EXECUTIVE SUMMARY

1. One of the five main objectives of the "Agenda 2000" reform of the Common Agricultural Policy (CAP) was the better integration of environmental goals into the CAP. Accordingly, member states are required to take appropriate measures, including general mandatory requirements, agri-environment measures and/or specific environmental conditions for direct payments ("cross-compliance"). This report considers the past and present environmental impact of arable agriculture, the likely impact of Agenda 2000, and describes potential measures for alleviating the impact. It was funded by the European Commission Directorate-General for the Environment, but the views set out are those of the authors and do not necessarily represent the views of the Commission or the Environment Directorate.

2. Although the coverage in pan-European, this report concentrates particularly on three member states representing the range of arable farming in the EU: The Netherlands, with the most intensive agriculture, the UK, representing the relatively intensive production typical of northern Europe, and Portugal, with mainly less intensive systems typical of southern Europe.

3. In **Section 1**, the arable sector in the European Union is briefly reviewed, particularly in relation to cereal, oilseed and protein crop (COPs), which accounted for 53.5m ha in 1996/7, or 90.5% of cultivated land in the European Community (excluding set-aside). 80% of EU cereal production is concentrated in five member states (France, Germany, Spain, Italy and the UK).

4. Cereal yields per hectare have increased at an average rate of 2.2% per annum since 1974, and this trend continues. Oilseed yields have also risen, though more slowly in recent years. Protein yields increased in the early years of the CAP but have recently declined.

   The increase in the use of fertilisers and pesticides has slowed in the 1990's and overall, use has declined though figures are variable between member states and between different measures of usage.

5. The number of holdings growing COPs has declined, while the area grown by a smaller number of specialist producers has increased. Very large individual farm cereal areas occur in UK, Denmark, Germany and France, whereas southern states still have much smaller areas per farm.

6. **Section 2** considers Environmental impacts of arable agriculture, under the headings of Soil, Water, Biodiversity, Landscape and Air.

7. Soils may be susceptible to erosion, loss of organic matter leading to poor structure, and pollution by pesticides and heavy metals. Soil erosion has effects external to the farm, through siltation of water courses and transport of pesticides and nutrients. The latter can also be conducted to water via leaching and sub-surface flow. Cultivation systems are

among the most important factors influencing soil properties.

8. Both ground and surface waters can be influenced by nutrient and pesticide pollution from arable land. This results in reduction in the quality of drinking water and necessitates expensive treatment. It also has ecological consequences for aquatic life. Intensification of farming systems, encouraged by economic support under the CAP has exacerbated these problems.

   Nutrients, especially phosphates cause eutrophication of water, which upsets the ecological balance and can result in undesirable effects such as fish death and algal blooms. Problems are greatest where farming is not intensive, and lower in southern Europe.

   Nitrates are particularly prone to leaching, and concerns over nitrates in water supplies have led to legislation in the form of the EU Nitrates Directive and the setting of limits in drinking water under the Drinking Water Directive.

9. Pesticides reach water via surface runoff, through soil cracks and drains. Permitted levels in drinking water are limited by the EU Drinking Water Directive, necessitating large treatment costs. Spray drift and acute pesticide pollution incidents can adversely affect aquatic organisms, as can the silt burden from eroded soil particles, which may also have phosphate and pesticides bond onto their surfaces.

   Inappropriate cropping and cultivation techniques can exacerbate these problems, but because the effects are externalised, they do not tend to play a large part in management decision-making.

10. Intensification of arable systems has led to a large decline in biodiversity on arable farmland. Loss of non-crop habitat and simplification of systems has disrupted food chains and caused declines in many species. Conversely, in southern Europe particularly, abandonment of arable management is also a problem.

    Declines are best quantified for birds, but there is also evidence for similar or greater levels of decline in mammals, plants and invertebrates. Important factors include the reduction in mixed farming, switch from spring to autumn sowing, reduced crop diversity, and increased use of pesticides and fertilisers. In the south, abandonment of fallows, intensification on the best soils and abandonment of the worst, and reduced habitat diversity through loss of traditional management systems in the Montado, Dehesa and Steppic landscapes have affected biodiversity. Drainage and irrigation also have also caused habitat degradation in many areas.

11. Landscapes have changed considerably as farming systems have changed. Landscape quality is partly subjective, but many valued features such as hedges, ditches, and stone walls have been lost in recent decades, fields have become larger and the landscape simpler.

    In southern states traditional montado and dehesa landscapes have come under threat

through intensification, often supported by irrigation. This has led to a more uniform landscape, while elsewhere abandonment or afforestation has resulted in major landscape change.

12. Whilst arable agriculture itself is not a major source of air pollution, emission of greenhouse gasses (NO_2 and CO_2) and to a lesser extent pesticides, does occur. Problems are greatest in the Netherlands, though most of the greenhouse gases result from intensive livestock rather than arable farming. Long-distance transport of arable inputs and products also contributes to greenhouse gases and climate change.

13. **Section 3** attempts to forecast the effects of Agenda 2000 on arable systems and their environmental impacts. Forecasts of changes in cropping patterns are given based on SPEL, CAPA, INRA and FAL models. The area of set-aside is a crucial factor in determining both arable areas and environmental impacts. Models differ in their predictions, but there is general agreement that cereals, especially wheat, will increase in area and the area of oilseeds will fall.

14. Trends of increasing cereal yields, declining incomes and fewer larger, more specialised farms, especially in the north, will continue. The Environmental effects of arable farming will be similar under the new regime with minor variations as a result of even greater dominance of cereals, and the impact of new technologies such as precision farming and genetically modified varieties.

15. **Section 4** puts forward practical suggestions for alleviating the environmental effects of arable farming. These are presented separately for each of the three key member states in the study. For each country, proposed options are presented in two categories: cross compliance (i.e. measures which would provide conditions for arable area payments), and agri-environment measures, for which payments would be made. Cross-compliance conditions are intended to be compatible with "usual good farming practice", as defined in article 28 of Commission Regulation 1750/1999, and to work towards both agricultural and environmental sustainability.

16. Management practices are proposed which address problems identified in Section 2 under the headings soil, water, air, biodiversity and landscape. It is important to avoid penalising farmers who already adopt good environmental practices. Integration of measures is necessary to maximise benefits, and whole farm plans can help here. The potential role of local marketing initiatives in maintaining regionally traditional production systems and minimising greenhouse gas emissions is emphasized. At the end of the section for each country, the environmental and agricultural benefits of the proposed measures are summarised in tables, and a further table summarises the degree to which cross-compliance measures meet criteria relating to impact on farming systems, cost, ease of monitoring and length of time needed for compliance.

17. Proposed UK cross-compliance measures are presented under the following headings: compliance with general mandatory regulations, soil erosion management plan, green stubbles and winter cover crops, contour strips, nutrient management plan, machinery maintenance, no autumn application of nitrogen, prevention of spray drift, prevention of

fertiliser drift, five metre buffer zones, no insecticides within 6 metres of field boundary, field pest threshold, one metre boundary strips, environmentally-managed habitat as percentage of eligible area, and minimum distance between non-crop habitats.

18. Proposed UK agri-environment options are: organic farming, arable conversion to grass, large riparian buffer zones, reedbed nutrient sinks, conservation headlands, conservation headlands with no fertiliser, wild bird cover crops, undersowing, grass leys, field boundary vegetation, hedges and shelterbelts, beetle banks, uncropped wildflower strips, hedge maintenance, stone walls and ditches, individual tree planting and integrated whole farm plans.

19. Netherlands cross-compliance conditions are classified in three sections (plus general mandatory regulations). Section A, procedural criteria, includes: erosion management plan, nutrient management plan, pesticide management plan, water management plan and nature management plan. Section B, technical conditions includes: general machinery maintenance, prevention of fertiliser drift and prevention of spray drift. Section C, physical conditions, includes: 2m field boundary strips and non-crop habitat as percentage of the farm.

20. Netherlands agri-environmental options are classified in two sections. Section A, flora and vegetation, includes: arable flora in *rotating* cereal crops without *herbicides* and fertiliser, arable flora in *rotating* cereals without *pesticides* and fertiliser *in any year*, arable flora in *permanent* cereal field (cereals five out of six years) without pesticides and low input of fertiliser, arable flora in cereal margins, and hedgerow management. Section B, fauna, includes: fauna margin, fauna fields, red list vertebrate management, and integrated whole farm plan.

21. Cross compliance conditions for Portugal include: contour ploughing, no stubble burning, winter cover crops, fallows as proportion of eligible area, buffer strips, and restricted fertiliser use within Nitrate Vulnerable Zones.

22. Agri-environment options proposed for Portugal include: restricted harvest dates, triticale erosion control, arable conversion to trees, extensive arable systems, montado, organic farming, polyculture, water points, wildlife crops, game management, shrub habitats and integrated whole farm plan. Issues and measures relating to afforestation of arable land in Portugal are considered in an appendix.

23. In **Section 5**, the criteria for distinguishing between measures which should be conditions for receiving direct payments and those for which additional payments shall be made are discussed. Crucial to these considerations is the achievement of environmental sustainability, both on and off the farm. We have interpreted the concept of good farming practice as including external impacts, which may not be given sufficient consideration by farmers left to their own devices.

24. Cross-compliance measures which are emphasized to ensure equity of contribution include managing a proportion of eligible area in an environmentally beneficial manner, and enforcing a minimum distance between non-crop habitats. The importance of

integrated whole farm plans is also stressed, with the desirability of achieving these for all farms as a long term aim. The need for baseline data to provide an inventory of existing status is highlighted.

25. The role and importance of cultivation systems is recognised, but in view of their complex nature and interaction with other factors, the best way forward may be through training and advice rather than implementation of general prescriptions.

    The benefits of local marketing initiatives as one way of conserving local traditions and environmentally benign production systems is emphasized.

26. The measures proposed in this study provide a first step in what will hopefully be a continuously evolving process towards an environmentally acceptable agriculture which also meets the wider needs of the population as a whole.