S1. Executive summary

S1.1. Objectives and methodology

This report explores the environmental impact of dairy farming in the EU and aims to provide technical advice (to DG Environment) on practical suggestions which could be easily monitored on how to reduce or eliminate any identified negative environmental effects of dairy farming. It also aims to contribute to the public debate about the environmental impact of dairy production.

The study was undertaken primarily as a desk research exercise. However, some additional interviews and discussions were held with some farm advisers, farmers, farmers' representative organisations, government officials and researchers.

S1.2. Typology for examining the environmental impact

A typology was developed to provide a framework for examining the environmental impact of dairy farming and for setting priorities for environmental enhancement. This essentially differentiates systems according to the way in which farmland is managed combining economic/technical classification criteria (see section 2), bio-geographical region and forage and fodder resources (see section 3). Using these three dimensions, all dairy farm in the EU have been allocated to one of ten broad dairy systems by reference to threshold values of some key indicators such as fertiliser use, concentrate use, farm size, herd size, milk yield, livestock density and main winter fodder used (see section 4).

Overall, the typology groups together dairy farms into systems according to environmental impact and their relative importance to dairy production (section 5). This identifies three main groupings of systems:

- those for which the biggest environmental issues are negative impacts on the environment. This includes four systems which account for most of the EU's dairy farms and where approximately 80% of dairy cows and 84% of milk production occur;
- four systems which have either a largely neutral effect on the environment or for which information is lacking. These represent dairy farms where 12% of EU milk is produced and 13% of dairy cows are kept;
- two ecologically valuable systems for which the continuation of dairy farming is the principal issue but which account for only 6% and 8% respectively of EU milk production and dairy cows.

EU dairy farming is restricted to a relatively few, rather limited geographical areas (see sections 2 & 3). Within these, the systems tend to focus on output maximisation and are more influenced by market constraints than physical constraints. As a result, farms of different dairy systems frequently occur contiguous with each other. For instance, conventional mixed systems can occur next to organic mixed systems, intensive grassland systems or maize silage systems.

S1.3. Trends in EU dairy systems and the environmental implications

a) Trends (see section 2)

In general, dairying in the EU is becoming more intensive and more specialised (see section 2, notably sub-section 2.4 which illustrates general declines in cow numbers, increases in average herd size and average yield per cow). This means that production is concentrating on fewer, larger farms (eg, 40% of EU dairy cows are in herds of at least 50 head) resulting in a corresponding decrease of dairy farming on many holdings and in some cases abandonment of holdings. This is true for virtually all dairy farms irrespective of system or bio-geographical region; noting that 85% of EU milk production is derived from one high input/output (see section 2) economic/technical class of dairy farming, except where national authorities actively seek to help maintain small producers or promote organic production (eg, Austria), such as some in mountain areas (P1 and G3 systems). The primary driving force behind these trends is economic. However, the economic framework is itself heavily influenced by the nature of the support regime (largely price support), technology development and structural change in the production sector (plus structural change in the up and downstream supply chain). The complex interaction of these factors makes disaggregating their respective (separate) impact virtually impossible.

b) Environmental implications (see section 5)

For all dairy systems described, largely negative environmental issues increase with increasing intensity of production (which is itself an underlying and major feature of EU dairy production: see section 2). Associated with the intensive dairy systems are high stocking rates, high use of chemical fertilisers and pesticides and mechanised methods (see section 2). These result in problems of direct point source pollution, diffuse pollution and pressure on marginal habitats and landscape features (see section 5 for further detail). More specifically:

- landscape and habitat: since some of Europe's dairy landscapes are grazing mediated systems whose structure and function are determined by the free-ranging movement of locally adapted stock, the effect of this process has been colonisation of meadows by scrub and woodland, loss of open grassland and field boundaries and degradation of hydro geological systems (see sub-section 5.3.2);
- biodiversity (see sub-section 5.3.3): the effect of dairying on biodiversity is far from straightforward, and includes the development of invasive herbs and loss of grassland diversity due to the increased use of fertiliser (particularly N&K), silage production, reduced grazing and scrub encroachment. While some intensively managed grassland, is of strategic importance to migrating and wintering wildfowl, large-scale changes in the intensity of use in traditional farmed areas seem to be associated with a loss of both complexity and stability. This effect is particularly significant in river-based and mixed Mediterranean systems;
- soil (see sub-section 5.3.4): the main impact is on soil integrity which is affected by increased use of fertilisers, feed additives and the more concentrated use of waste products like manure. As intensification increases, the level of application of fertilisers and manures usually rises to levels that are greater than crop requirements or the ability of the soil to retain them. Where these nutrients are relatively immobile or have limited water solubility this may result in the soil changing its essential character. Intensive production systems also make fairly widespread use of feed additives, medicines and growth promoters. Little is known about the impact of these on the environment, however: feed concentrates contain phytotoxic heavy metals such as copper (Cu), zinc (Zn) and cadmium (Cd) which accumulate in the soil and vet medicines persist in dung, affecting its fauna and potentially the

dependant bird populations. Also, high stocking rates may result in increased incidence of trampling and subsequent erosion;

- water (see sub-section 5.3.5): the primary impact is via the pollution of groundwater with nitrates and pesticides and surface water eutrophicated (eg, the guide level of nitrate concentration (25 mg/l) is exceeded in the groundwater under 85% of the EU's farmland). The full extent of surface and groundwater pollution due to farming (both in general and more specifically to dairying) is however largely unquantified;
- air (see sub-section 5.3.6): the impact of dairying on the atmosphere arises from de-nitrification, the production of, methane, ammonia volatilisation and carbon dioxide. Whilst methane generation per animal tends to be higher in low input systems than in the more intensively managed systems that use feed supplements, ammonia emissions are highest for intensively managed systems (these occur during manure storage and application to arable and grassland). In terms of carbon dioxide and nitrous oxide emissions, dairy production has only an indirect impact (mainly the use of energy to manufacture feed concentrates and to assist forage production as well as housing systems).

Overall, it is important to recognise that many of the complex relationships between intensive dairy systems and the environmental impact are not fully understood. In low input/output, transhumant and mountain grassland systems, the main issue is one of abandonment of dairying leading to scrub development or commercial forestry, loss of biodiversity and changes in landscape character. In the more intensive systems that dominate dairy production, the main issues are nutrient contamination of soil, groundwater pollution, surface water eutrophication and ammonia emissions.

S1.4. Future policy perspective and implications (see section 6)

The underlying policy perspective for dairy farming over the next few years is derived from the existing dairy regime coupled with some aspects of reform initiated by Agenda 2000. The main possible impacts of the (Agenda 2000) reforms on dairy production systems (section 6) are, however, likely to be limited and will largely not be implemented until 2005. This means that in the medium term the ways in which the dairy regime impacts on dairy production systems and on the environment is unlikely to be subject to significant change.

Where change can reasonably be expected to occur (post 2005) it mainly relates to the impact of lower milk prices, lower levels of gross farm revenue and ultimately lower income from dairy farming. In the main milk producing regions of the Community (northern countries and the Atlantic bio-geographical region), lower returns coupled with improved competitiveness of cereals as a feed ration is likely to make silage feeding relatively less attractive as a feeding alternative. To the extent that this may result in a shift away from silage feeding to cereal feeding, this is likely to result in higher levels of phosphorus and nitrogen output, increased eutrophication of water courses, possible increases in erosion and greater emissions of ammonia.

The recent policy changes do, however, introduce some scope for introducing positive environmental aspects into dairy husbandry systems via the implementation of the national envelope component of the direct payment, use of the horizontal and rural development regulations and continued adaptation of '2078' measures.

S1.5. Success to date of 'neutrality and enhancement' measures

Assessing the impact of measures targeting environmental neutrality or positive environmental benefits on dairy production has proved very difficult although it is probable that the impact has been limited (see section 7). In many cases this reflects the voluntary nature of measures offering environmental neutrality (eg, Codes of Good Agricultural Practice) or encouraging environmental enhancement ('2078' measures) although the targeting of almost all measures at environmental media rather than specific farming sectors also makes assessment of impact on dairying very difficult. The measures under 2078/92 do, however, provide a range of examples whereby livestock production in general (and therefore, by implication, dairy production in particular) may be made more environmentally friendly.

In general the two approaches, neutrality or enhancement, tend to be linked to two different types of location or region. The main features of each are:

- Neutrality measures, although universal to all areas, these tend to have the greatest impact in regions where particular environmental problems exist. For example, in the more northerly Member States, the Nitrates Directive largely replaced and incorporated existing national legislation. In contrast, in Greece, legislation to combat nitrate loss was only adopted to meet EU requirements. The most 'forward' examples of measures being taken to address the pollution problems can be perhaps drawn from in the Netherlands and Denmark. In both, pollution problems from intensive agriculture (mostly dairy farming and pig farming) have been an important target for many years and measures adopted to address the problem are widely perceived to have been reasonably successful. It should, however be noted that the problems remaining to-date in the Netherlands are considerable and the degree of compulsion in delivering reduced nutrient surpluses at the farm level only apply to about half of all Dutch farms. This contrasts with Denmark where mandatory controls apply to almost all farms. An important additional conclusion that can be drawn is that the success of measures to reduce environmental impact through voluntary codes and legislation depends as much on the awareness of the issues by farmers as on the design of the actions.

- Enhancement (2078/92) measures tend to be focused on more marginal areas which are characterised by relatively lower levels of intensity and include remote and/or mountainous areas. Here dairy farming is usually widespread, but comprises smaller scale producers in bio-geographical regions such as Alpine and parts of the Mediterranean, Continental, Boreal and Atlantic regions where mixed farming systems dominate. Overall, the current '2078' measures most likely to offer environmental benefits through the dairy regime are the grassland management measures. At a general level, restrictions on the use of inputs have led to environmental benefits in terms of reductions in phosphorus levels in surface water and reductions in nitrate levels in surface and groundwater. Reductions in fertiliser use have also resulted in a potential for increased biodiversity (section 7). However, whilst these positive environmental attributes have been delivered it is difficult to attribute specifics to changes in dairy production.

S1.6. The main environmental issues and practical options for addressing them (see section 8)

The limited impact of environmental policies and agri-environmental (2078) on EU dairy farming mainly reflects the technical and economic relationships that dominate in most of the dairy systems. For most systems the nature of markets and the dairy support regime provides a fairly strong incentive to produce milk within a high input/output system in which reasonably high levels of fertiliser (eg, 300kg+ N/ha)

are applied. As a result, most dairy farms have a relatively low level of biological diversity associated with marginal habitats and are linked to environmental problems relating to excess nutrient losses and significant diffuse pollution to air and water.

Any measures that might be used through Agenda 2000 policy changes (for example, by reducing nitrogen use on a large scale) would, most probably, impose a substantial cost to farmers (and in turn to the taxpayer if compensation or incentive payments were made). It would also, in most systems, probably have limited success in improving biological diversity due to the inherent high fertility and stored nutrients in most dairy pastures. It would, however, be more appropriate to use such measures in systems where the fertility of pastures is relatively low and there remains floristic diversity.

The most important and widespread environmental issues that affect all systems relate to the polluting effects of nutrient and chemical losses into soil, water and air. The second major issue, although affecting a relatively small proportion of dairy farms and only a few geographical areas, relates to the decline of dairy systems that are associated with farmland of high biodiversity. A secondary, but widespread, issue to these two environmental issues is the preservation of marginal habitats and landscape features which are characteristic of the dairy farming landscape.

S1.6.1. Common Market Organisations: dairy and beef

There are very limited possibilities within the milk and dairy products and beef and veal sectors to directly address these issues. The main measure, that could provide a small disincentive to further intensification of dairy farming, is the way that additional payments are paid by Member States through their national envelope allocation. However, in most cases this is likely to simply be paid as a top-up to the Dairy Cow Premium.

S1.6.2. The Horizontal Regulation

This regulation potentially offers the greatest opportunities for directly addressing any negative environmental impacts of EU dairying (and other agricultural) systems by attaching 'appropriate environmental measures' to agricultural land and agricultural production which are subject to direct payments.

In order to suggest options which are practical and have a reasonable chance of successful delivery, we have focused on generic actions which can be applied widely and fairly to all dairy farms. The primary aim of the environmental controls proposed is to contribute to 'sustainable' farming and for most of the dairy systems this has as its starting point a better understanding of sustainable nutrient management. Both the Dutch and the Danish ministries recognised this need several years ago because of the high intensity of their dairy farms and the excessive nitrate losses to water and to air and approached the problem through the Farm Nutrient Balance (FNB). Accordingly, we suggest that the first step in the introduction of conditionality on direct payments to dairy farmers should be measures to bring about the better management of nutrients, waste and water.

The adoption of these nutrient, waste and water requirements offers the following attractions:

- contributes to providing information about environmental impact: helping to define better the issues and identify appropriate actions;

- provides potential economic benefits to the farmer through scope for achieving more efficient use of inputs. It also offers flexibility and leaves choice of actions to the farmer's discretion;
- can offer practical benefits to farmers and contribute to improving understanding and perceptions about the environmental impact of dairy farming systems;
- national authorities may be more receptive to the imposition of conditions that can be seen to affect all EU farmers;
- they offer scope for being cost effective ways of encouraging changes in farming practices;
- provides for a basic practical measure, which could be monitored, to show that direct payments to dairy farmers are linked to one of the fundamental requirements for moving towards a more sustainable European agriculture. This could also provide a foundation on which to build further tiers of conditionality (if required) in the future;
- could help in the development of guidelines for good farming practice that incorporates good environmental practice and environmental enhancement.

S1.6.3. Rural Development Regulation

a) Less Favoured Areas

If the use of nutrient and water budgets and waste management plans became a minimum environmental condition in the dairy sector it could be included as a condition in LFAs for receiving supplementary payments.

b) Agri-environment (2078 type measures)

Actions under this measure to delivery environmental enhancement could include a range of actions (best practice) which protect and improve the environment. As there are budgetary constraints on the scope for using such measures, our suggestions are limited to (generic) schemes for the biologically most diverse systems and to areas where dairy farming is associated with interest of high nature value. Best practice is most effectively introduced through a combination of raised awareness (the FNB and training) and the provision of structural support required to introduce more sustainable techniques (see below). One exception is conversion to organic production. In the dairy sector, virtually all of the systems would benefit from organic conversion because of the limits on fertiliser use and stocking density that would be required. It would bring a degree of extensification into most systems and meet one of the explicit objectives of agri-environment requirements (Article 22). In the same vein we have only suggested specific management incentives for the low input/output systems where the conservation of a 'high nature-value farmed environment is under threat' (of abandonment).

c) Farm structures

The provisions for support for investment in agricultural holdings provides an important link between the nutrient and water budgets, the identification of better environmental practice and the ability to take actions to achieve improvement. For some systems (eg, transhumant) where facilities are often out dated and below modern hygiene standards there are possibilities for structural support which could help to keep these dairy farms in business.

d) Training

Training and advice will have an important role to play in delivering environmental improvements. This starts with providing farmers with an improved appreciation of the benefits of sustainable production systems and about the adverse environmental impact of some commonly used practices.

As such, the Rural Development Regulation could be used to provide training (and advice) which would enable dairy farmers to maximise the information they obtain on their nutrient balances. With a better understanding of the issues affecting their farm, they would be in a better position to choose the most appropriate elements of good environmental practice and environmental enhancement to adopt. Training could also be used to increase awareness of the possibilities for structural support and other options relating to marketing, diversification and organic conversion.

S1.7. Potential for greater benefits in future from new (or better targeted) options (see sections 8 & 9)

A summary of targeted, practical actions that are recommended for delivering environmental improvements in the dairy sector are as follows:

- introduce some element of cross-compliance via the introduction of the Farm Nutrient Balance (FNB) across all dairy farms together with requirements to do water budgets and waste management plans;
- use the nutrient balances as a starting point for targeting appropriate actions to move management practices beyond "usual good-farming practice" and towards what is considered to be good environmental practices. Using farm waste management plans some elements of better environmental practice can be introduced into dairy systems across Europe, especially the more intensive systems. Precedents in this area have already been set for example in Denmark. Specific requirements (cross compliance) for including as part of GAP are also suggested in Section 8 for reducing nutrient leakage from soils, ammonia emissions and pesticide use/emissions. Cost implications: these are extremely difficult to estimate as they will vary by farm. In the Netherlands the average cost per farm (in a region experiencing severe nitrate pollution problems) of complying with targets was estimated to be about 25,000 (equal to about 15-20% of income[1]) including the introduction of some capital changes such as increased manure storage capacity. This probably contributed to the limited imposition of mandatory controls to-date in the Netherlands where until 2002, only farms with stocking densities in excess of 2.5 LU/ha are subject to mandatory controls (ie, about half the national herd). In contrast, in Denmark, mandatory controls apply to all farms, although here average stocking densities are only about 0.9 LU/ha and the global nature of pollution problems are less intense (and hence less costly to address) than in the Netherlands. This highlights the importance of initiating FNBs before drawing up prescriptions for improving the environment and implementing parallel measures via, for example, the rural development and horizontal regulations (eg, provision of capital grants, subsidised finance/loans) to assist farmers in addressing the environmental problems rather than simply imposing controls and expecting the associated costs to be covered from existing economic activity;
- use the FNB to introduce greater flexibility in agri-environmental schemes and for providing flexibility to farmers in how they achieve better environmental practices (eg, timing and methods of application of manure, slurry and fertiliser). The cost implications here are also variable at the farm level (see above) and difficult to forecast. However, by providing flexibility it offers scope for delivering good value for money from an EU budget perspective if dairy farmers are encouraged to and can choose options that suit them (contributes to overcoming perceptions of compulsion and offers possible practical benefits);

[1] Source: Charter (1998) Farmers and custodians of water resources. Nuffield Farm Scholarship Trust, Maresfield.

- use agri-environment measures to target dairy systems of high biodiversity, especially those in danger of abandonment. The cost implications are also very difficult to assess. However, as high biodiversity dairy systems represent a very small minority of total EU dairy farms and are confined to fairly small bio-geographical regions, the cost implications are unlikely to be significant and can probably be reasonably easily incorporated within existing '2078' measures and budgets;
- support the above measures with specific training and use of advisory services to raise the level of awareness of the agriculture/environment interactions on dairy farms. Cost implications here are also difficult to assess. The provision of training and advisory services is an area in which a wide range of levels of expenditure probably occur across different member states. In some, the public sector (ie, national or regional authorities) dominate provision and funding is from a central source whilst in some other countries, there is greater degree of private sector involvement and hence fee charging. Either way it is likely that the provision of additional environmental awareness training could be reasonably easily be incorporated within existing extension service provisions that are mainly funded centrally. More in depth analysis of the ways in which the Dutch and Danish system operates might usefully be undertaken;
- provide financial support to dairy farmers required to make one off/capital style investments to comply with requirements (eg, increased manure storage capacity). This is particularly important in the more remote regions (LFAs) where marginal producers are increasingly leaving the sector. The cost implications are similar to those discussed above relating to measures required to fulfil FNB targets. Further examination of the Dutch system might usefully be undertaken;
- encourage the establishment of system-specific priorities to highlight where controls rather than enhancement type actions are more important. These could be undertaken at a regional or national level as part of the process of drawing up frameworks or plans for specific regions and associated rural development measures.