Water quantity

Abstraction licences. Cost constraints in compensating users for revocation of licences to secure environmental objectives. In proposing cases for revocation of licences or reductions in abstraction the EA is obliged to undertake cost-benefit analysis. This methodology, unfortunately, is deeply flawed from an environmental perspective, generating market prices for biodiversity and landscape which are essentially arbitrary and bear little relation to intrinsic values. Integrated Catchment Management Plans clearly useful concept - to what extent implemented? Groundwater catchment areas around sites vulnerable to abstraction being considered. Any progress? Encouragement of IDBs to adopt practices more congenial to nature conservation.

Coastal defences causing coastal squeeze. EA/MAFF make decisions on continued maintenance in terms of cost-benefit (public subvention to support subsidised farming). CBA generally comes out in favour of continued coastal defence when weighed against nature conservation benefits. Environmental benefits have to be purchased via incentives - pilot Habitat Scheme for saltmarsh creation.

- **Rural economy**

The developments described earlier have transformed the economy and society of rural areas. Agriculture itself has largely destroyed 'traditional' rural society. However, other changes such as the large influx of middle-class population into the countryside of the south and east has not only transformed the economy of rural areas but also displaced farmers and landowners from positions of social leadership. The rural economy is no longer dependent on primary production but is largely a service economy. These trends are reflected in the Government White Paper Rural England: *A Nation Committed to a Living Countryside* (October 1995). The paper recognises the changing and heterogeneous nature of the economy and society of rural areas. Its vision of rural communities is one of 'active communities which take the initiative to solve their problems themselves and which are 'close-knit and balanced' and which nurture traditions [sic] of independence, partnership and voluntary action'. As such the White Paper appears to be propounding a kind of rural populism grounded in models of 'endogenous' development. This approach is commendable insofar as it ostensibly supersedes exogenous 'modernist' framework of development and suggests that the specific resources of an area - natural, human and cultural - hold the key to sustainable development. In promoting sustainable rural economies, therefore, the objective of policy is to help rural communities to help themselves, to diminish rather than increase rural dependency - public intervention is seen to play an enabling role, where it has a role at all, this policy formulation appears attractive at the level of rhetoric. This objective emerges as largely specious, however, when its substance is more closely examined. While appealing to the new rural middle-class (whose wealth in most instances derives of course not from endogenous development at all but from their articulation with an increasingly globalised economy), this rural populism also accords with the thinking of new Right, deregulatory governments keen to dismantle traditional regional policy and to extol the virtues of self-help and the freeing-up of entrepreneurship. What this model appears to amount to in reality then is an increasing abrogation by the state of responsibility for rural development and a transfer of such responsibility to the forces of globalisation. Globalisation increasingly bypasses the state and articulates directly with the regional and the local. This then appears to be not so much an authentic model of endogenous development at all, but rather a process of globalisation seeking new 'flexibility' through the realisation of regionally defined comparative advantages.

Such trends are mediated, of course, by a process of Europeanisation which both inhibits/facilitates globalisation through an admixture of traditional 'exogenous' and novel 'endogenous' development models administered through the structural funding mechanisms of objective 1, 5b and LEADER programmes. Objective 1 and 5b appear to be still very much harnessed to traditional exogenous productivist approaches and, despite a formal requirement for their integration with environmental concerns, tend either to ignore the environmental dimension or, at worst, to enhance unsustainable practices. LEADER programmes appear to represent the most genuine attempt to foster 'authentic' endogenous and environmentally sustainable development and, as such, appear to be the exception rather than the rule.

Future policy direction, if the recent Cork Conference on Rural Development is indicative, is an increasing penetration of globalisation into the rural economy with a withdrawal of traditional 'state' derived productivist/exogenous development support and its redirection to socio-environmental services on a more closely targeted basis. (Movement in this direction has been slowed, of course, if only temporarily, by the intervention of the more traditionalist proposals of Agenda 2000.) However contradictory the overall framework of this policy scenario might appear to be, the sentiments expressed at Cork in respect of the formal aspects of future rural policy are to be welcomed nevertheless. Thus Cork recognised the need for a more integrated approach to rural policy, one which relies less on sectoral policies and is more focussed on meeting the wider environmental and social needs of rural areas. There are the beginnings of recognition that the objectives of rural employment, viable communities and a high quality environment are complementary rather than contradictory. There is now more appreciation that, because only a relatively small proportion of the countryside can be managed for biodiversity alone, nature conservation depends on land use practices which meet the needs of communities as well as wildlife. There is, therefore, an increasing need to identify policies and practices which not only yield conservation benefits but provide employment and income for rural communities. The danger, however, when viewed against the broader context of policy change, is that the framework required to support rural environmental and social sustainability will be juxtaposed to a process of enhanced globalisation (the ethos of competitiveness and efficiency) which appears to constitute the primary thrust of strategic thinking emanating from EC agricultural and rural policy-makers. The basic contradiction here then is a bifurcation of policy which, whilst dismantling sectoral policy dichotomies, succeeds only in re-erecting others of a spatial kind between 'global' enterprises, on the one hand, and local providers of socio-environmental services, on the other.

Conclusions

This survey suggests that agriculture practice and policy in this country remain very far removed from what could be described as environmentally sustainable. Despite some environmental gains and some reforms to the CAP, agriculture remains overwhelmingly productivist in orientation, with generally adverse impacts upon biodiversity, soil, water, atmosphere and the social structure of rural areas. To some extent, these continuing impacts are the result of policy 'inertia'. Thus, the MacSharry reforms have achieved a partial decoupling of arable and livestock support by cutting price guarantees and offering farmers area and headage based payments in compensation. The Arable Area Payments Scheme, in combination with reduced price guarantees, does mean that the link between subsidies and yields is weaker than it was before 1992, giving farmers a reduced policy incentive to intensify production by applying more inputs to cropped land (although the farmer still has an incentive to maintain the 1992 arable area in order to continue to receive payments). A similar partial decoupling of support has been achieved in the livestock sector, where new direct producer aids have been introduced that are subject to quotas, ceilings and stocking rate limits. Although payments depend on current livestock numbers being maintained, there is now technically no policy incentive to expand above these levels unless warranted by market prices. Equally, however, there exists no incentive actively to deintensify production.

The impacts of productivist policy remain not only as a result of inertia but, in the arable sector, have been reinforced in recent years through buoyant markets. Additionally, however, there is good reason to suppose that commodity regimes, either directly or indirectly, are still providing a positive incentive to damage the environment. For example, the AAPS eligibility rules tend to encourage environmentally damaging activities. By including temporary grass within the eligible crop area but not making this eligible for payment, farmers are encouraged to maximise their cropped area at the expense of temporary grass in order to maximise entitlement to arable area payments (Winter and Gaskell, forthcoming). AAPS thus encourages permanent cropping and fewer grass leys with rotations, thereby increasing dependency on chemical inputs within the arable system and eliminating arable/grass mosaics. By 'capturing' a particular area as arable and confining payments to that land, AAPS discourages mixed and integrated farming, dependent on crop and grass rotations, which has considerable potential for increasing biodiversity and landscape interest and for reducing chemical inputs. AAPS, additionally, has knock-on adverse effects on the environment. There may be a strong incentive to grow non-eligible crops on non-eligible land. For example, farmers who might otherwise have grown potatoes within arable rotations are now unlikely to do so since, to grow potatoes on eligible land would be to forego the opportunity of arable payments on eligible crops. The eligible area rules mean that there is a strong incentive for potato farmers to cultivate non-eligible land, sometimes permanent pasture adjacent to water courses.
Policy responses to address such adverse impacts of productivist policy are overwhelmingly mitigatory, rather than preventative, in kind. In addition, formal commitments to principles on which environmental sustainability could be premised are not generally translated into substantive policy. Thus, it is difficult to perceive conformity to any of the environmental principles enshrined in the 1987 Single European Act (see Annex 2 for details).

This is not to suggest that environmental policy initiatives have not imposed themselves increasingly on the agricultural agenda since 1980 - they undoubtedly have. However, far from providing a radical break with previous agricultural policy, as might appear to be the case at first sight, 'green' policy initiatives have served to emphasise the durability of some of the underlying features of post-war policy. There is still a pervasive voluntarism in the way schemes are administered and the preservation of 'rights' of farmers to a degree of state support, through the extension of their property rights to cover environmental goods, remains largely unchallenged, as does their 'right' to continue to pollute and degrade essential resources, biodiversity and landscape where such rewards are not offered.

The need for strong sustainability founded on causal analysis of generic issues

We have seen that current domestic and EU agri-rural policy is characterised by a heavily mitigatory approach to the environmental contradictions that it engenders. Such an approach may be termed 'environmental managerialism'. It is increasingly clear, however, from the scope and scale of natural resource and biodiversity degradation and decline, that 'environmental managerialism', as an approach to sustainability, is itself unsustainable. It is from such a realisation that calls for integrated policy and whole countryside approaches have arisen. Such approaches problematise mainstream economic activity as the causal basis of environmental contradictions. Consequently, if environmental contradictions are to be addressed seriously then what is required is a change, towards sustainability, in the character of that economic activity itself. This is what is meant by 'strong' sustainability as defined in this report. A whole countryside approach, based on strong sustainability, has as its objective, therefore, not only the conservation and enhancement of semi-natural habitats existing at the margins of intensive agriculture, on special sites and in the wider countryside, but also the transformation of the 'infield' practices of productivist farming so that these conserve, not only characteristic biodiversity, but also the natural resources of soil, water and atmosphere. The linkages and complementarity between environmental and socio-economic sustainability also need to be emphasised. A whole countryside approach cannot be built, therefore, on the basis of managerialist 'symptom management', but rather by addressing generic causes deriving from the unsustainable practices of mainstream farming activity.

Chapter 4. Objectives for sustainability in agriculture

This chapter attempts to define the physical and management objectives for sustainability in respect of the agricultural dimensions identified in the previous chapter. The appropriate policy framework that is likely to be required to secure these sustainability objectives will be addressed in Chapter 5.

It was noted earlier that environmentally sustainable agriculture may be defined as that "which seeks to maintain and enhance the natural qualities and characteristics for the farmed environment and its capacity to fulfil its full range of functions, including the maintenance of biodiversity."

Environmentally sustainable agriculture, it is maintained here, can be secured only by the adoption of an integrated, holistic view of countryside management. This means that there is an intention not only to conserve and enhance semi-natural habitats existing at the margins of intensive agriculture, on special sites and in the wider countryside, but, additionally, to transform the 'infield' practices of modern farming so that they nurture the characteristic habitats and species of these areas and the productive resources of soil, water and atmosphere upon which farming depends. Such objectives need to be underpinned by viable farms and rural communities and, more broadly, by principles of social equity and 'deliberative democracy'.

In detail, environmentally sustainable agriculture will involve:

- **Biodiversity objectives (on-farm sustainability)**

  - ❑ The conservation, enhancement and expansion of all semi-natural 'infield' habitats (low intensity grazed habitats), for example, unimproved neutral, calcareous and acid grassland, mires, heaths and moorland (this category includes 'unenclosed' habitats).

  - ❑ The conservation, enhancement and expansion of 'interstitial' habitats, for example, hedges and hedgebanks, ditches, ponds and streams and, where appropriate, 'outfield' habitats eg semi-natural woodlands.

  - ❑ The conservation, enhancement and re-creation of biodiversity in artificial 'infield' habitats (for example, land supporting improved grassland or arable crops).

  - ❑ The conservation and enhancement of the overall fabric of the countryside in support of species utilising multiple habitats and of landscape distinctiveness.

  (Aquatic habitats/species are addressed under natural resource objectives below.)

- **Natural resource objectives (productive resources)**

  - ❑ The maintenance/improvement of agri-biodiversity and of environmental media (soil, water and atmosphere) through appropriate crop/livestock practices in support of sustainable food production and biodiversity objectives.

- **Socio-economic objectives**

  - ❑ The retention and extension of the wider range of skills within rural communities needed for biodiversity conservation and sustainable food production.

  - ❑ The retention and, where necessary, re-creation of viable rural communities and production systems in support of biodiversity objectives and sustainable food production, involving community participation in, and ownership of, the process of policy change and the determination of policy objectives.

Discussion in the previous chapter (and elsewhere, cf. Tilzey, 1997) highlighted the importance of identifying generic impacts (key environmental indicators) and tracing these back to generic causes. Such a framework is required, it is argued, if whole countryside objectives are to be realised and if these are to articulate with (and be realised through) agri-rural policy mechanisms. The identification of generic issues, causes and solutions affords a disciplined and structured means to address and to secure environmental sustainability. Such a structured causal analysis takes the following form: symptoms identified as generic issues; generic issues traced to generic causes; causes addressed by defining objectives through the structural features and requirements of habitat/species/resources as management practices enabling these to be addressed by generic solutions. These solutions require, firstly, the definition of physical sustainability objectives for key environmental components, comprising the structural definition of habitat/species/resource requirements in terms of agricultural management practices and the identification of 'desired' future condition' for these components in terms of spatial/numerical targets and the overall configuration of farming systems (this will be undertaken in this chapter). The next step involves the definition of policy frameworks and mechanisms appropriate to these objectives (to be undertaken in the next chapter). This step needs to be supplemented by an analysis of policy opportunities/constraints, both shorter and longer-term, delineating the parameters for action to secure sustainability objectives.

The total structure of analysis is as follows:

Symptom

↓

Generic issue

↓

Generic cause

↓

Physical objective

↓

Shorter-term Policy Objectives (symptom management) = Optimal use of ELMS, expedient use of commodity supply control measures, regulation, advice and expansion of such mechanisms in scope and scale where feasible.

↓

Longer-term Policy Objectives (addressing generic cause) = Removal of 'productivist' system of support and replacement by 'green' interventionism (recoupling) based on direct payments, regulation and appropriate marketing structures.

In setting sustainability objectives a key issue will be the definition of 'desired future conditions'. The desired future condition is likely to be a 'vision' for the longer-term future, one which realises the goal of whole countryside management and strong sustainability. Shorter-term objectives will need to be defined, however, that signify 'milestones' on the road to this notional end point. The emphasis of these shorter-term 'desired conditions' will tend to be primarily upon the removal of negative impacts upon priority nature conservation and productive resources and upon a limited series of positive measures delivered principally through ELMS. Such measures will focus primarily upon special sites and areas but will also need in some measure to address wider countryside issues insofar as these are a requirement of Biodiversity Action Plans for farmland species and habitats, or commitments with the Sustainable Development Strategy. In the longer-term, at a time when these shorter-term priorities have been addressed, strong sustainability will require a shift in emphasis towards securing wider and positive benefits through higher standards for productive resources and through habitat and species expansion. This will be matched by a shift in overall emphasis from special sites and areas to 'common' habitats and species and general resource status in the wider countryside. It will be premised overall on an integrated approach to the environment, agriculture and rural development.

We earlier identified the key components of agro-ecosystems which, together with the socio-economic dimension, make up eight 'structural' elements. These components provide a structured means to define generic groupings of habitats (and their associated species), their spatial relationships and agricultural impacts upon these to define sustainability objectives. They also provide the means to assess the character of the policy opportunities and constraints surrounding those objectives. These structural components enable us to gauge the level of compatibility between habitat/species/resource requirements and the agricultural practices that govern their status. This compatibility must be gauged not only on the basis of agricultural practices themselves but also upon the character of the policy instruments which locally encourage such practices. In the final analysis, this framework should enable us to define the requirements for, and assess the ease of meeting, objectives for sustainability. From these structural components of agro-ecosystems it is possible to derive three key principles which will underlie the setting of sustainability objectives:

a. Maintenance/enhancement of 'sensitive' habitats.

b. Expansion of sensitive habitats through reversion of intensively used land.

c. Diversification/extensification of intensive practices to secure biodiversity and natural resource objectives.

As we have seen, through time the focus of objectives will need to shift in emphasis from a-c.

We shall now proceed to develop the analytical framework outlined above by detailing sustainability objectives for the key structural components, together with some discussion of shorter-term policy responses.

Biodiversity Objectives (On-farm Sustainability)

- **Semi-natural 'infield' habitats**

  Main habitat types: Chalk and limestone grassland, neutral grassland, acid grassland, fen meadows and mires, grazing marsh, lowland heathland, heather moorland.

Generic issue: Arablisation or improvement; undergrazing or abandonment (including the problem of fragmentation); overgrazing; drainage.

Generic cause: Intensification; specialisation generated through production linked agricultural subsidy and maintained through inherited rigidities of commodity regimes.

Structural habitat requirements: Appropriate grazing levels (and mowing for meadows), livestock infrastructure, viable management units, protection/expansion through site buffering and linkage targeted to lower nutrient substrates (appropriate water levels for mires and grazing marsh).

Short-term objectives/solutions: Use of ELMS to secure appropriate management, targeted expansion of habitat to secure site linkage/buffering and to facilitate grazing management; increased use of conditionality in commodity regimes, particularly in the uplands.

Generic policy solutions: Evolutionary transformation of CAP commodity regimes into socio-environmental direct payments, with due provision for 'additionality', with objectives defined by Natural Area; underpinned by strong environmental regulatory framework.

The objective will comprise the conservation, enhancement and expansion of all such examples. The conservation of such habitats is fundamentally incompatible with high input agriculture because the former are dependent upon low nutrient status substrates. Moreover, in much of lowland England, the management systems required for their conservation have often disappeared from the landholdings of which such habitats are a part. In the short-term, therefore, the conservation of semi-natural infield habitats in 'peripheral' (usually lowland) contexts will continue to depend upon the provision of special management secured by incentives through environmental land management schemes. Expansion of this habitat is severely constrained by surrounding intensive agriculture. The high opportunity costs of diverting the latter into low intensity systems means that, for budgetary reasons (and initially for ecological ones as well), semi-natural habitat re-creation will have to be highly targeted, firstly, to areas of highest priority (for example, to achieve site linkage) and, secondly, to areas of lowest productivity (for example, to areas of thin soils or naturally impeded drainage). Achievable targets for expansion and re-creation will therefore be modest because of difficulties (outside measures linked to commodity supply control) of purchasing the diversion of intensively farmed land. If targets for re-creation are to be met, either the budget for ELMS will have to be increased substantially or, alternatively, greater consideration given to the use of conditionality/cross-compliance within CAP commodity regimes. Additionally, current quota restrictions upon the movement of livestock impose practical constraints upon the area that can be returned to grazing management in the lowlands. The potential for securing 'whole countryside' objectives in the shorter-term is therefore limited and success, if any, will tend to be confined to ESAs.

Semi-natural infield habitats in the uplands, by contrast, are utilised as integral parts of mainstream farming systems. Here the currently prevailing problem is not the peripheral status of the habitat or the absence of appropriate management tools, but rather, too much management in the form of ecological overgrazing. In other words, the management systems required for habitat conservation (at least in terms of livestock if not always of labour), together with the habitat itself, albeit in sub-optimal condition, are already in place. In principle, therefore, all that is required (for the restoration of heather moorland, for example) is the replacement of the current system of output related support with one founded upon environmental criteria. This could prefigure the displacement of livestock commodity regimes and HLCA payments by a system of direct socio-environmental payments, rendering ELMS largely redundant except as mechanisms to secure 'additionality' on more sensitive sites.

- **Interstitial habitats**

Main habitat types: Hedgerows, field margins, ponds, ditches and streams.

Generic issues: Loss and degradation, eutrophication and drainage.

Generic causes: Intensification, specialisation, neglect, mismanagement.
Structural habitat requirements: Appropriate management regimes (cutting and clearing), creation of buffer zones to exclude effects of pesticides and fertilisers and to expand habitat.

Short-term objectives/solutions: Conservation of extant resource, with priorities defined by species richness and 'critical' species dependence; use of conditionality in commodity regimes to secure appropriate management and creation of buffer zones; re-creation and exacting management requirements supported through ELMS.

Generic policy solutions: transformation of commodity regimes into environmental direct payments; introduction of strong baseline regulation to secure basic standards of countryside management.

Hedgerows, field margins, ponds, ditches and streams are key determinants of landscape character and, in the lowlands, constitute, throughout large areas, the sole surviving examples of semi-natural habitat. They are, therefore, key to the survival of many plant, insect, bird, mammal and amphibian species in the wider countryside. Interstitial habitats are still subject, however, to direct destruction or, more commonly, to a slower process of degradation through mismanagement and/or neglect. The objective should be to conserve, enhance, restore and, where feasible, create all such interstitial habitats. In the short-term, priorities will need to be identified, based on species richness and 'critical' species dependence, where current policy constrains objectives and requires use of agri-environment funds.

The management systems required for appropriate conservation of interstitial habitats are, with the exception of traditional skills, largely available and need simply to be adapted to achieve defined goals. Moreover, the conservation objectives for some interstitial habitats (for example, hedgerows) can be secured at little, zero or even negative expenditure for the farmer and are, therefore, ideally suited to realisation through a system of environmental conditionality attached to mainstream commodity support or, more permanently, through a regulatory framework. The diversion of land to form buffer zones to safeguard/create field margins, linear water courses and ponds is again theoretically feasible through conditionality or, more contentiously, through a regulatory baseline. Currently, however, the favoured mechanism for achieving such nature conservation objectives is ELMS. Where substantial restoration or creation of habitat is required, ELMS represent the only realistic mechanism in the short-term. The high cost of purchasing the diversion of productive land into conservation usage, however, means that such agri-environment funds will need to be highly targeted to priorities.

- **'Artificial infield' habitats (infield practices of modern farming)**

  Main habitat types: Arable fields, grass leys, improved pasture.

  Generic issues: Loss and decline of arable weed species; loss and decline of characteristic farmland species (typically birds); loss of arable/pasture mosaics; shift to winter-sown crops; loss and decline of field edge flora and fauna (see also above).

  Generic causes: Intensification of production involving increased use of pesticides and artificial fertilisers; excessive, 'insurance' and non-targeted use of the latter; specialisation of farms into arable or livestock with loss of field mosaics; substitution of artificial for organic fertiliser.

  Structural habitat and species requirements: Arable/pasture mosaics, field margins (including beetle banks), conservation headlands, spring-sowing of crops, retention of winter stubbles, retention of high soil organic content, limited/targeted application of pesticides and artificial fertilisers.

  Short-term objectives/solutions: Use of conditionality in commodity regimes, use of targeted ELMS (for example, Arable Stewardship Option, new 'wider countryside' ESAs), introduction of regulation to enforce minimum environmental standards.

  Generic policy solutions: Transformation of commodity regimes into direct payments with most wider countryside objectives secured through basic tier payments; use of environmental regulation; targeted incentives for farms beyond policy reach.

  The great bulk of the lowland English landscape is now dominated by the ecologically impoverished environments of improved grassland and intensive arable cultivation. Current land-use practices of the latter appear to bear particular responsibility for the decline in 'common' farmland species. Thus, arable specialisation has led to the loss of arable-pasture mosaics required by species such as brown hare, stone curlew and skylark, whilst the shift to autumn-sown cereals has entailed, firstly, a drastic reduction in winter stubbles required by many seed-eating birds and, secondly, unsuitable nesting conditions for species such as corn bunting and lapwing.

  A number of measures could be adopted to address such declines including the creation of field and fallow margins, conservation headlands and beetle banks, a shift back to the use of spring-sown cereals and, where feasible, the adoption of mixed farming practices to re-create arable-pasture mosaics. Current farming systems and practices can, in theory and with appropriate incentive payments, fulfil all these objectives with the exception of the last. This is because they can be implemented at the margins of intensive practice or require only a rescheduling of that practice.

  The major constraints comprise, however, firstly, the likely adverse impacts of such measures upon farm profitability (in the absence of appropriate incentives) and, secondly, the rigidities of current policy. Again, the high opportunity costs of reverting arable land renders diversion to less intensive conservation use (other than AAPS set-aside) generally prohibitively expensive; the profitability of arable vis-a-vis livestock production, combined with the rigidities of commodity regimes, render a return to mixed farming unlikely in the shorter-term. AAPS set-aside could be deployed, however, to much greater environmental effect than is currently the case, both to create field and fallow margins and to mimic arable-grassland mosaics (but is proposed under Agenda 2000 to be reduced to zero, in any case). Environmental conditionality could also be introduced into AAPS as a mechanism to create field and fallow margins and to buffer interstitial features. The cost of purchasing the diversion of intensive infield to conservation use means that the use of ELMS (for example the Arable Stewardship Option to be introduced as a pilot in 1998) will need to be highly targeted and will therefore make little impression upon the overall scenario of biodiversity loss and decline in the wider countryside.

These conclusions suggest that conventional agriculture can, in theory (but probably at considerable financial cost), be made more congenial to 'common' field edge species via improved management of interstitial habitats, creation of field and fallow margins and beetle banks. Such 'field edge' measures, however, do not render infield practices any more congenial to biodiversity. Rather, biodiversity enhancement is purchased essentially through diversion of land out of intensive use. It is doubtful whether this conventional model alone will be sufficient to secure biodiversity objectives for the suite of species dependent upon appropriate infield practices. What this conventional model is unlikely to achieve is a shift back to spring-sown cereals; what it cannot achieve, because of its structural characteristics, is, firstly, the increased adoption of mixed farming practices and, secondly, increased availability of infield food sources, for example, seeds, insects and soil organisms that are a product of the restricted use of agrochemicals and the application of organic manures. These objectives can be secured, however, by organic agricultural systems. Organic systems incorporate features which will be central to objectives for infield practices *viz.*

a. Rotations incorporating grass leys and legumes;

b. Reliance on animal and green manures produced within the farm, rather than on synthetic fertilisers;

c. Very little use of chemical pesticides. Organic farming will also be central to securing other sustainability objectives relating to soil, water, atmosphere and agri-biodiversity (see below)

- **Overall Habitat Diversity/Species Dependent upon Multiple Habitats**

The diversity and juxtaposition of habitats and their associated species within a given area is an important measure of sustainability. A significant number of species of nature conservation importance is reliant upon such diversity and juxtaposition.

Generic issues: Contraction in population numbers and range of species dependent on multiple habitats (for example, greater horseshoe bat); loss of local landscape distinctiveness.

Generic causes: Agricultural specialisation and intensification, leading to loss of arable-pasture mosaics, hedgerows and small woods etc.

Structural habitat/species requirements (will vary from area to area): For greater horseshoe bat, for example, requirements are - permanent pasture, small fields, thick hedgerows, small broad-leaved woodland, no insecticide use. (These structural requirements may be similar to, or overlap with, other species [for example, many woodland edge birds] allowing generic solutions to address multi-specific objectives.)

Short-term objectives/solutions: For greater horseshoe bat, for example, maintain and enhance mosaic habitats of small, broad-leaved woods, thick hedgerows and permanent pasture; create smaller fields where possible through hedgerow planting and plant new broad-leaved woodlands. Use of ELMS (ESAs, CS, Farm Woodland Premium Scheme) and conditionality in commodity regimes (maintenance of hedgerows, extensification of grazing, reduction in pesticide use).

Generic policy solutions: Transformation of commodity regimes into environmental direct payments supported by appropriate environmental regulation and modulated by Natural Area (local area biodiversity objectives).

Agricultural intensification and specialisation has tended to substitute uniformity for diversity with deleterious consequences for local landscape distinctiveness and those species dependent upon the close juxtaposition of different habitats. It is very important, therefore, for attention to be given to the 'synthetic' outcomes of all the biodiversity objectives described above, in other words, to look at the spatial objectives for individual biodiversity components <u>in relation</u> to one another. This is vital in identifying a 'vision' for any particular Natural Area.

Productive Resources

- **Water** (water quality and quantity, flood and coastal defence)

  Main habitat types: Open water, rivers, canals, fens, topogenous mires, estuaries and saltmarsh.

  Generic issues: Reductions in water quality and quantity, coastal squeeze, drainage, river canalisation.

  Generic causes: Intensification and specialisation of agricultural production involving increased application of artificial fertilisers and pesticides, drainage, canalisation, water abstraction and conversion of coastal habitats to intensive use (mainly arable).

  Structural habitat requirements: High water quality and appropriate water quantity, habitat expansion and re-creation (for example, flood plain grasslands and woodlands, saltmarsh).

  Short-term objectives /solutions: Use of ELMS (NSAs, Habitat Scheme, ESAs), conditionality in commodity regimes, environmental regulation, strategic management and planning (for example, the Environment Agency's Local Environment Agency Plans).

  Generic policy solutions: Transformation of commodity regimes into direct payments, strong environmental regulation.

  Problems of water quality, water quantity, flood and coastal defence have increased in tandem with agricultural intensification and specialisation and are manifested in pollution by fertiliser/pesticide runoff and drift, irrigation, drainage, disruption of natural river catchment processes and coastal squeeze.

  Water Quality: The maintenance and enhancement of water quality should be based on key biological indices and secured through protection from/prevention of diffuse pollution from fertiliser and pesticide application and from/of point source pollution from farm wastes, including slurry and silage effluent.

Diffuse pollution: The volume, timing and distribution of fertiliser applications, particularly of nitrates, have an important influence on eventual losses to the environment. Considerable reductions in pollution and some savings in fertiliser use can be made by adopting best practice and utilising new knowledge and technologies. A starting point for the efficient use of inputs is a precise knowledge of crop requirements and the conditions applying in individual fields as well as the farm as a whole. This can be greatly assisted by new analytical techniques for assessing the 'available' nitrogen in particular soils. Good practice will also include the use of appropriate crop rotations, including legumes, new methods of cultivation and soil management. Further reductions in fertiliser use can be achieved by adopting lower input techniques and the wider application of the kind of measures being adopted in Nitrate Vulnerable Zones. (The Codes of Good Agricultural Practice relating to the protection of water produced by MAFF recommend that manure and slurry should not be spread within 10 metres of a watercourse or within 50 metres of a spring, well or borehole).

Well designed buffer strips sown to grass can provide watercourses with significant protection, especially where they are bordered by arable land. In a recent report, the Royal Commission on Environmental Pollution quotes research suggesting that grassed buffer strips can reduce herbicide loss from arable plots by a factor of 40, nearly eliminate soil loss and reduce the volume of run-off water by a factor of 6 (RCEP 1996). Strips may need to be 12 m or more in width if they are to prevent pesticide pollution of surface water effectively.

Other techniques will be needed to protect groundwaters, particularly from nitrate and pesticide leaching. These include maintenance of crop cover at sensitive times of year, especially the autumn, conversion of arable land to grassland managed for extensive grazing, the replacement of ploughing by low tillage techniques and careful management of manure and slurry. Special measures are required in ecologically vulnerable areas. The compulsory rules to be applied in Nitrate Vulnerable Zones could be applied on the basis of ecologically defined standards with assistance for compliance available through NSA type measures.

A large number of measures could be taken to reduce the hazards and environmental costs associated with pesticide use on farms. They include:

- Improved information in a readily available form to allow farmers to select appropriate crop varieties, choose the least environmentally harmful procedure or product for dealing with pests, determine the minimum necessary dose accurately and the best time for application.

- Further development of efficient limited-use techniques, such as precision farming based on accurate information about crop disease and field conditions, patch spraying in place of total crop coverage and use of low doses where risks associated with complete treatment are acceptable.

- Promotion of biological systems of control, which are used on an increasing scale in horticulture but could be applied more widely elsewhere. Some relatively simple techniques are effective, including the establishment of beetle banks and appropriately managed field headlands.

- Wider uptake of organic farming techniques, especially in areas of particular ecological vulnerability, for example in and adjacent to semi-natural infield habitats and in the vicinity of important freshwater sites.

Farm wastes are a major cause of water pollution, particularly from dairy farms. They are a significant source of nitrogen and phosphorus, heavy metals, pathogenic organisms, ammonia and methane emissions. General application of best practice, including appropriately timed spreading of slurry and manure on the land, well designed, managed and maintained storage facilities and the adoption of waste management plans can contribute substantially to reducing the pollution burden from farm waste. The government is still considering whether to make farm waste plans compulsory. Since the best time for spreading slurry is usually in the spring, it is necessary for farms to have adequate storage facilities to take them through the winter. Since many farms do not have this capacity, or adequate facilities for handling wastes, a considerable programme of investment is required. These results of course are a product of production concentration and intensification; a return to more extensive management would resolve many of these issues.

Government approaches to these problems have so far been piecemeal. The RCEP commented in 1992 on the lack of a rigorous programme of monitoring and the NRA in 1995 called for 'a national strategy aimed at minimising pollution of the water environment by pesticides'.

Sustainability implies not only increased emphasis on control of pollutants from agriculture, with increasing internalisation costs and changes in practice but also an acceptance that some production options will be limited by sensitivity of the water environment. For example:

- There are areas where extensive grassland may be the appropriate land use because the underlying aquifer is sensitive to nitrate leaching.

- Intensive livestock systems may need more regulation in some catchments to prevent pollution.

- There is a need for measures to protect streams and rivers from diffuse pollution, for example, through the establishment of riparian strips.

A more comprehensive national resource analysis coupled to clear ecologically defined water quality targets would form a more solid basis for identifying likely restraints on agricultural practice than is available at present.

Water quantity: in order to sustain water resources in the future, it seems likely that some limits will need to be placed on abstractions for agricultural purposes in particular locations (notably East Anglia). This is likely to constrain production capability.

Many of the habitats affected by the above impacts tend to be differentially located in areas of high productivity agriculture and will tend therefore to be subject to the same sorts of constraints relating to more ambitious whole countryside objectives that pertain to other lowland habitats described above. Policy mechanisms that can be marshalled in support of nature conservation objectives in the short-term comprise incentive schemes - ESAs, Countryside Stewardship, Habitat Scheme (water fringe and saltmarsh) and Nitrate Sensitive Areas -, regulation - Nitrate Directive, abstraction licensing and changing regulation of farm waste -, and collaborate strategic planning - water level management plans, Local Environment Action Plans, delineation of 'groundwater catchment areas' and 'managed retreat' to address the issue of coastal squeeze. These objectives will be secured either through diversion of land out of intensive production and targeted appropriately to secure buffering and habitat re-creation or through the adoption of more extensive conventional farming or organic agriculture. It seems clear that a more rigorous deployment of the polluter pays principle is required, more fully enforcing the internalisation of environmental costs by users of scarce resources. As noted previously, the implementation of such policy solutions is currently constrained, in significant measure, by the continuing incentives, rigidities and entitlements flowing from the CAP commodity regimes.

- **Soil resources**

  Soil changes have been most marked under arable regimes. The shift to arable has produced in these areas a progressive loss of soil organic matter and a consistent increase in nitrate run-off and deterioration in soil structure. These changes in turn will engender in turn a greater intensity of tillage, increased application of fertiliser and pesticide with decreasing water retention and entail greater risk of drought. The current system of arable specialisation is therefore unsustainable.

  To reverse this currently unsustainable use of the soil resource will require improvements to soil through increases in organic matter content. This will necessitate a return to mixed farming practices and crop rotations, entailing the adoption of organic systems of production utilising a detailed knowledge of land capability, specifically the sustainable productive capacity of different land types and the adoption of integrated land use practices. The diversion out of intensive production of land with thinner, less fertile and more erodible soils and into the creation of species diverse grassland or heathland can contribute to biodiversity objectives. Such measures need to be supported through promotion and demonstration of practices and farm systems to farmers which have been shown to conserve soil structure and a programme to heighten awareness of need to conserve soil fertility.

- **Agri-biodiversity**

  Intensive, capitalised agriculture has largely abandoned mixed cropping system for 'monovarietal' monocultures. This has involved the substitution of landraces or 'primitive cultivars' by modern cultivars, many of which are now derived from the same narrow genetic sources. Three traditional systems that tended to maintain agri-biodiversity and directly or indirectly benefitted non-crop biodiversity were:

  - ❑ crop rotations;
  - ❑ varietal mixtures;
  - ❑ mixed crop polycultures.

  The wider adoption of organic/mixed farming practices would seem to be the only realistic means by which to halt and reverse the process of agri-biodiversity loss.

- **Atmosphere**

The level of atmospheric pollution from the agricultural sector is closely related to the intensity of agricultural production, particularly to the amounts of energy intensive nitrogen inputs and livestock numbers. Consequently the promotion of less intensive, more integrated farming systems with reduced dependence upon external inputs could help to reduce atmospheric pollution from this sector.

- ❑ Ammonia = increased nitrogen deposition and acidification.
- ❑ Sulphur deposits = acidification but now much reduced.
- ❑ Greenhouse gases (methane, carbon dioxide, nitrous oxides) = methane largely from livestock; CO_2 from machinery and livestock; nitrous oxide from nitrogenous fertilisers and animal wastes to farmland.

- **Socio-economic**

The relative biodiversity benefits of various forms of land use are now fairly well established. Given the increasing recognition of the importance of both conservation and job creation in rural areas there is a growing interest in the linkages between nature conservation, employment and the rural economy and the economic impacts of land use systems known to have nature conservation benefits. There is an increasing recognition of the need to promote an integrated and multi-sectoral approach to the development of rural areas. This means an approach that ensures that policies in rural areas are mutually enhancing (rather than contradictory) in order to maximise social, economic and wildlife benefits for rural areas.

Rural problems of unemployment, declining rural services, environmental degradation and loss of wildlife are indicative of a failure of rural policy in this country, and throughout the EU, to address what should be its principal objectives - to protect the environment and to maintain rural communities. Policy makers hitherto have usually assumed that these objectives can be met through orthodox 'exogenous' models of development.

Under the CAP, as we have seen, agricultural subsidies have combined with technological developments to promote the capitalisation of land management practices, thereby under-utilising labour and damaging the environment. It is questionable whether many current rural development programmes, often also environmentally damaging, have actually promoted longer-term and sustainable employment. It is increasingly evident that the CAP should encompass wider rural policy objectives and that the balance of instruments should shift towards 'structural' and rural development policies and move away from food production subsidies.

There is an increasing number of examples of rural activity which can benefit both biodiversity and the rural economy. At present, these opportunities are not being exploited fully often because insufficient or inappropriate funding is available and/or they are unable to compete with other policies and subsidies which may have less obvious benefits.

There is therefore a need for:

- better definition of rural policy objectives;
- reform of rural support systems and incentive structures;
- better integration of policies;
- more long-term funding to sustain rural initiatives with conservation benefits;
- more training in environmentally beneficial rural skills;
- better exchange of good practice and experience across Europe;
- more support for the marketing and local processing of goods produced with benefits for the environment.

The maintenance and enhancement of the social and environmental assets and resources cannot be achieved through free markets so that there is a need for government intervention to ensure that negative externalities generated through private production are internalised and that provision of public goods continues, and is not compromised by, private production itself. Reforms are required to focus public spending more directly on the public benefits that rural and agricultural policies are attempting to secure and to ensure that regulation secures the appropriate internalisation of environmental costs. There needs to be, therefore, a:

- removal of 'perverse' subsidies with damaging environmental and social effects;
- clearer definition of rural policy objectives to secure environmentally and socially sustainable objectives and selection of appropriate policy mechanisms for this purpose;
- better integration of policies to ensure that they do not conflict;
- where possible, selection of mechanisms which are capable of providing both social and environmental benefits.

Policies in rural areas should be collaborative and take place within a coherent strategic framework. Such integration of policies should ensure that they do not act in opposition to one another nor to the detriment of the environment. Agricultural, forestry, tourism and rural development policies need, therefore, to be planned in a more integrated way at all levels of government - European, national, regional and local. In practice this means ensuring, for example, that programmes for ecotourism are not planned independently of agricultural or forestry programmes which may provide support for programmes which harm or benefit the environment. By focussing on the common end objectives of rural policy - to meet the needs of people and the environment - and by ensuring that policies work together to meet these objectives, conflicts can be reduced. Reform of agricultural subsidies to decouple them from productivist interventionism, and recouple them to objectives for the support of rural incomes and employment, would help social and environmental policies in farming areas to work together.

Objectives for broad configuration of farm systems

The preceding section identified the broad objectives for the key components of agro-ecosystems expressed in terms of responses to generic issues. Such objectives are 'ideal typical' and are not expressed geographically. Such geographical expression can only be given through modulation of such objectives down to local areas, for example, Natural Areas. We need now, however, to bring these components together, to overlay them as it were in a holistic way, in order to suggest the broad configuration of farm system(s) best able to deliver the identified sustainability objectives. The suggestions will of course only be of an indicative kind since they cannot take account of geographical variation in sustainability objectives. They can be broadly differentiated, however, into upland pastural systems; lowland pastural/mixed; lowland arable.

To summarise the physical objectives for environmental sustainability:

Semi-natural 'infield' habitats:

- Appropriate management of extant resource (grazing cutting levels, livestock infrastructure, appropriate management units, non-application of artificial fertilisers and pesticides, buffering).
- Expansion of resource through habitat re-creation (diversion of land from intensive production) targeted to lower productivity soils, poorly drained areas.

Water resources:

Secure ecologically defined water quality objectives through:

- Substantial reduction in nitrates and phosphates in surface and groundwaters.
- Substantial reduction in pesticide levels in surface and groundwaters.
- Buffer strips along watercourses.
- Conversion of arable to pasture in more sensitive areas.
- Better timing/targeting of fertiliser and pesticide applications.
- Conversion to organic farming and improvement in soil structure, organic matter.

Secure ecologically defined water quantity in ground and surface waters:

- Reducing abstraction from sensitive surfaces and groundwater sources.
- Enhancing soil moisture retention through better soil structure/organic matter.
- Production of less water demanding crops in areas prone to water shortage.

Soil: Conservation and enhancement of the soil resource through:

- Definition of current status and capability.

- Change in land use to reflect capability eg diversion of land out of intensive use into less intensive/organic system.

- Widespread adoption of organic systems to promote improved structure and organic content in order to sustain longer-term productive capacity, reduce/eliminate nitrate and pesticide leakage, reduce erodibility.

Atmosphere: Reduce emissions of harmful gases (ammonia, nitrous oxides, methane) in order to reduce acidification and contribution to global warming:

- Reduction in livestock intensity and techniques to reduce ammonia emissions, methane and nitrous oxides.

- Reduction in inorganic fertiliser use to reduce release of nitrous oxides.

Primary conclusions:

a. Reduction in grazing levels in uplands to ecologically defined levels.

b. Reduction in intensity of livestock production in most pastural areas (particularly dairy production) together with appropriate management and expansion of semi-natural infield and interstitial habitats.

c. Diversification of arable areas to mixed farms in order to create arable/pasture mosaics, secure management and expansion of extant semi-natural 'infield'.

d. Diversion of land to less intensive production to facilitate habitat expansion/linkage, reduce/eliminate fertiliser/pesticide run-off and conserve soil resource.

e. Widespread conversion to organic systems to c) and d) above together with shift back to spring cereals, increased availability of seeds, insects and soil organisms, elimination of pesticides and nitrate run-off, improvement in soil structure and organic content. Additional considerations are human health, reduction in dependence on non-renewable energy sources, minimising dependence on external inputs and reducing global footprint.

Broadly, therefore, the configuration of agriculture required for environmental sustainability will be in the current arable belt: a return to mixed and preferably organic farming with particular attention paid to the conservation and expansion of remaining habitats of nature conservation interest and creation, where appropriate, of new ones.

In the pastural belt a reduction in intensity of livestock production and shift where feasible and appropriate to mixed farming (only on productive land) within conservation and expansion of extant semi-natural habitats in the uplands, a reduction in grazing levels and increase in broadleaved woodland cover where this does not conflict with other nature conservation priorities.

Conclusion: **Wider adoption of low input, organic farming systems based on mixed crop and livestock farming, reflecting, where possible, the ecological character of the local area.**

Intermediate systems of crop and livestock production offer environmental benefits without major increases in cost. They are compatible with other objectives such as improved landscape management. The main emphasis, however, is on increasing the efficiency of input use to maximise profitability and farmers may continue to use relatively intensive systems and to become progressively more specialised. Unlike organic and very low input systems, they permit a relatively high level of pesticide use and there is no preference for mixed farming. Integrated crop management, for example, seems likely to drive forward good practice and to increase uptake of new technologies in the farming community - technological and management advances of this kind are useful tools for engineering more environmentally sensitive agriculture. At present, however, they address only a certain number of the objectives defined for environmental sustainability. In addition, without a requirement on ICM farmers to adhere to any specific rules, there is uncertainty about how far environmental concerns impinge on agronomic priorities when management decisions are made.

Low input and organic farming systems have distinct advantages in respect of the sustainability objectives identified:

- Relatively low use of nutrients per area, particularly in organic fertilisers and use of organic fertilisers.
- A low or non-existent consumption of pesticides.
- Relatively low stocking densities.
- Only modest investment in drainage, irrigation and capital equipment.
- Limited use of concentrate feeds.
- Constitute the most appropriate context for the management of special sites in particular and nature conservation in general.

Organic farms are 'low input' in the fundamental sense that they avoid the use of inorganic fertilisers and nearly all synthetic pesticides. Some, however, achieve yields similar to those of conventional farms. Standards laid down by the Soil Association and others address several key sustainability objectives, notably an emphasis on the recycling of nutrients, an extremely low use of pesticides, and the maintenance of healthy soils. In the case of Soil Association standards, this has been supplemented by a Code of Practice covering the wider environment including biodiversity. Many low input farms, including a sizeable proportion of organic holdings, are mixed farm enterprises with both crops and livestock. There would seem, therefore, to be a strong case for the inclusion of a significant element of low input and organic agriculture in securing sustainability objectives for agriculture. This is necessary to maintain and enhance certain semi-natural habitats and protect sensitive areas in addition to offering a system of farming based on sound management of soil and very limited use of critical inputs such as fertilisers and pesticides.

Organic farming will tend frequently to comprise mixed crop and livestock farming systems. Such characteristics themselves contribute to meeting a number of sustainability objectives. They generate a mosaic of habitats; they require lower levels of pesticides and other agrochemicals since land is rotated; less requirement for inorganic fertilisers to maintain fertility and easier disposal of organic manures on arable land within the farm; benefits for biodiversity in terms of field mosaics, maintenance of hedgerows, low application of pesticides and inorganic fertilisers, high soil organic content.

In short, a range of sustainability objectives is secured as a <u>systemic</u> outcome of organic production, making it also inherently easier to attach any 'additionality' needs as integral parts of a whole farm system. This contrasts markedly with intensive, conventional agriculture in which biodiversity conservation has to be secured by placing land essentially outside the production system (purchased at considerable expense through ELMS). Where biodiversity conservation is to be achieved through changes in infield practices and cropping patterns on conventional farms, its objectives run counter to, or at least compromise, the primary economic logic of the production system. In short, conventional agriculture runs against the grain of environmental sustainability, with the result that specific measures have to be welded onto it artificially in attempted mitigation of its adverse impacts. The objectives of organic agriculture and environmental sustainability appear to run in the same direction, however, with the result that organic agriculture may be described as the system which holds out the best prospect of reversing the negative impacts of mainstream farming practice.

In practice, a diminishing number of farmers is still following mixed and low input production systems, since they are becoming increasingly uncompetitive unless high premiums are available. Such premiums are available to organic producers and to some farmers in ESAs and other designated zones. Elsewhere, they are exceptional and the majority of producers are drawn towards greater specialisation.

Economically, of course, the current agricultural policy climate imposes constraints upon the expansion of organic production. Yields tend to be lower, as would be expected from a low input system, and production costs are generally higher than in conventional farming. Incomes also vary substantially but on aggregate they have been below those on conventional farms (RCEP 1996). To achieve a high level of conversion to organic or other low input (as opposed to intermediate) systems would require higher product prices or more generous subsidies, or a combination of the two. Stronger environmental regulations or taxes on fertilisers and pesticides would also help tip the balance in favour of organic production. Again the polluter pays principle needs to be rigorously enforced. Organic production is also more compatible with objectives for socio-economic sustainability than conventional agriculture. Thus, studies in different countries have estimated that between 20% and 100% more labour is required on organic farms, depending on the diversity of the enterprise, the extent of on-farm marketing and processing activity and the importance of vegetable and root crops. Small organic farms have higher labour requirements per hectare than larger enterprises (Padel and Lampkin, 1994). Bateman and Midmore (1993) suggest that organic agriculture offers advantages to the rural economy through creation of direct farm employment; that any possible disadvantages in terms of reduced inputs may be more than offset by increased processing; that the main beneficial impact of these changes will tend to be felt locally due to increased on-farm employment and the fact that organically produced food is more likely to be processed and marketed locally.

There is considerable scope for expanding the organic sector at present, not least because around three quarters of organic food is currently imported into the UK. If more comprehensive policies for supporting sustainable agriculture were in place, the commercial potential for organic production would be significantly larger. Due to the economic constraints identified above, organic and other low input systems are likely to form a limited segment of agriculture in the short-term but they could and should contribute much more to national production in the longer-term.