction in stocking rates of between 10 and 50% as a result of cutting N fertilisers.

(Allen, 1995) notes that even modest applications of nitrogen can rapidly and fundamentally alter the composition of a species-rich meadow in favour of competitive and more productive grasses. The positive impacts on floral species will correlate with positive impacts on faunal species they support.

It should be noted that on organic farms inputs are restricted or prohibited over the whole holding whereas on the non-organic Tir Gofal farms this only occurs on parts of the farm where specific management agreements require it.

### 6.1.1 Biodiversity Impacts: Flora

The addition of N fertilisers is intended to promote lush growth of crop plants such that they out-compete less robust and scarcer species that cannot tolerate high nutrient levels (Gimingham, 1989). The UK Biodiversity Action Plan Steering Committee has identified a series of actions necessary to protect and conserve Biodiversity Action

Plan (BAP) habitats and species. The Agricultural and Rural Affairs Department of the National Assembly for Wales (now Department for Environment, Planning and the Countryside) committed itself as an actionee for 90 Species Action Plans (SAPs) and 16 Habitat Action Plans (HAPs). In many cases, BAP actions parallel organic standards, and this is particularly so where BAP actions call for limitations on fertiliser and biocide use. Some examples where control of fertiliser is specifically mentioned are:

| **BAP Actions** | **BAP Habitats and Species** |
|---|---|
| Reduce the risk posed by run-off of agricultural chemicals including nitrate and phosphate fertilisers | Violet Crystalwort, *Riccia huebeneriana* |
| Control drift and run-off of agricultural chemicals | Earth-Tongue, *Microglossum olivaceum* |
| Reduce the threat of adverse practices (including herbicide and fertiliser use) | Lesser Bearded Stonewort, *Chara curta* |
| Protect hedges from fertilisers and pesticides | Ancient and/or species-rich hedgerows |

The use of soluble nitrogen fertilisers is prohibited by organic farming standards. On lowland organic farms crop rotations include legumes to provide sufficient nitrogen to maintain the level of productivity. In the uplands, however, maintaining high performance productive pasture is often associated with establishing ryegrass/clover swards, usually, but not necessarily, on in-bye land. The performance of these swards without N input decreases rapidly because the sward is dependent on the clover content which itself is adversely affected by the abiotic environment (Frame, 1996; Frame and Boyd, 1987; Newbould, 1982). This is a major problem for organic farming in the hills and uplands, and in northern latitudes (Dyrmundsson, 2000). This is also influenced by inputs of P, K and Ca, which will be used in appropriate forms by organic farmers, but may conflict with environmental objectives to avoid increasing fertility, or even to reduce fertility. This is one area of potential conflict between organic food production and environmental objectives, although organic farming still offers benefits compared to conventional farmers who are not restricted in their ability to import N and other nutrients.

The study by ADAS for the National Assembly for Wales concluded that organic farming methods are largely consistent with actions for BAP species and habitats, and that where one or more UKBAP species are present on a farm, the site would benefit from the adoption of organic farming methods (Frost, 2003). Non-farmed components of a farm such as field margins, hedgerows and woodland contain relatively higher levels of floral biodiversity. The removal of artificial N from the system can only be beneficial to the flora and its supported fauna in such areas. A number of species that are adapted to the semi-cultivated landscape common to LFAs cannot co-exist even with modern organic farming, because any inputs would leave the system too fertile for them (Hampicke, 1978). Therefore not all organic farms are benign to nature conservation; there may be cases of relatively highly stocked organic farms (most likely to be dairy) that also participate in Tir Gofal that bring less environmental benefit than a non-organic extensive farm only subscribing to Tir Gofal.

Peat-based ecosystems respond rapidly to enhanced N deposition. Emissions of N oxides result primarily from fossil fuel burning, and the main source of NH3 emission is from farm animals and from small, but significant, amounts of inorganic fertilisers (Kirkham, 1999). Reduced stocking rates encouraged by organic standards, combined with no N application will be beneficial relative to conventional farming. On acid moorlands the interaction between grazing pressure and atmospheric nitrogen deposition affects vegetation composition.

Large scale studies investigating the effect of annual applications of fertiliser (N, P and K) to grazed and ungrazed heather stands found that in grazed areas, N reduced C. vulgaris cover relative to grass species, mainly Nardus stricta. This effect was most pronounced in those areas where plants were already in poor condition due to grazing pressure (Kirkham, 1999).

### 6.1.2 Biodiversity Impacts: Fauna

The cessation of N applications is likely to have a number of consequences; the onset of sward growth is likely to be delayed, the structure of the vegetation will affect ground nesting birds and invertebrate populations. Larger invertebrate populations are associated with improved grassland but with lower species diversity and lower average body mass, which is detrimental to bird species feeding on them. (McCracken et al., 1995).

### 6.1.3 Soil Quality Impacts

Soil temperatures are slower to warm up in the uplands in spring, so natural bacterial activity releasing available N into soil occurs later in the season. For this reason, many upland farmers have been reluctant to convert to organic, claiming that successful early grass growth is dependent on application of inorganic N. Thus the cessation of N applications will reduce overall productivity, which may reduce soil organic content .

Soil flora and fauna are likely to be positively affected by the cessation of N applications. Little is as yet know about the mechanisms maintaining soil biodiversity, but applications of N are associated with negative impacts on mycorrhiza and soil fungi in general (Shannon et al., 2002).

### 6.1.4 Air Quality Impacts

Fertilised grassland is commonly responsible for the highest emissions of $N_20$ and relatively low soil oxidation rates of atmospheric $CH_{4.}$ Grassland emissions from the ley phase of an organic rotation were low (Ball et al., 2002).

### 6.1.5 Water Quality Impacts

N leaching to water is governed by soil type and structure, rainfall patterns and the supply of easily leached N (Davies, 1974). The cessation of N addition will substantially reduce the problems of nitrite toxicity to aquatic life and eutrophication of water bodies in the uplands.

### 6.1.6 Resource Use Impacts

Impacts will depend on what N applications are replaced by; but the industrial N fixation process is hugely energy consuming so a significantly reduced energy use is likely.

### 6.1.7 Further Research

The Centre for Ecology and Hydrology in Bangor is leading a project to determine changes in nitrogen fluxes and critical chemical values in soils, vegetation and waters, which are indicative of changes in species performance. This work will assess the validity of current nitrogen critical load (CL) values in Wales.

## 6.2 Restriction on P& K Use

*4*. Mandatory – Little effect on hill (rarely fertilized), but impact on uplands and associated lowland*

*See Table 2 page 8

Under conventional farming P & K fertilisers are used in the uplands in the form of low N compounds eg 5-10-10 and as basic slag type products. The use of artificial, soluble sources of potash and phosphate are prohibited in organic standards, although where levels are low natural products such as rock dusts may be permitted. If P & K fertilisers are used the organic standards state that application must be in relation to a soil analysis and organic farmers may not rely on these fertilisers as a permanent source of P & K. The use of nutrient budgets is recommended.

Sewage sludge is not allowed on organic farms, therefore avoiding the potentially toxic environmental effects of metals contained therein. (Hillman et al., 2003).

### 6.2.1 Biodiversity Impacts: Flora

Any reduction in soil fertility by restricting P and K inputs provides better conditions for less competitive herb species to flourish and will assist the protection of species-rich grasslands from damaging inputs; however, the usual aim in organic farming is not to reduce fertility (unless the soil index was higher than recommended initially). High soil P levels are negatively correlated with species diversity (Goodwin et al., 1998). However, such effects are less noticeable at high altitude, where extreme climatic conditions are more likely to limit diversity than soil nutrient status.

### 6.2.2 Biodiversity Impacts: Fauna

Impacts will be concentrated on birds and mammals and, in particular, invertebrates in species-rich grasslands.

### 6.2.3 Soil Quality Impacts

Soil P reserves have been shown to be falling on organic farms because fertiliser input is lower than offtake (Unwin et al., 1995). As P and K status of the soil have been elevated by many years of applications, soil productivity may be supported by historic applications for some time and there may be a long lag phase in some effects in the hills and uplands, although Greenland (2000) (Greenland, 2000) notes that this cannot be sustained indefinitely.

### 6.2.4 Air Quality Impacts

There will be minimal impact on air quality, because they are less mobile elements.

### 6.2.5 Water Quality Impacts

Unlike N, the P cycle does not have a significant atmospheric component and therefore its transfer to water is its dominant impact (Haygarth and Jarvis, 1999). Reduced application in less soluble forms will reduce the risk of enrichment of waterbodies.

### 6.2.6 Resource Use Impacts

Less use will reduce the need to mine these elements which are both raw materials. Work is ongoing (Philipps et al., 2000) to assess the sustainability of permitted inputs into organic systems.

## 6.3 Use of Lime

*1* .Recommended – Likely to occur for reasons outlined.*

*See Table 2 page 8

Soil pH is a measure of acidity or alkalinity and generally ranges in agricultural soils from 4.0 (very acid) to 8.0 for soils which are naturally rich in lime or have been over-limed. Increased pH has been one of the many agronomically and environmentally desirable changes to biological, physical and chemical properties in cultivated organically managed soil identified by a number of studies (Bulluck, 2002; Stockdale et al., 2001). A long-term study of floral diversity associated with a range of management practices on middle hill land with low pH status at ADAS Pwllpeiran is demonstrating that plots managed as traditional hay meadows with lime and aftermath grazing have the greatest range of diversity, related to the change to more neutral grasslands.

Increased biodiversity does not necessarily increase biodiversity value based on characteristic species; some species-poor vegetation types have conservation value because they represent natural assemblages of species.

Grass-clover swards are less tolerant of acid soil conditions than all-grass swards and clover is likely to be less persistent at soil pH levels below the optimum. This is particularly important in organic systems where clover is the main source of nitrogen. A pH of 5.8 – 6.0 is generally regarded as necessary to maintain good clover levels on mineral soils, with a pH of 5.3 - 5.4 recommended for organic soils.

To ensure the maximum benefit from manures, clover and permitted fertilisers, most organic farmers undertake regular soil analysis to ensure that the correct pH is maintained.

The use of calcified seaweed is restricted in the organic standards and permission must be sought before use. This is because some sources come from unsustainable harvesting practices.

### 6.3.1 Biodiversity Impacts: Flora

The target pH for UK agricultural grasslands is 6.0 for mineral soils. Peat soils can be allowed to become more acid (5.8) without affecting yield. Lime has traditionally been used to optimise soil pH for the utilisation of certain nutrients by seedlings and for vigorous grass and particularly clover growth (McConnell, 2003). Lime application reduces soil acidity and will therefore impact upon flora that are adapted to acidic conditions, which is particularly relevant to upland Wales.

### 6.3.2 Biodiversity Impacts: Fauna

Lime encourages soil biological activity and enhances the organic matter cycle in the soil, releasing available N and reducing the need to fertilize (Fertilizer Organisation of Ireland, 1999). Above ground faunal species would largely be affected by the impacts on floral species important in their life cycle. The production of clover would benefit bee and other pollen-reliant invertebrate species.

### 6.3.3 Soil Quality Impacts

Lime adds calcium to reduce the concentrations of hydrogen ions, which is the cause of low soil pH. The addition of lime makes potassium uptake more efficient in plant nutrition and increases available molybdenum. Lime increases the rates of breakdown of soil organic matter, thus releasing available nitrogen into the plant root zone (Fertilizer Organisation of Ireland, 1999).

Toxic levels of aluminium can be largely eliminated by raising soil pH to about 5.5, further liming to about pH 6.5 will usually increase soil productivity even further, possibly because of increased bacterial activity which yields more nitrogen, molybdenum, and other nutrients.

### 6.3.4 Air Quality Impacts

A reduced need for N, K and P application would reduce gaseous losses.

### 6.3.5 Water Quality Impacts

In watercourses, a change in pH could, over time, change the whole ecology of the aquatic flora and fauna.

### 6.3.6 Resource Use Impacts

Limestone is a limited resource and its use in agriculture is questionably sustainable.

### 6.3.7 Education & Dissemination

In the unlikely occurrence of excessive liming of upland and hill fields, there is a risk of leaching into watercourses and groundwater. BAP aquatic habitats such as mesotrophic standing water and blanket bogs would be particularly at risk from the effects of lime.

## 6.4 Use of Clovers and Herbs in Grass Leys

*1* Recommended – likely to occur in upland and associated lowlands for reasons outlined.*

*See Table 2 page 8

In organic grassland farming without N fertilisers, clover is usually regarded as essential for building soil fertility. In grass-clover swards, 25%-30% content (Dry Matter) is considered necessary to produce sufficient nitrogen. Root rhizobia associated with white clover in ryegrass/clover swards can fix nitrogen at rates up to

280 kg N/ha/yr. in lowlands and up to 150 kg N/ha/yr. in uplands. Clover is more difficult to manage on hill and upland farms than on lowland farms; upland soils are slower to warm up in the spring and hence the rhizobia start synthesising N much later; also because of the generally colder and wetter conditions coupled with acidic soils and low phosphorous (P) and potash (K) indices.

Grass-clover swards are less tolerant of acid soil conditions than all-grass swards and clover is likely to be less persistent at soil pH levels below the optimum. This is particularly important in organic systems where clover is the main source of nitrogen. A pH of 5.8 – 6.0 is generally regarded as necessary to maintain good clover levels on mineral soils, with a pH of 5.3 - 5.4 recommended for organic soils. A variety of flowering plants and deep rooting herbs are frequently included in organic seed mixes to aid livestock health by supplying essential minerals and condensed tannins.

### 6.4.1 Biodiversity Impacts: Flora

Clover/herb silage leys, usually grown on associated lowlands of upland and hill farms are an integral part of organic systems and can meet the forage requirements of an organic farm whilst improving the protein content and overall feeding value of winter forage (RuralNi, 2002). Sown clover is often inoculated with rhizobia to improve its N fixing capabilities. Inoculation involves the introduction of the specific nitrogen-fixing bacteria to the roots or seed of the plant before planting. In terms of its impact on native flora, clover is a fast growing species and when grown with other herbs can quickly smother less vigorous species and encourage coarser, more competitive species. Without added sources of N, clover is a vital component of productive pasture to provide N in its most usable form to plants. In trials on the Pwllpeiran Organic Unit, without inorganic N input, a white clover annual average cover of 25% in swards is necessary to fix N at rates equivalent to 150kg N/ha in upland soils (Frost, 2000). This is a relatively high rate of clover cover which has an impact on floral diversity but must be balanced with the production needs of a farm.

### 6.4.2 Biodiversity Impacts: Fauna

Clover is favoured by butterfly and bee species including the rapidly declining populations of bumblebees. It can be important as cover for ground nesting birds and mammals. In improved agricultural grasslands, a diverse sward is more productive from a wildlife point of view (see section **Error! Reference source not found.**); there must be a balance of conservation and production when considering clover as a source of N.

### 6.4.3 Soil Quality Impacts

When ploughed in as a green manure clover/herb mixes increase N availability while providing high levels of soil organic matter, although its use in an upland situation is limited. Clover produces N in its most soluble and therefore valuable form directly to the plant but is susceptible to leaching. Different rooting habits of different herbs bring trace elements from deeper soil reserves, adding to soil fertility.

### 6.4.4 Air Quality Impacts

The use of leguminous fertility building crops is likely to increase N2O emissions if cultivation is improperly timed. Emission peaks are usually linked to rainfall events (Shepherd et al., 2003).

### 6.4.5 Water Quality Impacts

Water sources will be vulnerable to nutrient enrichment resulting from the effects of untimely cultivations of clover leys, especially if this coincides with heavy rainfall. This should be balanced against the problems associated with soluble N fertilisers.

### 6.4.6 Resource Use Impacts

Clover is valuable as a winter forage, and therefore reduces the demand for purchased feed, although it will not survive all upland situations. Soil depth and warm aspect will enable success. Red clover is winter hardy and relatively pest and disease resistant, reducing the need for herbicide treatment, but will not withstand hard winter grazing by sheep or poaching in wet winters by cattle.

### 6.4.7 Agri-environment Scheme requirements

The separation of land use for production and conservation should not lead to a farmer being debilitated by conservation objectives. The suppression of weeds is likely to be at conflict with Tir Gofal objectives (see below)

### 6.4.8 Further Research

Consider other leguminous crops for hills and upland, for example grain lupin which is currently being used in fodder trials by the Scottish Agricultural College. A proposal exists for a project with Farming Connect 2004 on improving the quality of forage for organic ruminants.

### 6.4.9 Education & Dissemination

Provide clover/herb cultivation guidelines to minimise environmental impacts of N leaching, with specific reference to the limitations of physical conditions of hills and uplands, and technology transfer on research requirements above.

## 6.5 Cessation of Use of Chemical Pesticides and Herbicides

*4*. Mandatory – Little effect on hill (except bracken spraying areas), but impact on uplands and associated lowland*

*See Table 2 page 8

The use of most chemical pesticides, and all fungicides and herbicides whether as sprays or seed dressings are prohibited by organic farming standards. A limited range of insecticides such as insecticidal soaps are permitted for use in organic crop production. A very small number of naturally occurring products such as Derris and Neem are restricted by organic standards because they are harmful to beneficial pest-predators and permission for their use is only granted when absolutely necessary. Bio-rational practices such as the use of biological controls, encouraging pest predators and using varieties that are resistant to pests and diseases are the preferred methods in organic farming.

Where cereals crops have been grown in the past the organic Certification body may insist on a soil analysis to determine whether levels of chemicals such as Atrazine, which has a long residual life, still exist in the soil before land can be entered into organic conversion.

### 6.5.1 Biodiversity Impacts: Flora

The use of synthetic herbicides and pesticides has been shown to be one of the most significant impacts on wild flora (Unwin et al., 1995). The direct and indirect benefits of cessation of their use are:

- Re-introduction of broad-leaved weeds in cropped areas and recolonisation of associated invertebrates. Some weeds are desirable aesthetically and others are important sources of seed for some farmland bird species.
- Proliferation of flora and fauna species in non-farmed areas
- No poisoning of non-target flora.
- Positive impacts on soil mycorrhiza and fungi

The avoidance of agro-chemicals is perhaps the lynchpin for the increase of floral diversity on organic farms. Productivity of crop plants grown may be affected by competing weed species and this is often a cause for concern for arable and horticultural farmers who contemplate the hand removal of weeds from their fields. The benefits to floral diversity are likely to be greater species diversity within crop, at crop margins and in the non-farmed areas.

The benefits to hedgerow and field margin habitats from cessation of spraying are that they are thereafter not subjected to spray drift and residues. This will enhance their existing role of becoming key areas of floral diversity on a farm and potential refuges for endangered species (Frieben and Kopke, 1996) and *de facto* encourage recolonisation out into fields.

### 6.5.2 Biodiversity Impacts: Fauna

As with flora species, the use of synthetic herbicides and pesticides has been shown to be one of the most significant impacts on wild fauna (Unwin et al., 1995). The direct and indirect effects of cessation of their use are:

- Proliferation of fauna species in non-farmed areas
- Increase in fauna in farmed areas, particularly invertebrates in arable areas and grassland.
- Increased insectivore breeding success due to increased food source
- Better natural predator/prey balance reducing the need for pesticides
- No poisoning of non-target fauna.
- No risk to beneficial insects.
- Positive impacts on soil organisms

In lowland studies, the effect of nil-use of chemical pesticides and herbicides has been shown to be particularly beneficial to bird species which rely on farmland for food and nesting. The increased availability of seed and invertebrate food increases the chance of winter survival for adults and chicks and increased breeding success (Fuller, 1997). At Denmark Farm (an experimental, middle hill site with mixed grazing, in Mid Wales), the benefits of a total ban on pesticide use combined with other organic practices to promote biodiversity has shown a significant difference in breeding bird numbers compared to a neighbouring farm using conventional hill farming practices (Bryngwyn Farm):

| Site | Acres | Breeding Species | Pairs | Pairs per Acre |
|---|---|---|---|---|
| Bryngwyn | 73 | 21 | 46 | 0.6 |
| Denmark Farm | 40 | 41 | 180 | 4.5 |

(Source BTO Common Birds Census 1994)

Wickramsasinghe *et al* (2003) found significantly higher bat activity on organic farms paired with on conventional farms. The activity of *Myotis* species was significantly higher over water habitats on organic farms than conventional farm water habitats. The authors relate this to agrochemicals applied to fields being a major source of aquatic pollution and suggest that localized changes in water quality account for the differences in bat activity.

### 6.5.3 Soil Quality Impacts

Because most pesticides are prohibited on organic farms, their impact on soil quality is negligible. Only copper, sulphur, natural pyrethroids and derris are permitted and only for use in protected cropping (Shepherd et al., 2003). The accumulation of copper fungicides is potentially problematic (Unwin et al., 1995) but is being addressed by changes in organic standards.

### 6.5.4 Air Quality Impacts

Cessation of threat from pesticide spray drift from aerial spraying of bracken.

### 6.5.5 Water Quality Impacts

The few materials that are permitted in crop production are only likely to enter water through misuse near watercourses or accidental spillage (Unwin et al., 1995). The limited capacity for crop production in the uplands further reduces the risk of contaminated run-off. Appendix 2 of IFOAM (International Federation of Organic Agriculture Movements) Basic Standards (IFOAM, 1998b) gives a complete list of permitted pest and weed control treatments. The use of all synthetic pesticides is prohibited.

### 6.5.6 Resource Use Impacts

The off-farm costs of conventional pesticide production are far greater than for production of the limited number permitted on organic farms. Pesticides are rarely used on organic hill and upland farms and therefore fuel costs for machinery are reduced but non-use may be compensated by mechanical weeding which negates on-farm benefits of fuel saving.

## 6.6 Mechanical and Manual Weed Control, sensitive and timely cultivations

*0/1* Unlikely to apply to hill farms and upland farms. Likely to be common in associated lowland. Recommended – likely to occur for reasons outlined*

*See Table 2 page 8

In terms of impact on biodiversity and particularly floral diversity, the inappropriate use of farm machinery can be detrimental not only for its effects on soil quality but also for its impact in areas such as peat-rich upland hills. The effects of the use of heavy machinery can be compared with heavy and sustained poaching causing loss of soil structure and compaction.

In conventional farming, pesticides are used to control weeds, pests and diseases. The use of weed wipers and all herbicides is prohibited by organic standards so organic farmers are more reliant upon good husbandry. Well timed cultivations, good grazing management and regular topping or use of a weed puller in an integrated programme are the basis for control of grassland weeds such as docks, thistles and rushes.

Timely cultivations and the appropriate timing of weeding operations, is crucial, equally so for topping perennial grassland weeds as for preparation of a seed bed for arable crops. One well-timed weeding will be better than several operations at the wrong time.

In arable crops on associated lowland there are a number of mechanical methods to control weeds e.g. steerage hoes, brush weeders, thermal weeders, comb-harrows, and powered and non-powered rotary cultivators. For many arable crops, the early stages of development (4-6 weeks) are particularly important; the first weeding operation of the year may be necessary across a whole field to provide a weed-free environment for planting or sowing, although subsequent operations can be confined to inter-row weeding, intra-row or patch weeding.

### 6.6.1 Biodiversity Impacts: Flora

Any weed control method directly affects floral biodiversity as species are removed to increase nutrient availability and space for crop plants. Removal of noxious and toxic species is likely to be done by hand and is therefore less damaging overall to flora.

The practice of removal and suppression of weed flora in arable crops is, by its nature, a negative influence on floral diversity. It is an indiscriminate process and problematic, aggressive weed species being removed along with more benign and possibly rare ones. Cultivation combined with controlled grazing as weed control rarely allows the lifecycle of a flowering plant to be completed, and here the importance is revealed of marginal habitats such as hedgerows, buffer strips and field headlands, as refugia for arable flora species. The practice of spring cropping on organic farms and more varied rotations using grass leys increases crop structure provide opportunities for less robust species to establish themselves (Shepherd et al., 2003).

### 6.6.2 Biodiversity Impacts: Fauna

Manual weed control, although more time consuming and in some circumstances physically demanding, is likely to be much less disruptive than chemical controls.

The key to good farmland biodiversity lies in providing a diverse mosaic of habitats and timely sowing and harvests (Soil Association, 2002). The well documented decline in some farmland bird species such as skylark (Alauda arvensis) and lapwing (Vanellus vanellus) has largely been attributed to the widespread change from spring to autumn-sown crops. The latter, particularly winter wheat, are often too tall to allow nest building and easy movement of chicks (Soil Association, 2002). In uplands, the timing of spring cropping and silage/hay making as prescribed by Tir Gofal would meet organic standards, but would be limited by the physical constraints of growing cereal crops. The timing of cutting for silage is particularly crucial for ground nesting birds and small mammals such as brown hare (Lepus europaeus) which nest and rear their young in pasture.

Heavy machinery can have a devastating impact on biodiversity if used at sensitive times of fauna lifecycles. Use of machinery during nesting periods for ground nesting birds and mammals should be carefully monitored to ensure that eggs and young are not disturbed or destroyed (Dodds, Appleby & Campbell, 1996). Use of mechanical weed control and aeration methods, especially chain harrowing, may be problematic for ground-nesting birds if carried out after April (Soil Association, 2002).

### 6.6.3 Soil Quality Impacts

Soil is a fragile limited resource, easily destroyed and in need of protection from farming practices, erosion and pollution (MAFF, 1998; MAFF, 1999). The relationship between 'the living soil' and plants, animals and human health is central to organic farming; and the sensitive use of machinery is a fundamental practice. All field operations on an organic farm, including spreading of manures and slurries should only be carried out only when conditions are favourable. Maintenance of good soil structure relies on the correct type of cultivation using appropriate equipment and when the soil has the correct moisture content. This in turn will support a more diverse agricultural soil ecology.

A number of studies have examined the effect of organic farming practices on soil. Using a 'Soil protection index' of erosion risk a higher index was found on organic and integrated farms in 80% of cases, with a higher index for organic than integrated farms (Hausheer, 1988). Overall the studies suggest that there is likely to be a net positive impact on soil conservation from organic farming (O'Riordan, 2001) (Stolze et al., 2000)

### 6.6.4 Air Quality Impacts

Any type of cultivation has the capacity to release N in gaseous and soluble form. Arable cropping which is rarely carried out in upland and hill farming but is more common in the associated lowlands, or ploughing for re-seeding of pasture which is a limited practice in hills and uplands, may cause heavy losses of N through oxidation if carried out during times of heavy or prolonged rainfall.

### 6.6.5 Water Quality Impacts

Cultivations may cause N leaching and siltation, if carried out during or before periods of heavy rainfall (see also 6.1.5).

### 6.6.6 Resource Use Impacts

A major focus of cultivation timeliness is the prevention of soil erosion.

### 6.6.7 Agri-environment Scheme Requirements

There are many agri-environment requirements in place to prevent poorly timed cultivation impacting on biodiversity.

### 6.6.8 Standards Changes

Seeding times of upland plants are likely to be later in the year than lowland species and the later nesting and breeding times for upland species should be taken into account when carrying out field operations.

### 6.6.9 Further Research

This is an area that is relatively un-researched from the bio-diversity standpoint.

Research is required to investigate different cutting/harvesting dates with respect to habitats and species and the ongoing impact of this in a rotational and upland situation.

### 6.6.10 Education & Dissemination

Mechanised weed control is a potential cause of disturbance if timed wrongly and can be the cause of death of birds and mammals (Soil Association, 2002).

Careful shallow ploughing in fields with an established seedbank will ensure that plant diversity will be protected and allowed to flourish during rotations and spread seed to other locations. (Soil Association, 2002).

Cultivations should be timed to avoid likely periods of heavy rainfall to minimise N leaching and oxidation and soil erosion.

## 6.7 Use of Mixed Farm Systems and Rotations (Arable/Grass)

*0/1* Not relevant to hill farms. Limited on upland farms. Relevant to associated lowland.*

*See Table 2 page 8

Mixed farming is likely to positively impact farmland biodiversity through the provision of habitat heterogeneity at a variety of temporal and spatial scales within the farmed landscape (Benton, 2003) (Robinson et al., 2001).

Most hill and upland livestock enterprises are forage based systems. The introduction of arable crops into LFA areas is highly dependent on biotic and abiotic factors, notably climate, soil quality and depth, and altitude, so the choice of crop is limited and it can be difficult to harvest a crop dry (combine). Crimping, or taking the crop as wholecrop silage are valuable options for crops for animal feed.

Although arable crops may be grown on upland organic farms they should not be be seen as necessarily being part of a rotation; the farm may be limited in suitable fields, but also have a limited requirement for the crop, therefore any individual piece of land may be used only every seven or ten years, and the arable crop used to provide an opportunity for re-establishing grassland by undersowing it.

Of five organic LFA farms studied in 1997/98 (Fowler et al., 2001), two grew root crops and one had 17% of UAA (utilisable agricultural area) under cereals. Four of the farms also had areas of rough grazing. Of 30 recently converted organic farms (Ardeshir, 2003), 24 of which were beef and sheep or beef or sheep, nine grew some sort of arable crops, the majority comprising one or two fields of forage peas and/or rape.

Where cropping and rotations are allowed by physical conditions on associated lowlands, on grass and arable units the fertility-building phase usually comprises at least 50% of the rotation. FYM, where available, is applied in the grass years and the fertility released by this ley is utilised by the following crops, with heavier feeders grown first, followed by less demanding and more weed-smothering crops.

### 6.7.1 Biodiversity Impacts: Flora

A baseline vegetation report has been produced after a comprehensive survey of thirty OFS farms throughout Wales (Ardeshir, 2003). The report showed "encouraging diversity of arable weeds". The impact on floral species in lowland organic mixed farms has been shown to be a positive one.

From the findings of the Ardeshir report (2003) there is no evidence to date that arable crops are being introduced on the 30 OFS farms surveyed despite Tir Gofal payment incentives, and some suggestion that farms that had arable areas prior to conversion dropped the arable component; one of the farmers stated that weed control was not possible without sprays (it is not clear from the report if this is from experience or expectation). The research also found that on one farm Tir Gofal had funded a switch from arable land to pasture.

With regard to the management of associated lowland for floral diversity, the findings of a two year study comparing the diversity and abundance of plant species on neighbouring organic and conventional arable farms in England produced a large body of evidence with the organic farms supporting substantially more rare and declining arable plant species (Stolton, 2002). Research reported by the Soil Association on farm margin habitats showed that at the field and crop margins, the diversity of threatened species was twice that of the conventional farm (Azeez, 2000).

An increase in weed species diversity and abundance increases the habitat diversity for species that cannot compete with those favouring higher nutrient levels, such as ryegrass. Spring cropping and more varied rotations using grass leys increases crop structure and hence, niche opportunity for less robust species (Shepherd et al., 2003). The relative abundance and diversity of arable species in organically managed systems must also be attributed to the lack of chemical herbicide use. A survey of organic and conventional farming systems on floral species by Kay & Gregory (Kay, 1999) concluded that many plants restricted to organic farms were known to be sensitive to herbicides and that these species could survive the weed control measures of the organic system. By producing livestock fodder as part of the arable rotation, there is a significantly reduced risk of GM genetic pollution from bough-in feed.

Any reseeding of permanent grassland will result in grassland not as species rich as permanent grassland, but permanent grassland is now protected from ploughing by the compulsory EIA requirement. There is evidence that there has been an emphasis on re-seeding grasslands on upland organic farms to maintain productivity and to control aggressive weed species (Ardeshir, 2003). There is a danger that species rich grasslands may be ploughed up for cropping under organic management if they are not aware of the value of what they have. Some specific habitat types are protected by the list of Environmental Management Prescriptions in the Organic Farming Scheme, although cases of the BAP habitat 'lowland meadow' were found on OFS farms which may leave them vulnerable to being re-seeded (Ardeshir, 2003).

Although the sown mixtures used in leys are often simple, organic farmers may include herbs (chicory, plantain, etc.) in the mixtures, and always include clovers, and therefore the use of non-grass, flowering species may be increased. This would be in contrast to ryegrass only or ryegrass-dominant conventional improved swards on LFA farms. The contrast may be less strong with respect to in-bye land where clover may play a more important role on conventionally managed farms.

At ADAS Pwllpeiran, surveys of vegetation diversity in plots following organic conversion showed an overall increase in species compared to conventionally managed plots, with noticeable increases in improved grassland and mountain re-seeds. Minor heather cover fluctuations were also noted on SNRG (Frost, 2000). Although many vegetation studies provide evidence that organic production can increased floral diversity, the effects of different management systems, irrespective of organic or conventional status, cannot be discounted (Stolton, 2002).

### 6.7.2 Biodiversity Impact: Fauna

The impacts of mixed farm systems on faunal biodiversity are inextricably linked to floral impacts. Although the research into lowland organic farming is indicative, it should be noted that, the number of species likely to be found in lowland habitats will be higher than the number of, and type of species adapted to upland conditions. Extrapolating the likely effects of organic farming in upland areas on fauna is, therefore, difficult without specific research on the species present.

Invertebrate diversity, predominantly on lowland farms has been extensively researched, particularly butterflies, bees and honey bees and in the majority of cases these have increased in numbers and diversity on organic farms (Unwin, 1995). A key reason for this is the presence of flowering plants in organic crops and grassland (clover mixes). There is also evidence of increases in beneficial predatory species such as parasitic wasps, ladybirds and ground beetles and a better predator prey balance negating the need for pesticides use (Stockdale et al., 2001). Spider diversity and abundance has also been shown to increase in organic fields of crop and grassland. The greater abundance and diversity of spiders correlated with the extent of understorey vegetation in crops (broad-leaved and grass species). The structure of understorey vegetation can provide a complex system of structures and niche habitats for web-building species and their prey (Gibson, 1992).

Studies of pest and non-pest species of butterflies on 10 paired farms (Feber, 1997) in southern England, sampling farmed and non-farmed habitats, showed a threefold increase in non-pest species in organic cropped areas. There was no significant difference in the number of pest species that were particularly attracted to oilseed rape and linseed. Grass leys, more pertinent to an upland farm situation, were more attractive to non-pest species. It must be noted that relatively few butterfly species are found in high upland habitats and no research was found investigating the benefits of organic farming to upland butterfly species such as dark green fritillary (Argynnis aglaja) and pearl bordered fritillary (Boloria euphrosyne), a BAP priority species in Wales. Both of these species are found in upland heath with bracken, their foodplants being members of the violet family.

Organic farming methods allow the completion of breeding cycles of many beneficial invertebrate species, particularly bumblebees, 5 species of which are BAP species. White clover pollination is dependent on bumblebees and honeybees; only bumblebees pollinate red clover and their presence is crucial to the success of clover leys grown for seed. Provision of bumblebee habitats has been proposed as an essential management tool on organic farms (Edwards, 2000 ).

Agricultural impacts on Bird diversity has been extensively researched, primarily by the RSPB and BTO. The BTO carried out a survey of 22 paired organic and conventional lowland farms, focusing on the breeding and overwintering patterns of farmland bird species. Bird densities of all species studied were found to be higher on organic farms in proportion to the greater abundance of invertebrates and food sources. The skylark, an Action Plan species, which breeds in upland and lowland habitats, was found to have a greater breeding success on organically managed farms (Stolton, 2002).

The regeneration of grasses and broadleaved plants after harvesting and leaving winter stubble has been shown to provide an important winter food source for seed eating bird species (Fuller, 1997).

Mammal diversity is largely influenced by the availability of prey and suitable breeding habitats. Insectivorous mammals will benefit from an abundance and diversity of prey insects to feed on, and a proliferation of small mammals will benefit higher predators. Research into the abundance and diversity of insectivorous mammals, including bats, has shown a marked increase in individuals and species present on comparable organic and conventional farms. Ongoing detailed research of the organically managed Shared Earth Trust's Denmark Farm in Ceredigion has shown a steady increase in small mammal numbers and diversity during its gradual conversion from marginal land to an organically managed grazing scheme with permaculture. Its primary purpose is to provide opportunities for biodiversity research and to educate the wider public on biodiversity issues through workshops and courses. In a study of barn owl pellets, a total of 668 prey of 11+ species were found in 150 pellets retrieved from the farm (Shared Earth Trust, 1994).

### 6.7.3 Soil Quality Impacts

Soil health is key to organic farming. Its fertility is determined by a set of interactions between the physical and chemical environments of the system and by biological activity (Shepherd et al., 2003). Fertility is intrinsic to organic farming practices and organic matter content is central to the maintenance of fertility. Mixed farm systems and rotations aim to achieve a balance of nutrient input and output without external inputs.

In terms of SOM content, long term grassland, prevalent in the uplands, contains more than long term arable. Undisturbed soils contain more SOM because cultivation causes oxidation and gradual loss of organic matter. The texture and water content of soils also influence the amount of SOM oxidation.

Upland soils tend to be cold, peaty and waterlogged for much of the year and their fertility is limited by these and impaired biotic activity, which result from the abiotic conditions. The degree of slope of land under cultivation (notably stubbles) can also influence the potential for soil erosion and nutrient leaching.

### 6.7.4 Air Quality Impacts

The extensive nature of upland and hill farming is important when assessing the impact of organic farming practices. Gaseous N, particularly methane ($CH_4$) emissions from livestock farming are significant in contributing to greenhouse gas problems. Approximately 40% of the UK's methane emissions in 2000 came from agriculture (Shepherd et al., 2003). Very few comparative studies of ammonia ($NH_3$), nitrous oxide ($N_2O$), carbon dioxide ($CO_2$) and methane ($CH_4$) emissions on conventional and organic farms have been undertaken. (Ball et al., 2002), comparing organic and conventional management of permanent grassland and arable, observed substantially lower $N_2O$ losses from organically managed permanent grassland compared to conventional, although substantial emissions were observed from organic arable, perhaps associated with the use of FYM. The study suggests that conversion to organically managed ley/arable systems may have little overall beneficial effect on $N_2O$ emissions, but notes that comparisons between crop rotations require a long time before true effects appear (Ball et al., 2002).

### 6.7.5 Water Quality Impacts

Water quality on agricultural land is highly dependent on the amount of nitrates, phosphorous and pesticides present. Organic farming adopts many of the practices that should reduce the risk of leaching and a mixed farm system, with restrictions on N input, lower stocking densities and use of green cover crops should limit N loss (Shepherd et al., 2003). The adoption of spring cropping to minimise N leaching also meets prescriptions in arable options in the Tir Gofal scheme.

Because an organic system aims to be essentially "closed" there is a much-reduced risk of excess nutrients from bought-in feed and fertilisers.

Losses after ploughing of ley are large and can have devastating effects on water quality if followed by heavy rainfall, a problem exacerbated in the uplands where rainfall levels, on average, are considerably higher than in lower areas. Catchment areas are therefore particularly vulnerable to the effects of leaching.

Pathogens from livestock can enter watercourses used by humans, particularly if manures are not stored correctly. Studies have shown that composting manures and treating slurries under organic standards reduces the survival of pathogens.

### 6.7.6 Resource Use Impacts

Arable cultivations typically use machinery and fuel, whereas a grazing situation uses few/none of these. Harvesting/drying/storing of crops also use fuel resources.

### 6.7.7 Agri-environment Scheme Requirements

Provide specialist analysis of habitats to identify BAP habitats that should be protected prior to conversion.

There should be a greater incentive for farmers to introduce arable crops. The use of selected undersown crops should be allowed.

The reintroduction of traditional grass mixtures that are adapted to upland conditions and are nutritionally sustainable to support stock should be encouraged.

To lessen the impact of erosion and leaching into watercourses from cultivated land with a steep gradient, a headland should be left uncultivated at the based of the slope as a buffer.

### 6.7.8 Further Research

Further research is needed on the sustainable integration of arable crops, particularly with respect to soil erosion.

Trials on the most effective ploughing methods to prevent erosion and leaching on cultivated slopes.

Detailed research is needed into suitable crops for upland sites, husbandry, uses, harvesting techniques, uses in feeding and storage.

### 6.7.9 Education & Dissemination

Awareness should be made of new Environment Opportunities Assessments that are a requirement for grant receipt under Farm Business Development Plans in Farming Connect, and of the EIA regulations.

Provide advisory documentation on the maximum slope gradient that can be put under arable cultivation in an area high rainfall.

Advise on alternative crops to clover to use as cover crops.

Provision of bumble bee habitats has been proposed as an essential management tool on organic farms (Edwards, 2000).

More information needed on specific overlap and competition between Tir Gofal and organic objectives.

## 6.8 Use of Cover Crops and Undersowing

*0/1* Unlikely to apply to hill farms and only to a limited number of upland farms. Likely to be common in associated lowland.*

*See Table 2 page 8

When cereal crops are grown as part of an organic rotation on lowland farms, or where conditions allow on in-bye land on upland farms it is usual practice to undersow the crop with a grass seed mixture. This provides soil cover and suppresses weed-growth. It also provides grazing after harvest and protection for the soil through the winter until the next crop is sown.

There are four strategies for cover crops in a rotation:

- Fallow crops that require taking land out of cash crop production for all or part of a season.
- Winter cover crops that are sown in late summer or autumn and remain in place until spring.
- Smother crops that are grown during a spring, summer or autumn window between cash crops.
- Interseeded cover crops that may remain in place for varying amounts of time.

The practice of undersowing is somewhat like planting desirable weeds between the crop rows. If crops are kept weed free for the first 4-5 weeks, later competition from low-growing weeds will have little effect on production.

### 6.8.1 Biodiversity Impacts: Flora

A fundamental goal of cover cropping is to avoid bare soil between cash crop plantings. The effects on floral diversity are determined by the competitiveness of the cover crop. Intercropping is a little used practice of sowing two or more different types of crop within the same row or in alternate rows at the same time in a field. It is usually carried out in small scale fields and by its very nature is beneficial to plant diversity. Leaving weed strips within the field further increases species diversity.

It is important to highlight the fact that using cover crops and undersowing are practices limited in upland farming by abiotic constraints. In experiments on the ADAS Pwllpeiran upland Organic Unit at Cae Felin, it was shown that the short growing season and high rainfall can seriously impact on the productivity of a crop, with loss of a whole year's production a serious possibility.

### 6.8.2 Biodiversity Impacts: Fauna

Undersowing of cash crops provides cover and niche habitats for invertebrate and vertebrate species. Legumes or crops such as mustard can enhance mosaic of crop patterns and provide valuable habitat for voles, the major prey of owls and other desirable species (Soil Association, 2002).

### 6.8.3 Soil Quality Impacts

Building organic matter by use of cover crops and undersowing can encourage earthworm and beneficial soil fauna activity (Yeates, 1997), thus helping to establish a sound grassland sward. Sward root establishment can positively impact on soil quality by improving soil structure, conserving water and reducing soil erosion, thereby slowing overland flow and downstream flooding.

### 6.8.4 Air Quality Impacts

No information available at the time of the report's preparation.

### 6.8.5 Water Quality Impacts

Possible reduction of N leachate if correctly cultivated (also see 6.8.3).

### 6.8.6 Resource Use Impacts

No known research.

### 6.8.7 Agri-environment Scheme Requirements

Use appropriate native plant species in seed mix which will benefit less competitive flora.

Allow undersowing in Tir Gofal with selected crops – eg mustard

### 6.8.8 Further Research

Research required on suitable undersowing strategies compatible with conservation objectives, i.e. seed rates of competitive undersown crops, novel undersowing crops/techniques.

## 6.9 Use of Green Manures

*0/1*Unlikely to apply to hill farms and only to a limited number of upland farms. Likely to be common in associated lowland.*

** See Table 2 page 8*

Green manures are frequently included in organic rotations. They are used to increase soil fertility, to suppress weeds in cropland and to prevent loss of nutrients due to leaching when land is uncropped over winter. The main categories of green manures are nitrogen fixers (such as red clover and trefoils) and nitrogen lifters (such as grazing rye). Brassicae green manures are used as trap crops to reduce damage from pests such as flea beetle *Phyllotreta spp*. Similarly, clovers can be grown amongst brassica crops to deter pests such as pigeons. Green manures such as grazing rye, vetch, phacelia, mustard, *etc* are also grown between crops as an inter-row weed suppressant.

In the uplands this practice is largely replaced with catch cropping a forage crop such as stubble turnips where not only the residues are returned to the soil but a large proportion of the crop nutrients in the way of manure from grazing lambs/stock.

### 6.9.1 Biodiversity Impacts: Flora

Growing a crop which is to be ploughed back into the soil requires the minimum of weed control, if any. The competitiveness of the manure crop will determine the range of weed species that can grow within it.

### 6.9.2 Biodiversity Impacts: Fauna

Green manures have been shown to be beneficial to soil organisms by improving the SOM content of soil, a vital food source for soil fauna, particularly earthworms, although the actual tillage involved with returning the grown crop to the soil is thought to be detrimental to earthworm activity (Ramesh, 1997). Establishing overwintering green manures improves conditions for beneficial surface living insects, ensuring their presence in newly established crops the following season (Soil Association, 2002).

### 6.9.3 Soil Quality Impacts

Green manures, particularly those sown with clover mixes, add organic N to the soil and reduce the need for N applications. They are an excellent source of SOM reducing the need for FYM application. As with cover crops, green manures increase vegetative and residue cover during periods when erosion is possible and prevent run-off of nutrients. Legumes utilise a higher amount of P than grasses which is beneficial in animal waste management (Scherz, 1994). Cover and green manure crops may be beneficial in upland soils by removing excess moisture and alleviating waterlogging problems (USDA United States Department of Agriculture, 1996).

### 6.9.4 Air Quality Impacts

Nitrogenous emissions from the cultivation of leguminous green manure crops are likely to be the only direct impacts on air quality.

### 6.9.5 Water Quality Impacts

Water quality will be protected from the use of added N and FYM if a balanced nutrient status is achieved by the manure crop. The aim of the green manure crop is to retain nutrients, thus reducing the need for the use of soluble N or added manures which may endanger water quality. Green manures have been shown to reduce erosion and thus reduces run-off and sediment from floodwaters and wind in upland areas (USDA United States Department of Agriculture, 1996).

### 6.9.6 Resource Use Impacts

Nutrient retention and prevention of soil erosion due to cover.

### 6.9.7 Agri-environment Scheme Requirements

There are already opportunities within Tir Gofal to grow a grazed root crop that replaces the role of green manures in some respects. There could be opportunities to vary this theme to include green manures if they were seen to contribute to similar objectives.

### 6.9.8 Standards Changes

Attention should be brought to registered holdings that where they wish to run organic and TG side by side, that conflicts may exist between fertility building cover/green manuring and other conservation (fertility reducing) objectives.

# 7 IMPLICATIONS OF THE FACTORS INVOLVED IN ORGANIC CONVERSION AND MANAGEMENT FOR BIODIVERSITY AND THE ENVIRONMENT - Environmental/Habitat Management

## Summary


1. A baseline survey of 30 farms receiving support for conversion through the OFS (half of which also had other agri-environment schemes) identified the presence of 14 BAP habitats on the farms. Lowland meadows were noted as being difficult to identify, suggesting a need for survey by a competent botanist prior to conversion, to ensure their protection as environmental management features thereafter.
2. Organic regulations do not require habitat creation, but standards state "that concern for the environment should manifest"…"in high standards of conservation management throughout the organic holding". Organic farmers are required to prepare a map identifying all 'recognised' wildlife habitats and landscape sites, archaeological and historic features on the holding.
3. Certifying bodies vary in their interpretation and requirements for conservation and conservation plans, and the rigour of inspection of these factors is uncertain.
4. Organic systems incorporate a sensitive approach to hedgerow and ditch maintenance.
5. Upland semi-natural habitats have served as refuges for faunal biodiversity; the maintenance of wildlife corridors is essential [7.7].
6. The relationship between early spring grazing and the success of nesting birds favours organic systems, which are slower to respond to spring warmth that fertilised sites.


There is no compulsory habitat creation requirement in the EU regulation 2092/91, but UKROFS standards state "concern for the environment should manifest itself in willingness to consult appropriate conservation bodies and in high standards of conservation management throughout the organic holding" (UKROFS, 2001), see Appendix 1. The focus in organic standards is to prevent damage and to conserve and optimise what exists; to this end organic farmers are required to prepare a map identifying all 'recognised' wildlife habitats and landscape sites, archaeological and historic features on the holding. Potentially damaging operations on designated or candidate statutory 'recognised sites' are prohibited, and application for certification will be refused if the above had been knowingly carried out within the last five years.

The Soil Association standards include a section on Environmental management and conservation' which contains some requirements and prohibitions (requires management of river banks to ensure the risk of erosion and soil runoff is minimised, restricts the removal of hedgerows, banks, ditches and walls and the seeding of clover into pastures identified as unimproved in the whole farm conservation plan and prohibits hedge trimming between March and August inclusive), but contains mostly recommendations, including that to prepare and maintain a conservation plan (Soil

Association, 2000). Organic Farmers and Growers control manual contains a section on 'Biodiversity Care of the Environment' and which gives guidance on; Natural Features, Hedges, Ditches, Alterations to Traditional Boundaries, Woodland Management, Avoidance of Pollution, Heritage Sites and New Hedge and Woodland Plantings, although requiring the preparation of a conservation plan before conversion and its maintenance thereafter (Organic Farmers and Growers, 2001).

## 7.1 Baseline Survey of Organic Farms

BAP habitats and species are recognised and supported financially by agri-environment schemes. It is, therefore, important to identify species and habitats present on farms and to establish baseline data for monitoring purposes. The Organic Farming Scheme (OFS) is being monitored as part of the Welsh Assembly Government Agri-environment monitoring programme, to meet the requirements of the EU (EC regulation 2078/92) and to demonstrate the environmental benefits from the agri-environment policy. This is a three-year project comprising a baseline study of farms recently entering organic conversion in 2002 and a follow-up study of the same farms 24 months later, in 2004. A sample survey of longer established organic farms has also been undertaken. As part of this project a Baseline Monitoring Report was prepared for the Welsh Assembly to assess the environmental benefits provided by the OFS.

The Report (Ardeshir, 2003) is based on a survey of thirty farms throughout Wales. At the time of the survey, half the farms had an agri-environment agreement other than the Organic Farming Scheme and half did not. The Report gives clear examples of the greater biodiversity benefits offered by the OFS when combined with a whole-farm agri-environment scheme (Tir Gofal or ESA) particularly regarding the condition and re-instatement of hedgerows. There was no evidence of hedges being removed on any of the surveyed OFS farms but on six farms with ESA or Tir Gofal agreements, considerable hedge laying or coppicing work had been carried out during the previous two years, and this was a considerable advantage to field management for the organic system.

Most of the OFS farms accommodate a number of BAP habitats, mostly woodland, and those with an additional agri-environment agreement, particularly Tir Gofal, had the highest number of BAPs.

The Report identified the following BAP habitats on the thirty farms surveyed of which those marked * are found in uplands:

Wet Woodland*

Upland oakwood*

Lowland meadows

Fen

Upland heath/acid grassland mosaics*

Upland mixed ashwood*

Lowland dry acid heathland

Purple moor grass and rush pasture*

Parkland

Cereal field margins

Mesotrophic lake*

Blanket bog*

Lowland heath

Ancient and/or Species rich hedge*

Many of these habitats were found to be on ‘Land in Conversion’ or ‘Land to be Converted’. The survey report suggests that all BAP habitats should be classed as Environmental Management Features (EMF) and identified on any mapping exercises on the farm. Lowland meadows were noted to be difficult to identify and present on many of the OFS farms; as valuable and declining habitats they should be identified by a competent botanist prior to conversion, and included on the map of EMF to ensure that they will not be ploughed or improved.

There is a potential conflict in the introduction of crops in rotation in the uplands to lead to the ploughing and seeding of semi-improved grassland, although the Organic Farming Scheme prohibits ploughing, reseeding or improvement of heathland or grassland of conservation value, including species-rich grassland. The report found one case where a farm that previously grew arable crops was supported under Tir Gofal to put the land in reversion to semi-improved pasture option, and another where introduction of oat and barley crops was introduced and supported by Tir Gofal payments.

## 7.2 Conservation Plans

The Soil Association recommends that a whole farm conservation plan should be prepared for the whole holding and should be implemented and updated thereafter. The plan should detail the opportunities for improving the wildlife conservation and landscape value of the holding, together with a detailed action plan for further work (including the availability of grant funding). The plan should be commissioned from a competent advisor or organisation and prepared in conjunction with the farmer.

Organic Farmers and Growers standards require a Biodiversity and Conservation plan for the holding to record the existing features of conservation importance and the plans to enhance the biodiversity of the holding during the conversion, and require that the plan is kept up to date.

## 7.3 Maintenance of Specified Habitats

Studies of the management methods of non-farmed habitats on lowland conventional and organic farms have found that organic farms have better quality non-crop habitats, especially hedgerows, than non-organic farms. A greater abundance and diversity of weed species, more uncropped areas, greater proportion of grass leys, higher and wider hedges, smaller field sizes, and more hedgerow trees have all been reported under organic compared to conventional management. Organic farms are also more likely to be mixed farms, which are of considerable benefit to wildlife.

## 7.4 Creation of New Habitats

Although not a requirement of EU or UK national organic standards, certification bodies such as the Soil Association and OF&G encourage creative conservation and habitat creation. Monitoring of new habitat creation is a feature of organic inspections by these bodies and features in the Soil Association Standards for Organic Agriculture and in the OF&G Control Manual.

The possibilities of the reversion of improved land were noted by Allen (1995). Formerly arable land sown to a traditional mixture of meadow grasses left uncut until late in the season was found to attract invertebrates thus providing a food source and habitat for butterflies such as the Meadow Brown (*Maniola jurtina*) and cover that encouraged small mammals.

Hopkins and Tallowin, (2002) assert that in many cases the plants that were once the key species of old meadows are not only absent from the sward but their seeds are absent from the soil; necessitating changed management and positive habitat restoration in carefully targeted areas. They conclude that successful restoration is a site dependent process; remaining species-rich grassland areas must be preserved as an important national resource.

## 7.5 Maintenance of Field Boundaries

Traditional stonewalls are a feature of upland and hill farms in Wales. Although not a requirement of EU or UK national organic standards, maintenance of traditional field boundaries is encouraged by sector bodies such as the Soil Association and OF&G. In Wales, environmental management prescriptions in the Organic Farming Scheme require organic farmers to retain traditional farm boundary features, for example, hedges and walls, and to maintain any stock proof boundaries using traditional methods and materials.

### 7.5.1 Floral Biodiversity Impacts

The use of barbed wire and metal/wooden fencing for field boundaries has long been established as a relatively inexpensive way to retain stock. Such boundaries have no ecological value and the Tir Gofal scheme provides payment for the establishment of hedgerows or repair/replacement of traditional walling which provide important habitats for many species of flora and fauna (Stopes, 1995).

Hedgerows form a crucial part of the farm environment and their ecological value is determined by;

Age
Tree/shrub diversity
Structure
Management.

Traditional practices of hedge planting, laying and coppicing are able to achieve the primary objectives of stock containment, shelter provision of timber and the encouragement of wildlife (Stopes, 1995).

The dramatic loss of hedgerows to intensification during the last century led to the introduction of legislation to protect them from damage and destruction. In England and Wales the Hedgerow Regulations 1997 are intended to protect important countryside hedges from destruction or damage. The Regulations were drawn up in response to the high rates of hedgerow removal that occurred in the 1980s. Between 1984 and 1993 185,000km of hedgerow in England and Wales was lost.

Organic systems incorporate a more sensitive approach to hedgerow and woodland management and the use of traditional methods of hedge maintenance such as hedgelaying and coppicing are encouraged. Tir Gofal offers financial incentives to restore and maintain hedgerows for stock protection as well as biodiversity enhancement.

### 7.5.2 Faunal Biodiversity Impacts.

A recent study on bat activity and species richness on organic and conventional farms found that in paired organic and conventional farms organic farms, the organic farms had significantly higher hedgerow height and that this contributed to the higher bat foraging activity on organic farms (Wickramasinge et al., 2003).

### 7.5.3 Resource Use Impacts

Hedgerow and stone wall maintenance can be labour intensive, requiring relatively high numbers of man hours to carry out repairs or laying/coppicing in the case of hedges, to ensure they remain stock-proof.

## 7.6 Landscape Impact

Perception of landscape is a matter of personal taste and preference and difficult to quantify in terms of positive and negative impacts. A dead tree may be beautiful to one person and an eyesore to another. The landscape in the view of a biodynamic farmer could be a healthy organism, which supports the individuality of the farm (Vereijken, 1995). In terms of farming systems, organic farms generally have smaller fields, diverse crop rotations and active habitat creation, thus shaping the landscape (Elsen, 1997).

In a study by the Countryside Commission in 1995, comparing the landscape impact of lowland organic and conventional farming, organic farms were found to have more traditional landscape features such as bushy hedges, recently established trees, woodland and smaller fields. Entec (1995) in a survey of extensively farmed upland regions, no visible differences between the farming systems were observed. The baseline survey by Ardeshir (2003) concluded that the OFS and whole farm Agri-Environment schemes are delivering more environmental benefits with regard to hedge maintenance and re-instatement than OFS on its own.

### 7.6.1 Bracken

Cutting bracken is one of the few bracken management options open to organic farmers. Although seen as a serious weed problem, bracken has been used for livestock bedding for many years. A research project carried out at the University of Aberdeen (Donnelly et al., 2002) investigated uses for bracken material including as a source of fertility from raw material and ash, weed control for vegetable crops, animal bedding, cover mulch, insect repellent, seed treatment, anti-fungal agent, and biofuel.

## 7.7 Heather moorland

Evidence from (Milne et al., 2002) researching the productivity of *Calluna vulgaris* in a study of annual and seasonal productivity of six plant species or communities in the uplands showed that there was higher productivity from more mature plants; suggesting, that this may be due to the greater leaf area or the reduced susceptibility to drought in the deeper rooting more mature plants.

This work suggests a greater synergy between moorland conservation and livestock production than expected, and offers a positive role for sheep where they have been previously regarded only as a problem.

Anecdotal evidence from Vyrnwy of greater use by the organic flock of the heather moorland due to its management for nature conservation suggests that the livestock are in better condition when they return from the hills than previously. The sheep spread out more widely over the moors, thus preventing the pockets of bare soil that previously occurred.

## 7.8 Vertebrates

Upland semi-natural habitats, particularly moorland and rough grazing areas with woodland, are largely unaffected by agricultural inputs and are refuges for faunal biodiversity. Recent studies of water vole (*Arvicola terrestris*) populations in upland lakes in Mid and South Wales have demonstrated the importance of these upland refuges to a red data species, extinct or under threat of extinction in many areas of the UK (Midgley, 1998) (Strachan, 1998) and (Williamson and Hall, 2003) notes the importance of viable commuting corridors between the uplands and lowland habitats. The careful maintenance of ditches, with lengths done in rotation as recommended by organic standards, one bank at a time at appropriate times of the year can minimise disturbance to vole colonies.

Generalisations cannot be made concerning grazing management for conservation, as the land concerned will influence the precise pattern of grazing and the environmental objectives set for it. Allen (1995) emphasises that the key is to be clear about the environmental purposes of grassland management and the land suitable for those purposes.

Wickramasinghe *et al* (2003) found bat activity to 61% higher on organic farms compared with paired conventional farms. Although the farms were paired and found to have no difference in farm area, total number of habitats or area of habitats sampled between the two farm types studied. Bat foraging activity was also 84% higher on organic farms. *Rhinolophus* species were only recorded on organic farms in wooded, arable and pasture habitats.

### 7.8.1 Birds

Relatively few passerine bird species are adapted to breed in the high uplands, a notable exception being four species of thrush; ring ouzel (*Turdus torquatus*) a recent addition to the Red List of endangered UK species, whinchat (*Saxicola rubetra*), wheatear (*Oenanthe oenanthe)* and stonechat (*Saxicola torquata*) the first three being migratory species; but a relatively large diversity of raptor species rely on this habitat. Persecution of such species, particularly peregrine (*Falco peregrinus*) and hen harrier (*Cirsus cyaneus*) for their predation on game birds, leaves their numbers relatively low. Birds of prey are all protected under the EEC Birds Directive and most are BAP species (Fuller *et al*, 1997). This implies that upland farming should incorporate methods that protect these species from persecution and maintain habitats to allow successful breeding i.e. sensitive management of breeding areas to maintain an ecological balance of prey:predators.

Research work (Allen, 1995) has demonstrated the relationship between grazing density in spring and early summer and the success of ground nesting birds in breeding, with higher densities leading to reduced success. The slower start of spring growth on organic farms relating to the higher temperature needed to stimulate clover growth will help. Similarly early cutting disturbs the nesting cycle and prevents flowers and grasses from setting seed and regenerating. First cut silage is later on organic than conventional farms, but incentives to revert to hay will often be needed.

## 7.9 Research requirements

Habitat structure in the uplands can be defined at different spatial scales and is primarily affected over short time-scales by grazing herbivores. Current (2001-2004) research being undertaken by the Scottish Agricultural College will use an experimental model system to investigate the direct and indirect effects of different species and stocking densities of grazing herbivores on plant - insect herbivore - bird predator interactions. Arthropod food supply is hypothesised to be one of the major limiting factors for upland bird populations. Most previous work that has attempted to quantify the role of arthropods has been descriptive, not experimental. It is not certain whether habitat structure affects arthropod abundance and distribution directly or whether it affects the availability of arthropods to foraging birds.

# 8 DISCUSSION

Organic farming uses a systems approach (described in Section 4.1). Conventional farmers could adopt any or all of the practices, but it is the engagement with the entire system with a rigorous annual inspection system that identifies the organic farmer.

Although specific practices with environmental impacts have been outlined throughout this report, there are other constraints that have not been identified as having direct environmental impact that nonetheless do have indirect effects. One example is the health and welfare issue of bedding and space within cattle housing and the restriction on slats; this has implications on the production of FYM rather than slurry, the need for bedding materials, the size of buildings and breed selection. Each management decision within the system will have impacts on different parts of the system and hence the environment.

It has long been acknowledged (Allen, 1995) that low input/low output grassland systems are needed to deliver environmental benefits. The most obvious impact of conversion to organic production on the uplands is the reduction in stocking rate; if there is no introduction of cattle the reduction in sheep numbers will be significant. This stocking rate reduction will be to adjust the stocking to that more appropriate to the carrying capacity of the land without the regular use of soluble fertilisers and large quantities of imported feeds to supplement the forage production.

## 8.1 Water

The main risks to water from farming activities are: manure, pesticide and medication contamination. There is a clear risk reduction from organic farms due to the reduced pesticide and medication use. Manure risks would mainly, but not always, be site specific and often related to housing rather than overall stock numbers.

According to the Environment Agency, (Merriman, *pers. com*.) most pollution incidents from sheep dips are caused by poor management of the dipping process and by the use of old and poorly maintained facilities.

## 8.2 Is an upland farm only part of a system?

Organic Standards reflect the lowland origin of organic systems. UK standards require that the fertility and biological activity of the soil must be maintained:

> "…in the first instance, by:
> (a) cultivation of legumes, green manures or deep-rooting plants in an appropriate *multi-annual rotation programme*;" (UKROFS, 2001) (our italics)

or through the incorporation of livestock or other organic material.

The introduction of animal feed crops in the uplands present opportunities for crop diversity, but these do not constitute part of a rotation as they may occur at ten-year intervals on a particular piece of ground. Therefore hill and upland farms without adequate associated lowland appear to fail in achieving some aims of the organic system and this calls into question the applicability of the 'closed system' thinking of the organic movement and the biodynamic school of the farm unit as an organism. Due to isolation from other organic farms there is a limitation on most organic farms to 'biologically fraternise' with neighbouring farms. In this context it can be argued that the upland farm represents the permanent pasture element of the mixed farm situation, that is, not a viable unit for production, and dependent on nearby enclosed rotational land to ensure its viability and usefulness for production purposes.

Additionally the upland and hill farms have added problems of large areas with little fencing and of marginal agricultural productivity.

Organic researchers debating the meaning of the ‘farm system’ concluded that the system extended as far as those areas over which the farmer had direct control; a linked lowland farm finishing stock for an upland farm would fall within this ‘system’. Organic standards requiring 60% of the feed for ruminants to be produced from the ‘unit’ or ‘linked units’ suggest opportunities to ‘link’ the uplands with the lowland ley/arable organic farms to re-create a more balanced system on an inter-farm basis. Examples of this do exist but experience shows that these links are difficult to forge, and to achieve this balance of lowland may require assistance from other bodies. The infant status of the infrastructure of organic farming in Wales may require a compulsion to link hill and upland farms with lowland unit/system and/or scale down. Alternatively, this imbalance in a production system may provide a pointer to an alternative focus for hill and upland farms, where food production is less of an imperative and habitat management, landscape and other public goods receive more attention. Thus organic farming needs to be increasingly integrated into such activities as providing grazing management for land managed primarily for nature conservation or for open space within woodlands/forests.

## 8.3 Farmer aims and attitudes

Of the 360 organic farmers in Tir Gofal (of around 1,500 to 2,000 total farms in Tir Gofal), 195 farmers joined OFS after joining Tir Gofal. This may reflect an orientation towards conservation before becoming organic, or that entering Tir Gofal, and finding that stepping off the treadmill was possible, they felt more confident in moving to organic production, with organic prices providing a possible way of making stock reductions pay.

Research on the goals of organic farmers in general and their motives for conversion have been studied frequently and seem to have changed over time. (Padel, 2001) comments that in earlier studies problems with conventional farming (e.g. soil erosion or deteriorating animal health) were mentioned in between 30 – 75% of samples, whereas later studies indicate financial reasons were more important. Of the farm related and personal goals mentioned, general concerns of food quality, conservation, environmental and rural development issues are frequent and a shift from religious and philosophical concerns to a greater prevalence of environmental and political ones in later studies seems to have occurred.

## 8.4 Conversion criteria

The baseline survey of farms in conversion (Ardeshir, 2003) illustrates the risk of BAP habitats not being recognised and therefore being at risk of improvement under organic farming. This risk is not necessarily any higher under organic than under conventional farming except that the conversion process stimulates a close examination of the farm resources and management that may result in intensification of resource use.

Lowland meadow habitat appeared to be the BAP habitat that requires specialist expertise in identification. The new Environmental opportunities review available through Farming Connect in Wales, and strategic use of FWAG (Farming and Wildlife Advisory Group) could mean that a compulsory professional environmental assessment prior to conversion would no longer result in additional financial burdens and could be incorporated into the OFS scheme requirements.

The conversion plan should also show how the farmer intends to address the proposed requirements of the Entry Level Scheme Wales.

## 8.5 Capital issues

It is recognised that the re-introduction of cattle into the hills and uplands has biodiversity benefits, but the concomitant capital requirements for cattle housing may prevent this. Additionally, addressing the environmental concerns associated with water pollution from cattle excreta and manure handling may need further capital investment.

Best practice in manure handling through covering and preventing leaching from manure heaps is known, but farmers unable to financially justify the investment in covered sheds for manure storage. Nutrients harvested in winter feeds on associated lowlands must be returned; therefore the logistics and expense of transportation need consideration. Extra space is needed near the housing site if the FYM is to be composted there to ensure less dry matter to be carted. Suitable building design can enable composting within the buildings during the summer months.

The need to provide adequate standing space for sheep after dipping, and upgrading of dipping facilities to address the Environment Agency's concerns relating to water pollution are also capital demanding.

## 8.6 Agri-environment Schemes

Tir Gofal, as a conservation programme, places more restrictions on production than do organic farming standards; fertility building is actively discouraged in some management agreements within Tir Gofal. Many Tir Gofal management prescriptions are pre-defined limiting the possibility of varying them according to farm-specific needs (see Section 4.5) even though, in some cases, both environmental and production benefits could result.

More flexibility in an allowance of undersowing for weed prevention will benefit the farmer and the undersown crop could be valuable to certain fauna. Undersowing also addresses the issue of the prevention of soil erosion, which should be included in other Agri-environment schemes. Soil erosion will be an issue in cross-compliance requirements for CAP schemes.

A large proportion of organic farms in Wales are also in Tir Gofal and marrying the conservation focus often conflicts with production aims. It may be that due to the extensive nature of upland farming it may be easier to integrate organic farming and Tir Gofal than in lowland situations.

The biodiversity benefits of mixed stocking suggest that encouragement of cattle through agri-environment schemes would be beneficial. These could include incentives for use of appropriate breeds for management of particular habitats. Agreements for use of animals in different parts of the farm for conservation objectives may be required.

Forthcoming CAP reforms may reduce further the financial argument for maintaining cattle in the hills so steps to counter this may be necessary. There is anecdotal evidence that organic systems that do not incorporate cattle have greatly reduced overall stocking rates may mean that upland rough pasture is undergrazed, with a lack of cattle grazing, in particular, leading to a dominance of *Molinia* and suppression of other species. It may be that this is sufficiently rare that it contributes to a diversity of habitat, but little is known of the agronomic feasibility and sustainability of sheep-only upland organic systems, so they may be self-regulating.

Gordon, (1988) indicates a benefit of re-introduction of cattle on a sward in Scotland illustrating that there is a case for ensuring a minimum as well as a maximum stocking rate for nature conservation reasons.

## 8.7 Organic Standards and technical issues

There is a requirement by organic standards to maintain or enhance soil fertility (page 21). This involves a look at the term fertility and what is meant by it.

Although one aim of this report was to provide recommendations for changes to organic standards, in practice few recommendations have been made. This is partly because the practices identified have been based on identified organic practices (i.e. often those driven by organic standards) and the history of standards development means that they are pragmatic and must be able to be verified by inspection and some conservation objectives are not enforceable.

One recommendation is that the use of pyrethroid dips should require permission from the certification body (recently brought in by the Soil Association standards), which would require justification for the practice and detail all other preventative measures being taken. The inspection process should also ensure cross compliance with the requirement for a licence for dip disposal or verify the method of dip disposal, if used.

The requirement of a map of environmental features into a conservation plan that has to be actioned and reviewed is recommended.

The Soil Association agricultural standards committee currently has a working group on the uplands, including Scottish and Welsh representatives. The issues they have identified as being barriers to organic certification in the uplands are: housing – livestock density and bedding materials, common grazing and the need for organic land for away wintering. Some amelioration of the Soil Association standards regarding slatted housing has been suggested (allowing the slatted area if covered with bedding materials), but other issues are capital or infrastructure related, with potential for development work for appropriate locally-sourced bedding materials.

## 8.8 Standards Development

There is a current review of EU regulation 2092/91, but there are no proposals in the current review to include environmental issues. There is potential in the future that environmental issues could feature, which would then enable the UK authority to incorporate environmental issues as an integral part of the standards without the inequality that unilateral imposition of higher environmental standards would mean.

Improvements of Standards within the UK can be brought in by any licensed certifying body, but the elements of competition between certifiers limits the extent of changes. Even improvements made to the UK standards bring in elements of unfair competition, as imported organic produce would not need to comply with UK organic regulations; therefore the best route for standards changes is through amendments to standards at EU level.

## 8.9 Organic Inspections

Other issues relate to the rigour of inspections and enforcement of standards. There is currently no system for monitoring of the 'permissions' or 'derogations' issued by certification bodies for restricted practices. Without knowledge of the numbers and circumstances of these, it is impossible to judge the degree of environmental impact of standards that, by strict enforcement, would lead to desirable environmental impacts compared with conventional farming. Due in part to the competition between certification bodies, inspectors and certification committees are unwilling to enforce standards that would cause financial hardship – for example stocking rate reductions in the hills and uplands in cases where parasite burdens and ineffective controls indicate that this is necessary.

This issue extends to the enforcement of animal health plans; any change in the use of animal health plans would not appear to have direct environmental effects, however any improvement in health status of herds or flocks reduces the need for therapeutic intervention (which may have environmental costs) and improves the viability and profitability of the enterprise.

As all organic farms are subject to annual inspections it is tempting to suggest that guidance on management of, and inspection of wildlife habitats are included in the inspection process; however there is great pressure on the certification bodies to reduce the time taken at inspections and restrict the operation to ensure compliance with the relevant existing compulsory standards, and confusing their role with an advisory role may cause other problems. It may also be beyond the means and expertise of inspectors to provide habitat identification and guidance, which suggests a requirement for other means of assistance such as FWAG membership so that regular field visits and updating of conservation plans are carried out.

## 8.10 Research Requirements

This can be divided to two sections; data and monitoring requirements and research.

In preparing this report the lack of suitable data on stocking, size, farm type, SDA or LFA status of organic farms in Wales was a handicap. It is particularly ironic given the inspection system and additional recording burdens on the organic farmer that the co-ordination of data sources is so limited and there are restrictions on the sharing of data caused by the Data Protection Act. To an extent this is being addressed through an EU concerted action (www.eisfom.org) although this is looking only at current data sources, it will identify gaps and make recommendations for EU harmonisation.

Current work being carried out on the economics of organic farming at the Institute of Rural Sciences, University of Wales Aberystwyth will produce more data on the labour use on comparable upland cattle and sheep farms, and the Soil Association is undertaking research into the issue of labour use on organic farms. However, labour use is such an important aspect of the rural economy in the hills and uplands that a specific labour use study that included organic and agri-environment participating farms would assist policy makers.

Defra-funded work at ADAS Redesdale has provided much information on organic hill systems. Some less ideal, commercial organic sheep-only systems are being seen, and there is a need for them to be monitored so that information on vegetation changes can be gathered. Livestock health and welfare are of particular concern and have their own environmental impacts also need monitoring, and results from these studies should feed into agri-environment scheme reform. In particular there is a need for monitoring of herbage changes to determine the threshold of ‘under grazing’ under mixed and sheep-only systems.

Data on the actual use of indigenous breeds on organic farms would be useful. Research is needed into their ability to thrive under lower stocking rates in situations of particular trace element deficiencies, including their ability to forage for micronutrients in herbage, and the presence of that herbage. The evaluation of breeds for maintenance of self-contained breeding flocks with respect to disease control would be beneficial.

To support the marriage of production with conservation aims, further monitoring and investigation into the use of particular breeds and species for habitat management, including welfare monitoring is essential.

Further work on the biodiversity and conservation impacts of different cutting/harvesting dates would be beneficial; however results could only be useful for specific conservation targets and field operations in the hills and uplands are so constrained by climatic conditions that further restrictions would be impractical.

Continuous research on internal parasites is necessary; the work on internal parasites at Redesdale should be continued and alternative treatments for liver fluke are needed.

The hazards of synthetic pyrethroid pollution of water-courses identified by the Environment Agency suggest the need for further research into the environmental effects of veterinary medicines and their effects on the environment.

To enable the successful re-introduction of cattle into the hills research is needed into the provision of appropriate bedding materials, the use of bracken and woodchip warrant investigation. Also necessary is research into low-cost, welfare and environment friendly semi-housed systems, stand-off pads, wood-chip corrals.

Further work on non-chemical or mechanical management methods of undesirable and rank vegetation would assist many managers of wildlife reserves wishing to adopt organic methods. Also further research into use of feed blocks to encourage grazing in specific areas may be useful for the strategic use of poaching to provide microhabitats.

Other research issues identified:

- Development of alternative fly-control techniques: new treatments need investigating in terms of efficacy, environmental impacts relative to current treatments, and issues relating to UK approval.
- Issues of dietary control of acid-resistant E.coli and actual contamination of watercourses.
- Viable leguminous crops for hills and uplands for fodder.
- Effective ploughing methods to prevent soil erosion on slopes
- Suitable crops for upland sites, husbandry, uses, harvesting techniques, storage and uses in feeding.

## 8.11 Education and Dissemination

The proposed organic management plans in the revised ELS/OFS could be used to extend the assessment of the optimal stocking rate and mix of holdings undertaken during OCIS visits to existing organic farmers, which would lead to a recommendation for the stocking of different species (stocking mix) and overall stocking rates.

Training and education on the following issues have been identified:

- the use of 'plans' as management tools to improve systems – be they animal health, waste management, resource use,
- the need for monitoring and dissemination of parasite and grazing control in sheep only systems and implications for sward structure and composition,
- monitoring of worm burdens and the dangers of anthelmintic resistance,
- improving understanding of approved products for specific ectoparasites; advice on storage, appropriate timing of use and disposal – particularly of pour-ons,
- cultivation guidelines to minimise environmental impacts of N leaching in hills and uplands,
- the EIA legislation and thorough awareness of the implications of Tir Gofal with OF, including the assistance offered by FWAG.

## 8.12 Scale, time and climate change

Ecological impacts of agriculture and the rate of ecological change may act over much larger scales, be slower acting in the hills and more difficult to detect in the hills. Because of lower productivity, lower densities of species higher up the food chain may be expected (e.g. birds and larger mammals), which are therefore likely to occupy habitats (and be affected by processes) at a larger scale than individual organic units. The proposed 'co-operative actions' option in the consultation document for the revision of agri-environmental schemes would be ideal opportunities to target entire water catchments (as, for example the Lake Vyrnwy catchment).

In a review of the role of agriculture in the climate change process Kotschi and Muller-Samann (Kotschi and Muller-Samann, 2004) provide evidence on the capacity of organic agriculture to reduce emissions and serve as a sink of greenhouse gases.

Impacts also likely to be compounded by climate change; the impacts of climate change are likely to be most marked in the hills, with evidence of species moving ranges uphill. Climate change is likely to have considerable impacts on most or all ecosystems. Research (World Conservation Monitoring Centre, 2000) states that at the simplest level, changing patterns of climate will change the natural distribution limits for species or communities. Without barriers, vegetation zones may move towards higher latitudes or higher altitudes following shifts in average temperatures. Movements will be more pronounced at higher latitudes where temperatures are expected to rise more than near the equator, therefore having particularly significant implications for hill and upland biodiversity in the UK as a whole. The research also shows that in agricultural landscapes, changes in the length of growing seasons may improve productivity in mid-latitudes and increase the potential for arable crops at high latitudes. Negative impacts may include increased ranges of insect pests and diseases, and failure of crops in some regions from drought or flooding.

## 8.13 Farm viability.

Currently around 25% of organic produce is sold into the conventional market in the UK, thereby not compensating the farmer for the production method or any marketing effort. Even produce sold into the organic market does not always achieve a higher price than conventional produce. The organic 'premium' merely indicates a price above that of conventional produce; therefore if the conventional price is inadequate, it does not guarantee an adequate return to the organic farmer. With increasing globalisation of food production and as more and more quality marks are introduced and organic production increases the willingness to pay any differential may decrease and prices paid to farmers may reduce. Without the ability to achieve an adequate return for their management and investment, organic farming will not be sustainable.

The physical constraints against food production in disadvantaged areas are considerable and direct competition in global markets, especially with high labour costs, positive animal welfare and environmental conservation and protection is not realistic. Agri-environmental support needs to be at a level to compensate organic farmers for their production of public goods, leaving any price 'premium' to compensate for their investment in specialist marketing. If this is not achieved, reducing prices will cause organic farmers to either revert to conventional farming, or, more likely, leave farming altogether.

A less bleak scenario can be pictured if the strategic importance of food production and the public good aspects of agriculture are politically and publicly recognised. Public education is needed to inform the increasingly urban population of the importance of fresh produce and a balanced diet to good health and to demonstrate that food produced using environmentally beneficial methods

# 9 CONCLUSIONS/RECOMMENDATIONS

## Summary

1. :Recommendations for changes to the Organic Farming Scheme

   - A requirement for an Environmental Opportunity Review prior to conversion; the report should be included in conversion plan.
   - Conversion plan to show how the farm will address ELS scheme requirements.

2.Technical and infrastructure issues that need development:

   - Endo and ecto parasite control.
   - Control of injurious weeds without herbicides where mechanical control is limited by terrain.
   - Infrastructure development to integrate hill and upland systems with lowlands to produce a holistic system including the development of mutually beneficial agistment and summer grazing arrangements.
   - The use of forestry open space and conservation sites to relieve pressure on summer grazings

3.Training needs:

   - The use of ‘plans’ as management tools to improve systems – be they animal health, ‘waste’ management, resource use,
   - Biosecurity and positive health promotion.
   - Habitat and wildlife species identification.
   - Management to maintain semi-natural habitats in their optimum condition.
   - Improving understanding of approved products for specific ectoparasites; advice on storage, appropriate timing of use and disposal – particularly of pour-ons.
   - Cultivation guidelines to minimise environmental impacts of N leaching in hills and uplands.
   - The use of Environmental Opportunities Review, EIA legislation, FWAG, and thorough awareness of the implications of Tir Gofal on organic management.

4.Some Organic Standards issues bring relative benefits compared with conventional farming; however the benefit of others depends on the level of enforcement (for example permissions for treatment with anthelmintics). Positive adoption of environmentally benign practices is most likely achieved through the provision of training and positive support (for example for reduced and mixed stocking).

5.Research and development needs for organic farming in the uplands:

   - Investigation of optimal stocking rate and balance with regard to herd health, and the strategic use of grazing for conservation aims.

- The effects of different stocking balances and timing of grazings on upland habitats.
- Innovative semi-housing systems.
- The performance and suitability of indigenous breeds.
- The need for monitoring and dissemination of parasite and grazing control in sheep only systems and implications for sward structure and composition.
- Monitoring of worm burdens and the dangers of anthelmintic resistance

6. Food production can complement environmental and conservation principles if financial circumstances allow. To provide this the following recommendations are offered:

    - Enhanced financial support for organic hill and upland farming.
    - Preferential access to Tir Gofal and the proposed ELS and sources of capital funds for fencing, livestock buildings and manure storage facilities.
    - Incentives for mixed stocking and the use of adapted breeds.
    - Support for development of branded livestock products from ‘eco-regions’ and food tourism initiatives.
    - Output based agri-environment schemes developed through liaison of project officer and farmer.

Organic management involves looking at problems in a different way, which, because the system is based on ecological systems, often provides multiple benefits. There are specific standards limiting the use of agrochemicals, but also a tendency that organic farmers use less permitted agro- and veterinary chemicals. The aim for self-sufficiency in feeds is likely to increase the diversity of crops grown, either on uplands or on associated lowlands.

The biodiversity benefits of having mixed stocking are generally accepted. It is less clear if the use of other species may be more beneficial than cattle, but the fact that cattle are productive as well as assisting with floristic diversity may outweigh potential advantages from other species that may need less management. The need for housing for livestock can bring additional benefits as open agricultural buildings in hills and upland potential shelter for migratory and native species.

The major difficulty in drawing conclusions of the impacts of organic systems relates to the lack of data on actual, rather than recommended, management: there is no system which collates information on land-use, livestock numbers, veterinary treatments, etc. This is particularly ironic, given the multiple requirements on organic farmers for records keeping and the situation needs action to rectify.

Any agricultural production is likely to compromise conservation objectives, (although conservation commonly aims to preserve habitats which are the result of agricultural land-management,) but an organic system that may enable a marginal forage-based livestock system to be viable may be the best compromise. Management for particular species or habitats may require more imagination using organic management, and will often be a less ‘simple’ solution, but may lead to more robust results.

## 9.1 Capital and labour issues

As well as the difficulties of the capital costs for housing and manure management for cattle, with an increasingly aging farming population and the pressure to supplement farm incomes with off-farm employment, there is an issue of labour shortage for cattle husbandry. The greater use of machinery rings and the sharing of labour, including among farmers themselves appear to be successful overseas; unfortunately there is a cultural resistance to such co-operation that will need considerable work to overcome.

## 9.2 Education and dissemination

Some aspects of positive conservation management can be encouraged by agri-environmental schemes, enabling farmers to receive direct remuneration for the practices. Those not entering schemes may be persuaded to adopt the practices if production benefits are identified, but otherwise the route for changing practices is through Standards changes, which as outlined in the introduction, are likely to need implementing at European level to gain acceptance. Production benefits in such circumstances are likely to be subtle and masked by the multiplicity of other variables; they are also most convincing when identified by the farmers themselves, the need for on-farm demonstration events cannot be over-emphasised.

A route for encouraging a positive response to agri-environmental schemes is to harness the enthusiasm of farmers as naturalists. Farmers may welcome the opportunity to receive training and education in botany or wildlife identification.

The other major area of potential improvement through education is the increased use of plans as management tools. Resource management plans (includes manures and slurries) should be compulsory for all organic farmers, and the dynamic use of conservation and animal health plans should be encouraged.

## 9.3 Policy changes

It may be that, under CAP reform, organic stock production can turn in a positive margin when conventional is unable to; in which case the ability to sustain grazing livestock enterprises is important. A current interpretation of the implications of the mid term review of the CAP that 10% of larger scale producers will focus on production leaving the remainder as land stewards. It is undesirable that the remaining 90% who will be unable to compete in global markets because of scale or high cost base cease food production. Their continued viability will be dependent on adding value to their products and selling through local and specialist markets and the provision of other public goods. Organic farming is well suited to these markets.

Farming for the Future made recommendations for increasing the financial support to encourage environmental schemes, reflecting the growing recognition that an attractive countryside rich in wildlife can contribute greatly to rural prosperity. Organic production and marketing of the products, especially ‘telling the story’ of the food produced, is being recognised as an important tool (e.g. http://www.graigfarm.co.uk/traceability.htm) and enables public positive choice for animal welfare and contributes to viability and the economic sustainability of systems. This also depends on the strategic development of food tourism, and the promotion of ecoregions.

## 9.4 Technical issues

An increasing use of organic systems in the hills and uplands has revealed a range of challenges. There is a need for the development of technical approaches to address the particular character of hill and upland farming in the following areas:

- Integration of hill and upland farms with associated lowlands in a holistic system.
- Management of nature reserves and open spaces
- The role of lime in supporting invertebrate and bird populations in pastures.
- Investigation of methods for endo- and ecotoparasite control in hill and upland situations.
- Control of injurious weeds such as rush, bracken without herbicides and where mechanical control is limited by the terrain.
- Modification of cropping systems to minimize environmental damage risks and enable effective integration into farming systems (such as animal feeds and establishment of new leys.)
- Alternative legumes as a basis for extending grazing and the more secure provision of winter forage.

To assist the re-introduction of cattle to the hills some research and development is needed; particularly as into the use of stand-off pads to allow the additional benefit of the collection of FYM, controlling pollution as well as conserving nutrients for recycling and the potential use of bracken and wood chip as a bedding material. Additionally, confirmation of the fitness of indigenous breeds may enable cattle numbers to increase without the need for substantial housing. A general project covering technical issues, impacts on weeds, environmental benefits of selective grazing, parasite control benefits and financial/management issues would provide evidence to encourage producers and may provide evidence for a case for policy support.

## 9.5 Standards Issues

Few of the practices analysed in this document have suggested a need for changes in the organic standards. The issue of balancing the aims and aspirations of the organic system, the welfare expectations of (increasingly ignorant) consumers and the financial pressures on farmers are very difficult to resolve. Competition in the certification marketplace is likely to militate against the strict enforcement of standards that can never stipulate conditions for all farms in all conditions. Those farmers that thoroughly embrace the principles of the organic system and positively work with natural systems have an entirely different attitude to standards issues compared with those that converted (perhaps induced by financial aid) without a thorough understanding of the principles. The former may succeed in achieving a healthy and viable enterprise where the latter may fail. No standards can overcome the variability in management ability; they can only set principles in place. The increasing environmental and welfare demands of the public may result in an increased use of licences and permits for agricultural practitioners, but this can only happen if there are prospects of appropriate financial rewards.

## 9.6 Agri Environment-

Tir Gofal places more restrictions on production than do Organic Farming standards, for example fertility building is actively discouraged in some management agreements within Tir Gofal. Many Tir Gofal management prescriptions are pre-defined and farmers need to be very clear that they can be incorporated successfully into their farming operation. There is a case for the involvement of an agricultural consultant in drawing up and agreeing Tir Gofal schemes: anecdotal evidence suggests organic farmers entering Tir Gofal schemes during conversion or shortly after conversion, are finding the restriction of their flexibility a considerable handicap. This should be less of a problem where mature and stable organic systems enter management schemes.

There is synergy between organic farming and Tir Gofal, because of the provision of capital funds for fencing which allows more discrete management and smaller fields: double fencing for establishment of hedgerows assists with biosecurity as well as providing a refuge for invertebrates between cut or grazed fields. Additionally, the push through Tir Gofal for reversion to hay meadows will produce forage that may provide an opportunity for the linking of upland and lowland grazings.

It is recommended that agri-environment schemes should provide incentives for mixed stocking and the use of more 'adapted' breeds. The appropriate balance of sheep and other livestock stock will differ from site to site, but it is unlikely research could provide a sufficiently widely applicable prescription. It would be more appropriate to set output targets for particular habitats requiring the farmer and project officer to work together to ensure the desired results. Clearly, management for specific outputs must be financially rewarded. Monitoring of projects would be beneficial, but it would not be wise to hold up programmes waiting for results.

In common with forthcoming cross-compliance requirements for EU support, Tir Gofal and other agri-environment schemes should emphasize soil protection.

Organic maintenance payments require compliance with the current OFS environmental prescriptions, although in the future these may be incorporated into the proposed Entry Level Scheme; the conditions of which all organic farmers should be required to comply. This would behove the authorities to ensure that changes to ELS requirements were always complementary with organic farming methods.

To ensure no damage to BAP habitats, there is a need for a critical assessment of farms before entering conversion. Additionally, technical advisory assistance should be provided in devising a sustainable farming system if the proportion of BAP or wildlife habitat provides constrains reseeding on in-bye or productive upland.

There is a need to develop policies that address the potential conflicts between management for food production and environmental conservation in the hills and uplands of Wales. This could involve schemes such as:

a. Enhanced financial support for hill and upland organic farming.

b. Support for development of 'eco-regions' and branded livestock products from such regions ('Eat the View').

c. Better links between lowland organic farms in Tir Gofal schemes and upland organic farms should be encouraged, with the objective of making surplus hay from Tir Gofal agreement land available to hill and upland units, and for the development of mutually beneficial agistment and summer grazing arrangements.

d. Use of forestry open space and conservation sites (GAP) schemes to relieve the pressure on summer pasture on hill and upland farms and to allow more enclosures to be shut up for forage conservation.

e. Need for stocking rate and balance research for maintenance of animal health and the conservation of particular habitats.

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# ACRONYMS

| | |
|---|---|
| ACOS | Advisory Committee on Organic Standards |
| BAP | Biodiversity Action Plan |
| CCW | Countryside Council for Wales |
| EIA | Environmental Impact Assessment |
| EOR | Environmental Opportunities Review |
| FWAG | Farming and Wildlife Advisory Group |
| OCIS | Organic Conversion Information Service |
| OCW | Organic Farming Centre for Wales |
| OFS | Organic Farming Scheme |
| SNRG | Semi-Natural Rough Grazing |
| UKROFS | United Kingdom Register of Organic Food Standards |
| WAG | Welsh Assembly Government |
| WDA | Welsh Development Agency |

# APPENDIX 1
# COMPENDIUM OF UK ORGANIC STANDARDS

**March 2003 Version 3.5**



**(Wording identical in UKROFS standards ANNEX 1.6.i)**

## Organic Production and Care of the Environment

1.1. Organic production systems are designed to produce optimum quantities of food of good nutritional quality by using management practices which aim to avoid the use of agro-chemical inputs and which minimise damage to the environment and wildlife.

1.2. These systems entail the adoption of management practices which underpin and support the principles and aims of organic production. The principles include:-

i) Working with natural systems rather than seeking to dominate them;

ii) The encouragement of biological cycles involving micro-organisms, soil flora and fauna, plants and animals;

iii) The maintenance or development of valuable existing landscape features and adequate habitats for the production of wildlife with particular regard to endangered species;

iv) Careful attention to animal welfare considerations;

v) The avoidance of pollution;

vi) Consideration for the wider social and ecological impact of the farming system.

1.3. When applied these principles result in production practices whose key characteristics are:

i) the adoption of sound rotations;

ii) the extensive and rational use of animal manure and vegetable wastes;

iii) the use of appropriate inputs;

iv) appropriate cultivation, weed and pest control techniques; and

v) the observance of conservation principles.

## The European Community Regulation (EC No.2092/91) and the UK Standards

1.5. UK Standards must accord with the European Community Regulation (EEC) No.2092/91 which came into effect on 1 January 1993. However, in interpreting the Regulation and its Standards Defra will assess an apparent infringement in relation to any breach of one or more of the principles, set out above. The observance, or otherwise, of the following practices will be relevant to such an assessment.

1.6. The specific practices needed to respect the conservation principles of organic production will depend upon the individual circumstances on each farm. However, the role of conservation in organic farming is considered so important by Defra that for guidance additional principles are set out below:

> i) Concern for the environment should manifest itself in willingness to consult
>
> appropriate conservation bodies and in high standards of conservation management
>
> throughout the organic holding.
>
> ii) Natural features such as streams, ponds, wetlands, heathland and species-rich grassland should be retained as far as possible.
>
> iii) Grazing management of natural (or semi natural) habitats such as grassland, heath, moorland, heather and bog and rushy upland, should aim to prevent poaching of the soil and over grazing. Localised heavy stocking particularly in the nesting season should be avoided.
>
> iv) Hedges and walls should be retained and managed using traditional methods and materials as far as possible.
>
> v) In hedge and ditch maintenance the nesting season and wildlife requirements for winter feeding or shelter should be taken into account. Hedge trimming and ditch cleaning should generally not take place between 1 March and 31 August. Where practicable, the maintenance of hedges should result in hedges at diverse stages of growth.
>
> vi) If it is considered that there are reasonable grounds for alteration to hedges or to field boundaries these should first be discussed with a Conservation advisor. If alteration does prove to be necessary, consideration should be given to the need for compensatory environmental work.
>
> vii) The retention and management of trees in accordance with local custom and woodland practice is essential. Where re-planting is to take place, indigenous varieties of trees and shrubs should be given preference. Where practicable, natural re-generation and coppicing of appropriate species should be practised.
>
> viii) Clear felling should be restricted so as to retain a diversity of age classes and habitat within the woodland areas of the holding.
>
> ix) Care should be taken in the spreading of manures and slurry. The application of manure within 10 metres of ditches and watercourses and within 50 metres of wells and bore holes should be avoided. The spreading of manure or slurry on frozen ground or on saturated ground should be avoided, so as to prevent excessive run off.
>
> x) The land management should seek to preserve features of archaeological or historical value or interest avoiding, for example, the levelling of ridge and furrow, and the cultivation of monuments or earth works.
>
> xi) New buildings should be designed and located to have minimum impact on the landscape.
>
> xii) Existing rights of access should be maintained.