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European agricultural landscapes supply and demand: implications of agricultural policy reform

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Abstract

The paper describes the outlook for European agriculture to 2020 and its implications for the future trends in the supply (quality) and demand (value) for agricultural landscapes. This is followed by an examination of the recent and future impacts of the reform of agricultural policies on European agricultural landscapes. In the concluding section possible policy approaches to improve conservation of agricultural landscapes are examined, followed by the identification of a number of key questions which researchers need to address in helping to improve the monitoring of changes in agricultural landscapes for use by policymakers.

Keywords: agriculture; landscapes; policy reform; Europe; Common Agricultural Policy

Introduction

"Recombinant DNA techniques … were first recognized as adequately practicable in 1973. Less than twenty years later biotechnology was a staple of … agricultural investment … . In 1973 two chemists … first noticed that fluorocarbons depleted the ozone in the earth's atmosphere … yet by the early 1990s the existence of large 'ozone holes' in the atmosphere was layman's knowledge … ."

As these quotations (Hobsbawm 1994) highlight, agriculture is being increasingly influenced by the rapid pace of technological change and the scientific and public understanding of environmental issues, including a growing appreciation of the value of landscapes.

The key role of agriculture now and in the future is the production of an adequate and safe supply of food at 'reasonable' prices. Over the past 40 years, while world population has nearly doubled, food prices have dropped substantially in real terms and food production per capita has increased by nearly 25%. These developments have been made possible through farmers, scientists and public and private agricultural-research investment raising crop yields and livestock productivity and improving farm-management practices. The productivity improvements for agriculture have also been achieved through using less labour, purchased inputs and land to realize. Agriculture also generates various other benefits for society, such as providing habitat for wildlife, acting as a greenhouse sink, and providing cultural and scenic landscapes.

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There are concerns, however, that the scale of agricultural expansion is going to place greater pressure on the environment and current landscapes over the coming decades if it is to meet the 1.5-billion growth in the global population expected by 2020. Some consider that current farming practices are leading to the degradation and depletion of the natural resource base upon which farming depends, namely soils, water, natural plant and animal resources. Also there are fears that agriculture may be reaching certain biophysical limits in trying to raise crop and livestock yields further. There are broader concerns about the negative external impacts of agricultural in terms of harmful emissions into the environment and destruction of valued landscape elements.

But others see agriculture reaching a new era of expansion and growth through the 21st century. This scenario sees a continuation of improvements in farm-management practices, advances in biotechnology and in information and communication technologies. Also the process of trade liberalization and globalization of the agro-food chain will provide the basis for the investment and continued future growth of agriculture on an environmentally sustainable path, including the conservation of landscapes.

The outlook for OECD agriculture to 2020

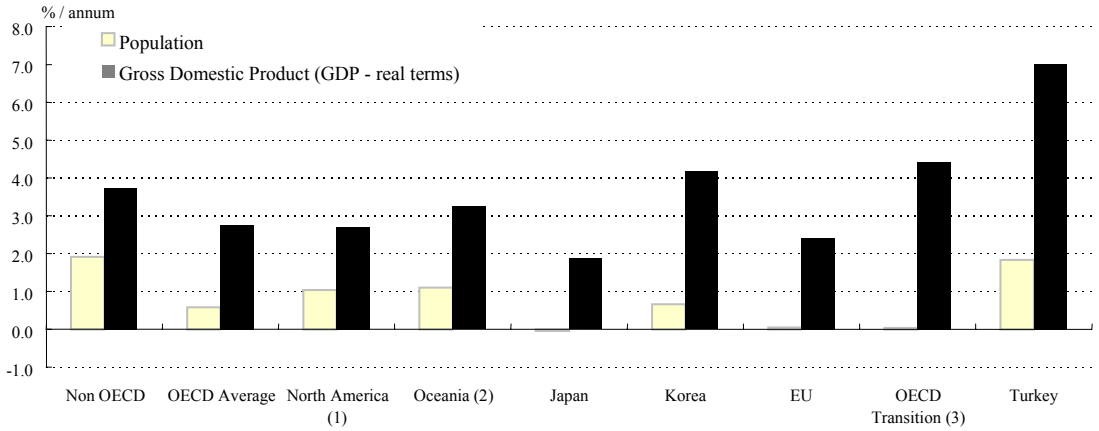
Demand for agricultural goods and services

There are a number of key developments in the demand and supply for OECD agricultural goods and services to 2020 which are important in terms of their potential impacts for the environment and landscapes. The agricultural demand and supply projections provided here mainly draw from OECD (2001b) and use current policy settings, and do not make any assumptions regarding possible changes regarding future domestic agricultural-policy reforms, including agri-environmental measures, or changes under any future WTO negotiations regarding agricultural trade liberalization. Commodity coverage includes cereals, oilseeds and livestock products, but not fruit and vegetables, permanent crops, harvested fodder or pasture.

Demand for agricultural goods and services, above subsistence levels, is mainly driven by population and income. The latest UN assessment of world *population trends* indicates an expected increase from about 6 billion in 2000 to 7.5 billion by 2020, with much of the increase occurring in urban areas of developing countries. Over the same period the population of OECD countries is expected to increase by around 150 million, with the EU contributing only a small part of this increase (Figure 1). The outlook for *growth in incomes* suggests that world economic growth could be lower over the next 20 years compared to the 1990s, with expansion of OECD economies slower than the world average (Figure 1). While income growth in developing countries will be more rapid than for OECD countries, the problems of poverty in developing countries will persist.

While the developments in population and incomes will increase aggregate food demand, they may lead to a *slow-down in world growth in food demand*. With per capita food consumption levels at or moving close to saturation levels in many OECD countries, the growth in demand for food will probably show only a small increase. OECD food-consumption patterns, however, are expected to change in response to demand for improvements in food quality, variety, convenience, safety, animal welfare, environmental quality and landscape conservation. Changing public preferences are also creating pressure on agriculture, through competition for farm

land, from housing, communications infrastructure, commercial use and recreational land uses, such as nature parks and golf courses.



Notes :

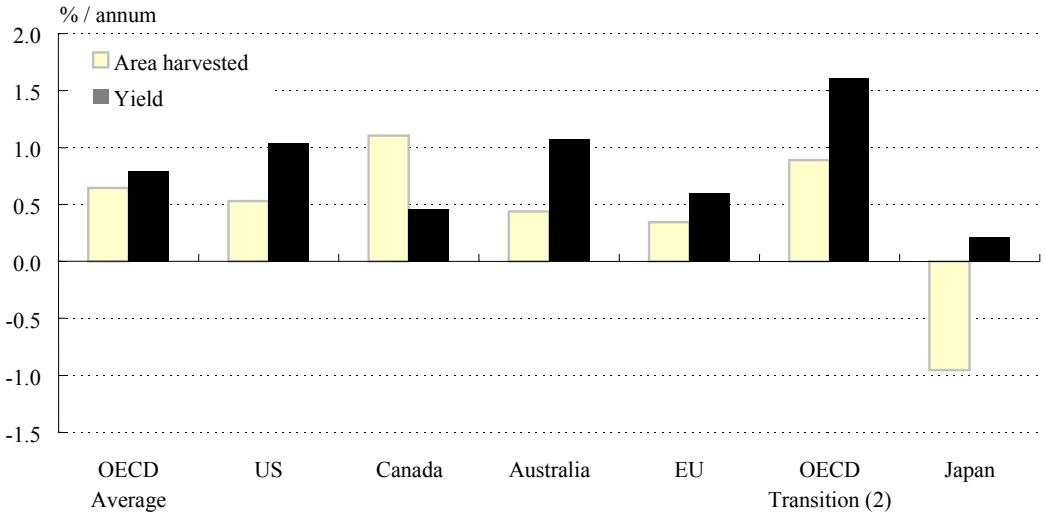
1) North America includes : Canada, Mexico and the United States.

2) Oceania : Australia and New Zealand.

3) OECD transition countries include: Czech Republic, Hungary and Poland.

Source : OECD (2001a).

Figure 1. World population and GDP projections, 1993-97 to 2020



Notes :

1) Cereals include: rice, wheat and coarse grains.

2) OECD transition countries include: Czech Republic, Hungary and Poland.

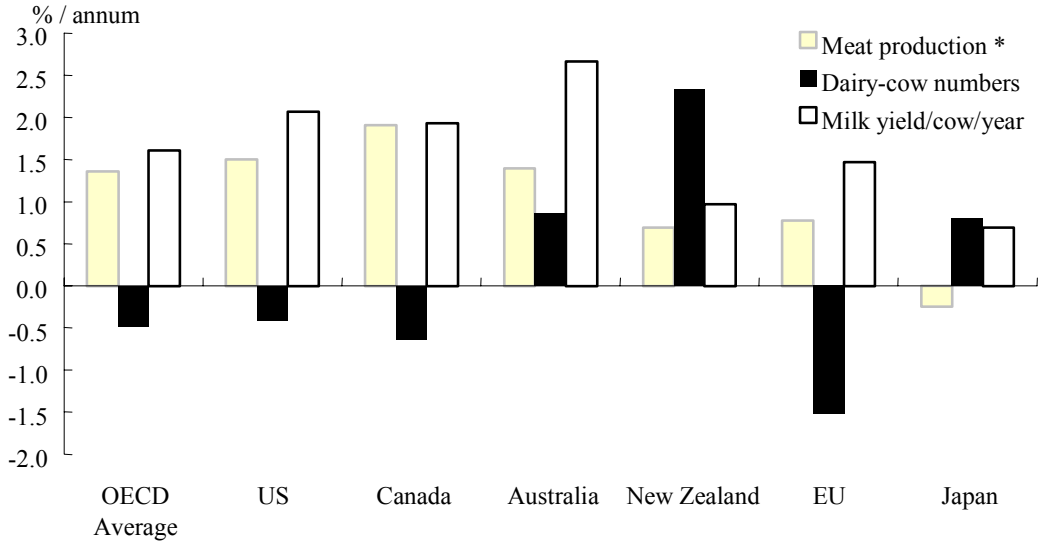
Source : OECD (2001a).

Figure 2. OECD cereal area and yield projections, 1993-97 to 2020

Supply of agricultural goods and services

Reflecting the slowdown in demand, projections of total OECD *production of cereals and oilseeds* from 1993-97 to 2020 indicate that growth rates will be lower than for developing countries, although there will be a 1.4%/annum expansion in absolute terms, except for rice. The total harvested crop area is anticipated to expand, but only slightly in the EU, mainly resulting from higher yields (Figure 2).

Overall the OECD *livestock sector* will expand up to 2020, with growth rates expected to be above the OECD average in North America and OECD transition countries (the OECD transition countries include the Czech Republic, Hungary and Poland), but below the average in the EU (Figure 3). The growth in livestock output will be mainly derived from improvements in productivity rather than from increasing livestock numbers. For example, the EU dairy herd may decline at 1.5%/annum in contrast to an increase in milk yields of nearly 1.5%/annum (Figure 3).



Note :

* Meat production includes : beef and veal, poultry, pigmeat and sheepmeat.

Source : OECD (2001a).

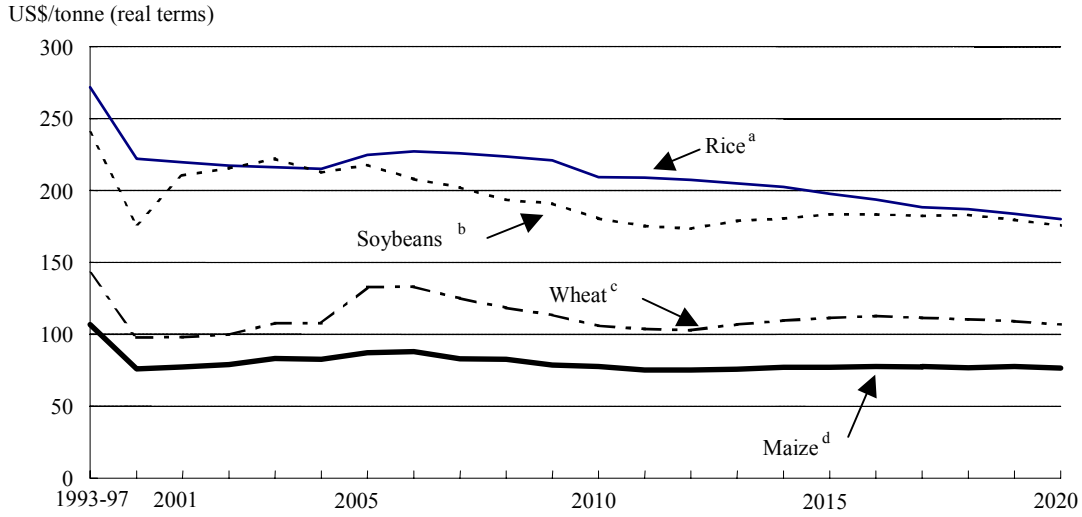
Figure 3. OECD livestock projections, 1993-97 to 2020

Agricultural commodity prices and farm structures

As a consequence of the developments in agricultural markets *world-market prices* for crops and livestock products, adjusted for inflation, are expected to continue their long-term downward trend to 2020, but at slower rates than in the previous two decades, and possibly remain stable for dairy products (Figures 4 and 5). The slower decrease in commodity prices, compared with past trends, reflects the reduced rate of crop yield increases as well as the strong demand for livestock products in developing countries.

The projected decrease in real commodity prices can be expected to bring pressure on farm incomes and contribute toward further *structural changes in European agriculture*, leading to a reduction in the share of agriculture in GDP and total employment. Production may further concentrate in a small number of farms, while most farmers, if they are to remain in agriculture, will need to gain an increasing share of their income from non-farming sources. These developments suggest average farm size could increase in terms of area and capital assets for most OECD countries, in a

move towards further gains in productivity to support agricultural profitability. Increasing farm size is likely to reflect the amalgamation of farm holdings rather than an expansion in the total area of land farmed.



Notes :

a) Milled, grade b rice, f.o.b. Thailand.

b) US soybeans, c.i.f., Rotterdam.

c) No. 2 hard red winter, ordinary protein, wheat, US, f.o.b Gulf Ports.

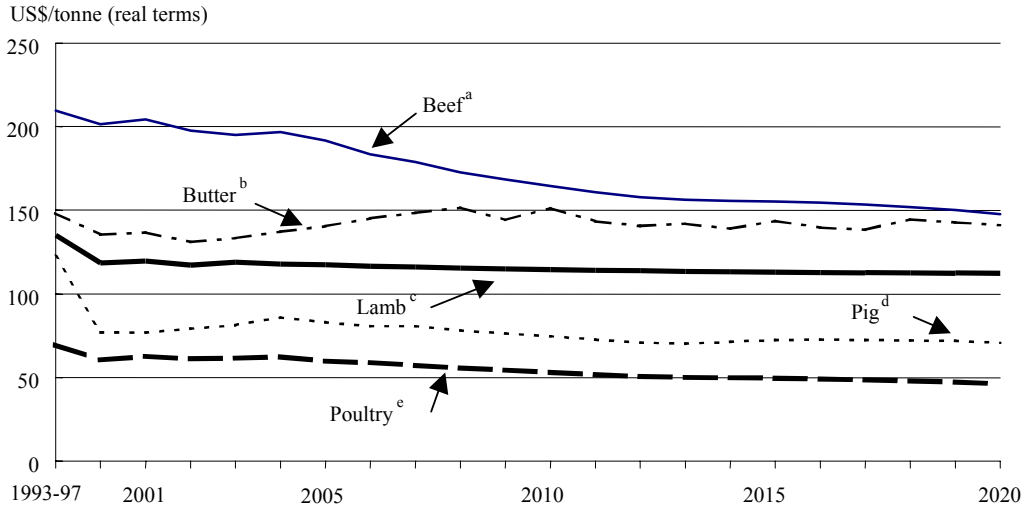
d) No. 2 yellow corn, US, f.o.b., Gulf Ports.

Source : OECD (2001a).

Figure 4. World-market cereal and soybean price projections, 1993-97 to 2020

A major driver in agricultural profitability and structural change is technology combined with improvements in farm-management practices. Many of the *technologies and management practices* available to farmers have the potential to steer agriculture along a sustainable path, providing both economic and environmental benefits to agriculture (Hrubovcak, Vasavada and Aldy 1999). Examples include: precision farming, such as linking global positioning to geographical information systems to map precise fertilizer and pesticide requirements; biotechnology, for example, genetically modified (GM) crops that are insect- and herbicide-resistant; and farm-management practices such as enhanced nutrient management, integrated pest management and conservation tillage.

Adoption of new technologies, farm input use and management practices by farmers are heavily dependent on profitability, perception of risks and the extent to which the regulatory system restricts the use of certain technologies, inputs or particular farming practices. Even where new technologies and management practices are profitable or input costs are relatively low, there can be impediments affecting their rate of adoption, diffusion and use, for example, the education level and training of farmers and different perceptions of economic risks. Illustrative is the small number of OECD countries where more than 40% of farmers have even basic training (Figure 6).



Notes :

a) Choice steers, 1100-1300 lb lw, United States.

b) F.o.b. export price, 40 lb blocks, Northern Europe.

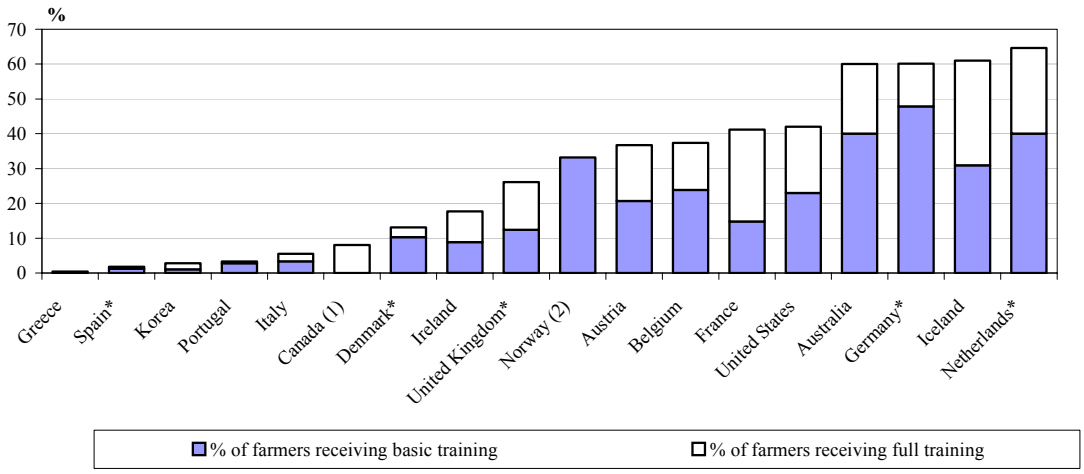
c) New Zealand lamb schedule price, all grade average.

d) Barrows and gilts, No. 1-3, 230-250 lb lw, Iowa/South Minnesota, United States.

e) Wholesale weighted average broiler price, 12 cities, United States.

Source : OECD (2001a).

Figure 5. World-market meat and butter price projections, 1993-97 to 2020



* 1990 data.

Notes:

1. Data not available for basic training.

2. Value refers to both basic and full training.

Source: OECD (2001b).

Figure 6. Educational level of farmers: mid / late 1990s

While the continued use of farm inputs and adoption of new technologies by farmers will be needed if agriculture is to achieve further improvements in productivity, there are uncertainties about the *limits to agricultural productivity gains imposed by physical and biological environmental constraints*. Technological improvements and increased input use might be unable to raise agricultural production sufficiently to offset the depletion of soil and water resources. It is also thought that in some regions further intensification of agriculture can induce irreversible changes in ecosystems, once sustainable thresholds of natural ecosystems are exceeded, especially soil degradation and depletion of water resources (Brown 2000; Laxminarayan and Simpson 2000; Penning de Vries et al. 1995).

The outlook for European agricultural landscapes

Overview

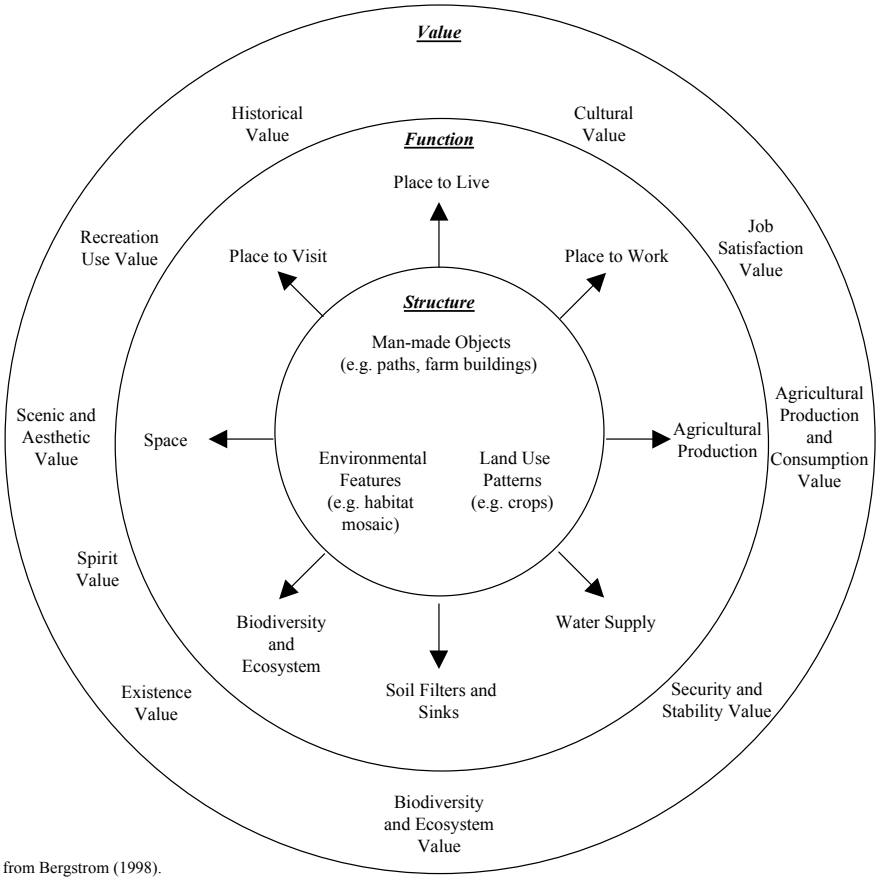
Agricultural landscapes, despite their variety at local, regional and national levels, can be described in terms of key elements that are relevant to any agricultural landscape (Figure 7):

- *structure (appearance):* the interaction and relationship between various environmental features (e.g. flora, fauna, habitats and ecosystems), land-use patterns and distributions (e.g. crop types and systems of cultivation), and man-made objects (e.g. hedges, farm buildings);
- *function:* the provision of landscape functions for farmers and rural communities as a place to live and work, for society as a place to visit and space for the enjoyment of various recreational activities, and also the function of landscape in providing various environmental services, such as the provision of biodiversity and ecosystems;
- *value:* concerning both the value society places on agricultural landscape, such as recreational, cultural and other amenity values associated with landscape, and also the costs of maintaining and enhancing landscape provision by agriculture.

There is no unique way in which the various structures and functions of landscapes shown in Figure 2 can be defined, classified and then valued. This will to a large extent depend on who is viewing and using the landscape. Hence, the urban public tends to value the landscape from a general aesthetic, recreational and cultural perspective. The ecologist perceives landscape as primarily a provider of biodiversity and habitats, while farmers, rural communities and ultimately consumers are interested in, or at least benefit from, the economic value of a landscape related to the production of agricultural commodities and as a place to live and work.

Agriculture's impact on landscape can be described in terms of a sequence of processes. The quantity of agricultural production is affected by the financial resources available to agriculture (both market returns and government support), the incentives and disincentives facing farming, and the kinds of management practices and technologies adopted by farmers.

These practices and technologies impact on the productivity of natural resources (e.g. soil) and purchased inputs (e.g. fertilizers) used by farmers. Depending on the management and productivity of agriculture's use of natural resources and inputs this will affect the rate of depletion and degradation of soils and water; the flows of harmful emissions (e.g. nutrients) into soils, water and air; and the quantity and quality of natural plant and animal resources (i.e. biodiversity) and landscape features.



Source: Adapted from Bergstrom (1998).

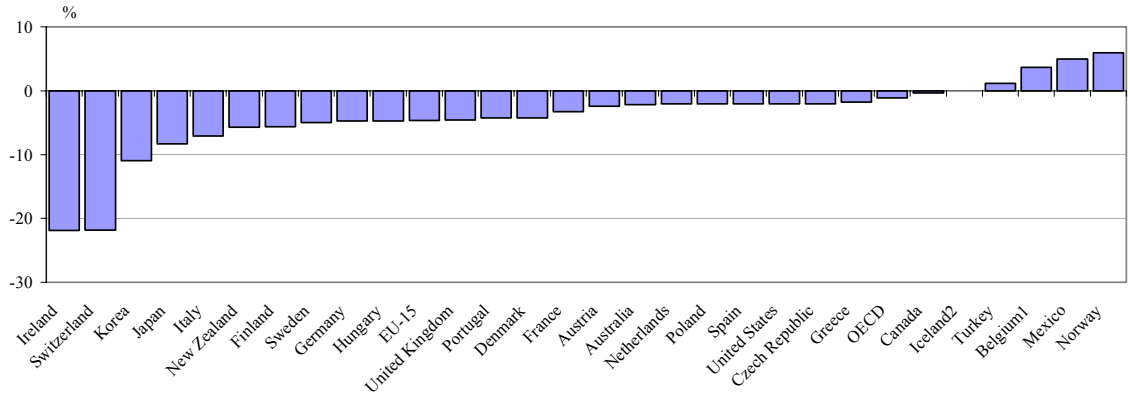
Figure 7. Landscape: structure, function and value

Supply of agricultural landscapes

Past trends in the supply of agricultural landscapes

The overall decline in the total agricultural land area for most OECD countries since the early 1980s (Figure 8), and over a longer time scale for many countries, has been associated with the conversion of highly productive agricultural land usually to urban, industrial and road development, and a large share of marginal farming land converted to forest (Figure 9). In many cases across EU countries, the decrease in the area of intensively farmed land, i.e. for arable and permanent crops, has proceeded at a faster rate than for extensively farmed land, i.e. permanent pasture. At the same time agricultural production on the remaining intensively farmed agricultural land has increased through improving productivity by, for example, the greater use of farm chemicals and the removal of boundary landscape features such as field border strips, to increase field size for larger farm machinery.

These developments in agricultural land use over the past 20 years are largely recognized as having had a harmful impact on the environment and landscape in most EU countries. Hence, there does seem to have been a trend towards increasing homogenization of landscape structures in EU countries, including the loss of some cultural features (e.g. stone walls). This trend appears closely related to the structural changes and intensification of production, but since the late 1980s the process toward increasing homogeneity of landscapes could be slowing or in reverse in some regions.



Notes:
1. Belgium, including Luxembourg.
2. Percentage is less than 0.1%.
Source: FAO Database.

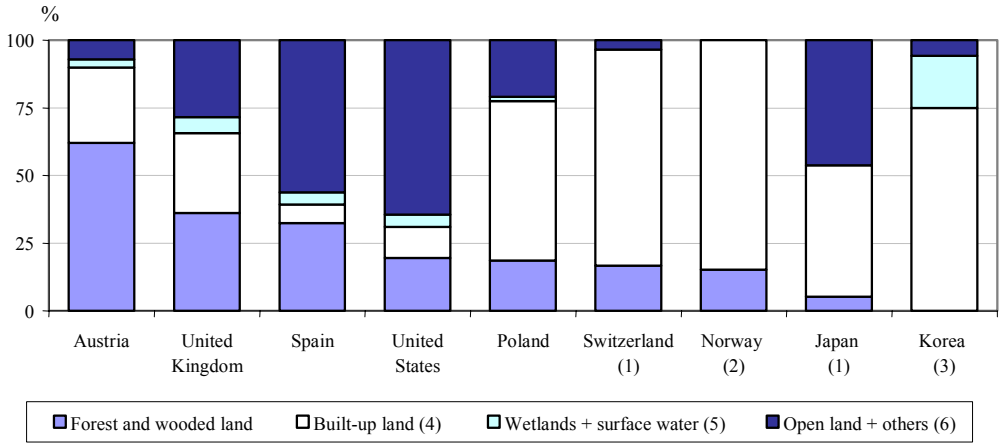
Figure 8. Change in the OECD agricultural land area: 1987-89 to 1997-99

This pattern of change began to alter with the reform of the EU's Common Agricultural Policy and introduction of agri-environmental measures in the early 1990s, which has encouraged changes in farming practices, for example, the development of field margins on cropland and the maintenance of hedgerows. In addition, the policy of taking land out of production, 'set-aside', has resulted in an increase in fallow land from around 1 million hectares in the early 1980s up to over 7 million hectares by the mid-1990s (Vidal 1999). Even so, it is still too early to be sure about the extent of these changes within or across EU countries, or the permanence of the positive changes in some wildlife populations using agricultural land as habitat and landscape conservation.

Two examples from Denmark and the United Kingdom are illustrative of broader trends across many regions and countries in Europe. A study of the Vejle county of Denmark (nearly two-thirds of the total agricultural land area in Denmark) from 1970 to 1995, revealed a number of important changes to semi-natural agricultural habitats and landscape in the area (Nowicki et al. 1999).

Over this period in Denmark semi-natural grasslands decreased by over 40%, accompanied by a shift from low-intensity pastoral farms to high-intensity pig and cattle enterprises. Wild-flora seed banks in arable fields declined by 60%, while there were significant reductions in areas of wet and dry heath land and peat bogs. The intensification of agriculture was recognized as a major influence on these changes, although measures introduced in the early 1990s, including agri-environmental management payments, are helping to maintain and restore semi-natural agricultural habitats and associated landscapes.

In the United Kingdom intensification of agricultural land use was considered to be one of the main contributors to the reduction in the area of semi-natural agricultural habitats over the past 50 years. However, as a result of targeted agri-environment policies, reductions in price support, technological developments and consumer demand, trends towards extensification of agriculture may be emerging (Stott and Haines-Young 1998). The UK has also set targets for the maintenance and restoration of priority semi-natural grassland habitats and field boundaries such as hedges (Ministry of Agriculture Fisheries and Food 2000). Legislation was also introduced in 1997 for the protection of important hedges.

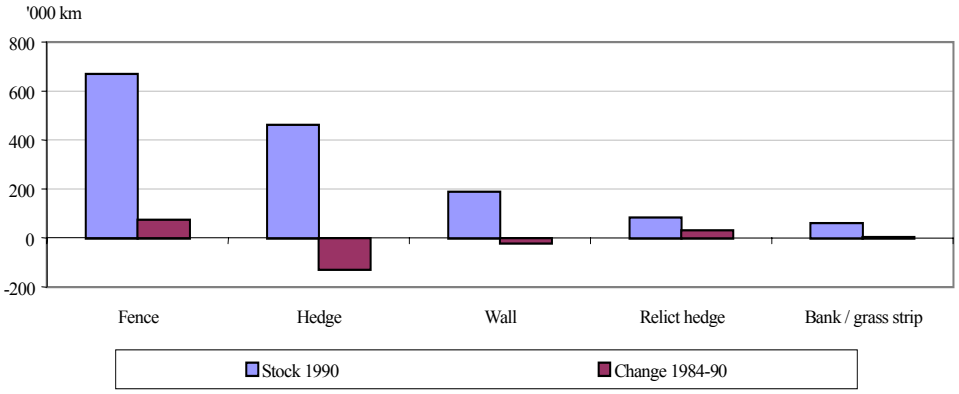


Notes:

1. Data for wetlands + surface-water areas are not available.
2. Data for wetlands + surface-water areas and open land + others are not available.
3. Data for forest and wooded land are not available.
4. Built-up land covers mainly land used for urban or industrial development and transport infrastructure, e.g., roads.
5. Wetlands + surface water: surface water covers mainly small ponds, lakes and diverted rivers.
6. Open land + others: land not used for any of the above uses, such as barren land, exposed rocks and for some countries, e.g., Japan, farm land abandoned but not forested.

Source: OECD (2001b),

Figure 9. Share of different land-use types in land converted from agricultural to other uses: mid-1980s to mid-1990s



Source: Stott and Haines-Young (1998).

Figure 10. United Kingdom: stock and change in field boundaries, 1984-90

Field boundaries are often seen as defining features of landscape character in the UK, adding local distinctiveness, which is widely appreciated. As well as their contribution to the character of the landscape, field boundaries are important as a habitat for animals and plants, providing food and shelter and acting as corridors for the movement of some species. They are often the oldest remaining feature in the countryside, providing important evidence of the historic development of the landscape.

The estimated length of hedges and walls in Britain in 1990 was 462,000 km and 188,000 km, respectively. Between 1984 and 1990, an estimated 129,000 km of hedges and 22,000 km of walls were either removed, incorporated in development or changed to another boundary type. In detail, two thirds of hedges were unchanged between 1984 and 1990; about 7% became relict hedges; 15% were converted to

fence lines or other boundaries and 11% were removed or incorporated in development (Figure 10). Three quarters of walls were unchanged; 14% were converted to fence lines or other boundaries and 9% were removed or incorporated in development. The total length of post and wire fence increased by 74,000 km and the total length of relict hedge increased by 31,000 km. It is too early to say whether changes in policy since the late 1990s will be sufficient to halt the trend of decline in traditional hedged landscapes in Britain (Stott and Haines-Young 1998).

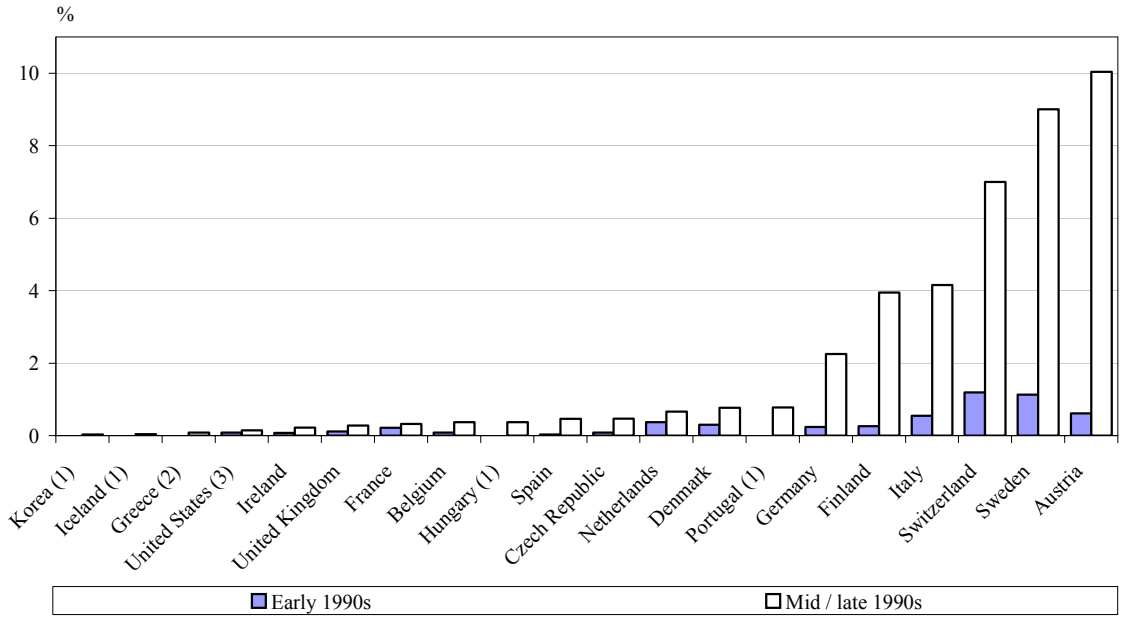
Outlook for the supply of agricultural landscapes to 2020

By 2020 a further 5% of EU agricultural land is projected to be converted to other uses, mainly the continued reversion of marginal grasslands to commercial forests or 'natural' habitats (OECD 2001b), reducing the share of agriculture in total land use to 40% by 2020. In addition, agricultural land is also expected to be changed to use for settlement and transport networks (e.g. roads and rail). Increases in the use of land for settlement, both close to urban centres and around rural villages and towns, is also expected to lead to the loss of some highly productive agricultural land and valued landscapes, especially in rural areas, which is in general irreversible. The pattern of land use, and therefore landscape spatial composition, can be expected to change due to a large number of influences, four of which are highlighted here:

1. The projected contraction of the EU agricultural sector. With the projected contraction of the EU agricultural sector by 2020, it can be expected that the area of annual field crops (e.g. cereals, oilseeds, etc.) will expand relative to the area under grassland. The decrease in the grassland area can be largely explained by the projected reduction in the EU cattle herd (dairy and beef) as described in section 2 of the paper. These changes are likely to bring changes to landscape patterns at larger regional scales, but more detailed local changes will depend on the structure and juxtaposition of crops, grassland, permanent crops (e.g. orchards) and the extent to which agri-environmental and rural development policies will encourage the conservation of landscape features in agricultural areas, such as hedges and woodland.

For other European countries, especially the transition countries such as the Czech and Slovak Republics, Hungary and Poland, projections to 2020 suggest that agriculture in these countries might expand (Figures 3 and 4). This would indicate greater pressure from agriculture on the environment and landscape conservation. The extent of this 'pressure' on landscapes over the next 20 years will in part depend on how rapidly these countries become full EU Member states and implement relevant EU agri-environmental and rural development policies.

2. Future prospects for organic farming. While organic farming has grown rapidly over the 1990s, nevertheless, its share of the EU total agricultural area is around 2%, but is over 4% of the agricultural area in Austria, Finland, Italy and Sweden (Figure 11). The future expansion of organic farming will largely depend on policy incentives, raising yields, lowering producer conversion costs and reducing consumer prices.



Notes:

1. Data for the early 1990s are not available.
2. Percentage for the early 1990s equal 0.003%.
3. Data for the United States are taken from Welsh (1999).

Source: OECD (2001b).

Figure 11. Share of the total agricultural area under organic farming: early 1990s and mid/late 1990s

A study of France shows that yields for conventional wheat production were about 23% higher than for organic wheat, while in the Netherlands yields of dairy cows under conventional systems were about 11% above those under organic systems (Rainelli and Vermersch 2000; Brouwer and Helming 2000). A case study from the United Kingdom shows that for a specific farm converting from conventional to organic farming, the gross margins fell by almost GBP 100 (US$ 150) per hectare in the conversion years, but, once fully converted, gross margins on organic farms were up to 15% higher than for a similar conventional farm (Cobb et al. 1998; Ministry of Agriculture Fisheries and Food 2000). Moreover, consumer prices for organic foods are generally higher than for conventional products, although complete price information on organic foods is poorly documented at present.

With the current yields obtained under organic farming, a significant expansion of organic farming would involve both an increase in the area under cultivation and animal stocking rates if current production levels were to be maintained. This could conflict with the conservation of biodiversity and non-agricultural landscapes, especially if additional land were brought into production. Moreover, unless the higher prices associated with organic foods are not reduced then this is likely to involve a slower growth in the demand for these products across EU countries over the next 20 years.

3. Changes related to climate change and agriculture. A further development in some European countries affecting cropping and landscape spatial patterns is the expansion of *biomass production* as a source of renewable energy. Overall the production levels of renewable energy from agricultural sources are low in most OECD countries, but agriculture has considerable potential to reduce GHG emissions through the replacement of fossil fuels with biomass energy from crops. International

Energy Agency (IEA) projections expect non-hydro renewable-energy (NHRE) sources (mainly geothermal, solar, wind, tide and biomass) to be the world's fastest growing primary energy source up to 2020 at nearly 3%/annum. There is increasing research in this area, however, with the use of some oilcrops for energy purposes, in addition to the production of energy from farm and agro-food industry waste.

Despite the rapid growth in NHRE production the share of these energy sources in total electricity production in the European OECD countries (i.e. EU countries plus Czech Republic, Hungary, Iceland, Norway, Poland, Switzerland and Turkey) is small but projected to rise from 2% at present to 5% in 2020, with over 45% of this expected to be accounted for by biomass. While concerns over climate change may encourage the production of renewable energy sources they are likely to remain expensive compared to fossil fuels, and their development in Europe will continue to rely on policy support to achieve the projected growth rates by 2020 (International Energy Agency 2000, see p. 24 and p. 102-103). Hence, while the increase in agricultural biomass production for renewable-energy purposes may be significant in terms on its impact on the landscape in some localities, its overall expansion across Europe is likely to be of less significance.

In the context of climate change, agriculture also has the capacity of sequestering (removing) carbon in soils. The carbon sequestration capacity of agriculture is affected by a complex set of relationships, but estimates show that about 50% can be achieved by adopting soil conservation and improving crop-residue management (e.g. reduction of stubble burning), 25% by changing cropping practices (e.g. increases in soil cover) and much of the rest through a combination of land-restoration efforts and converting cropland to pasture (Antle et al. 1999).

Future changes in sequestering carbon by altering farming practices and production intensity is thought to increase soil carbon slowly over the first 2–5 years, with larger increases between 5 and 10 years, reaching a finite limit after about 50 years. Recent trends for some countries indicate a growing number of farmers using conservation tillage practices and increasing the number of days per year the soil has a vegetative cover. In addition, if EU countries continue to keep agricultural land out of production through set-aside schemes this could have a positive impact for carbon sequestration and consequences for agricultural landscapes, depending on how this land is managed (OECD 2001b).

4. The future of agricultural land-diversion schemes. Many European OECD countries have implemented land-diversion schemes that pay farmers to take land, usually cereals, out of production or shift it to alternative uses. The land-use change induced by these schemes often aims to achieve a combination of supply control and environmental objectives, with the latter objective becoming more important (e.g. compulsory ecological compensation areas in *Switzerland*). The environmental objectives under land diversion commonly include improving soil organic matter, lowering farm chemical use and soil erosion, and providing greater diversity of plant species and other wildlife. These effects can be temporary, however, where land is eventually returned to production.

In the European Union over 7 million hectares were diverted from cereal and oilseed production under short-term set-aside schemes in 1995/96 (Vidal 1999). In 1994/95, total short-term set-aside ranged from just over 1% of the national base area in *Greece* to almost 17% in the United Kingdom (the base area is equal to average plantings of cereals, oilseeds, linseed and protein crops over the period from 1989-1991, including land fallowed during that time). Germany, France, Italy and Spain had more than 15% of their base area idled, whereas in Belgium, the Netherlands and

Portugal only 6% was set aside. Farmers have to ensure crop coverage on the compulsory set-aside areas, where the use of machinery is also limited. The EU set-aside policy also aims to re-introduce fallow lands in more arid regions.

The future reform of EU agricultural policies (i.e. lowering support and trade protection for agriculture) could alter the future role of land-diversion schemes and their consequences for landscapes. A lowering of commodity price support could reduce the need for supply control and thus short-term set-aside schemes (OECD 1997). Policy reforms could also lower environmental pressures, and free long-term set-aside of some of its current objectives. In this situation long-term set-aside could be restricted to situations where they remain the most cost-effective and efficient means of providing benefits demanded by society, such as 'attractive' landscapes.

Demand for European agricultural landscapes

For most OECD countries there has been *increasing demand from non-farming interests in the health of agricultural landscapes*, for cultural, aesthetic, recreational and ecological reasons. However, different values may be placed on these aspects of landscape – locally, regionally, nationally and by each individual. Over recent decades growing demand for landscape is mainly in response to rising incomes, increasing leisure time, greater personal mobility, and the impact of expanding urban areas stimulating demand for tranquillity and space.

While the increase in European population is projected to be small (Figure 2), changes in its spatial distribution can be expected to exert a greater pressure on landscapes over the next 20 years, especially the likely increase flow of residents from urban to rural population centres. The projected growth in incomes in Europe (Figure 2), however, could see the continued trend in demand for recreational and leisure pursuits, which will include greater emphasis on landscape conservation.

Establishing the demand or value society places on agricultural landscapes can assist policymakers in determining the benefits of landscape conservation and restoration. Because of the lack of market prices to help value the demand for landscape amenities, other methods must be employed to serve this purpose, such as:

- *Public-opinion surveys*, to ascertain public preferences for landscapes;
- *consumer expenditure patterns,* covering expenditures by the public in using landscapes (e.g. expenditures for recreation and tourism purposes);
- *non-market valuation,* to provide a monetary value of societal landscape preferences.

Public-opinion surveys are used by governments in some countries to provide socio-economic information on public preferences for landscape and other environmental amenities. Such surveys are usually sample-based interviews that aim to collect information related to, for example, the importance and preferences of one landscape type compared to another, the use and frequency of enjoying landscapes for recreational purposes such as walking. However, there may be a range of problems with these surveys, including the sample size of the survey, the regularity with which the survey is repeated and how survey questions are phrased in affecting responses. Also such surveys are susceptible to public views that an agricultural landscape which appears not to be cared for may have a low value, but in terms of biodiversity and wildlife habitat it can have a high value (see Ashworth et al. 1999; Cary 2000; and Nassauer 1992).

In addition to public-opinion surveys researchers have also investigated public perceptions of agricultural landscapes through interviews. In a study of rural residents in the United States, Nassauer (1989) found three dominant themes that residents used

to describe if an agricultural landscape was viewed as attractive or not, including: scenic quality, such as expansive views, a mix of different land uses, including unfarmed areas; neatness, for example, the absence of weeds, mown roadsides, straight rows of crops; and stewardship, which reflects on the farmer, such as strip-cropping and complex cropping patterns. A similar study in Australia (Cary 2000) also found that many people perceive agricultural landscapes that include patches of 'native' vegetation and areas such as fallow, as uninteresting and perceive them as illustrating a lack of care, although such areas and patches on farmland may be encouraging a rich and diverse biodiversity.

In some cases collection of data on landscape-related expenditures are collected at sub-national or national levels to assist policymakers in determining the economic value stemming from the public use of landscapes. This expenditure can include outlays on farm-based tourist accommodation, entry costs to farmed national parks, and the costs of travelling to scenic areas. However, care is required to distinguish between landscapes in areas of high touristic value and more remote agricultural areas where consumer expenditure may be much lower.

As landscapes are not normally traded in markets, economists use various techniques for estimating the non-market economic value of landscape, which help to estimate consumer values attached to landscape (Figure 12). These values include: use value, relating to how people are prepared to pay for an improvement in landscapes which benefit them directly; option value, the value placed on the possibility of using a landscape benefit in the future; and existence value, the willingness to pay to ensure the landscape is maintained, irrespective of any expectation of ever using the landscape in the future (OECD 1994).

The main landscape valuation techniques are the hedonic-price and travel-cost methods which use a revealed-preference approach that seeks to find some indirect reflection of landscape value in a market for other goods, and the contingent-valuation method which uses an expressed-preference approach where people express their hypothetical valuation of landscape (see for example Dubgaard, Bateman and Merlo 1994; Hasund 1998; Heimlich et al. 1998; Holstein 1998; OECD 1994; Olsson and Rønningen 1999, p. 16-20; and Santos 1998).

A selective overview of studies regarding the monetary valuation of agricultural landscape and wildlife conservation (mainly drawing on the CVM surveys made by Bonnieux and Weaver 1996; and Oskam and Slangen 1998; see OECD 1999) suggests a number of general conclusions regarding valuation of agricultural landscapes, although the authors stress the need to interpret these results with care. They observe that the studies reveal that agricultural landscapes are a valued externality arising from agricultural activity for a large number of countries.

These studies also suggest that the landscape surveyed today is the preferred landscape, while the willingness-to-pay to maintain a particular landscape decreases with increasing distance from a particular site. Heterogeneity in landscapes is given a higher value over more uniform landscapes, while 'traditional' elements in landscapes are valued more highly than new elements. Landscape areas with a high biodiversity value are not always the most highly valued, while accessible landscapes are valued more highly than inaccessible landscapes of the same quality.

Although considerable progress has been made by economists in refining non-market valuation techniques, current evidence suggests that policymakers are still somewhat reluctant to use these methods in policy formulation, instead preferring to use them as only a contribution to inform the policy-making process. This, in part, reflects concern that public preferences for landscapes may be transient and not take

into account other objectives of agricultural policy such as rural development and food security. It is also unlikely that these valuation estimates can be deployed rapidly enough and with sufficient sensitivity to inform fully cost–benefit considerations of landscape and other environmental amenities (Heimlich et al. 1998, p. 17). Valuation estimates may also be complicated by different attitudes in society towards monetary wealth superimposed on varying preferences for landscapes.

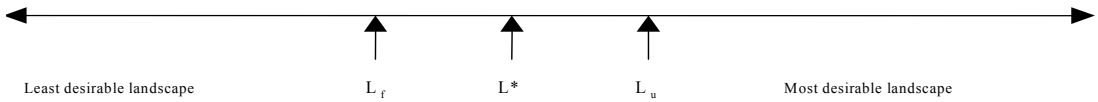
While all these methods of measuring consumer demand for landscapes have limitations, they do provide the foundation for the quantitative evaluation of the demand or value the public attach to landscapes. That is to say, such approaches can help provide subjective evaluations of landscapes expressed in monetary terms, with the exception of public-opinion surveys. Establishing the demand for landscape in this way may assist policymakers to determine the importance attached to landscape values by society, and also determine the policy solutions to encourage farmers to maintain and improve the quality of landscapes to meet public demand.

Policies and landscape provision: the role of policies in optimizing the provision of agricultural landscapes

Policy background

The inability of the market to match the supply and demand for landscape relates to the public-good character of landscape and other rural amenities (see Bromley 1997; OECD 1994). Most of the benefits of using and enjoying agricultural landscapes accrue to those who have not produced them, such as tourists, although most farmers also enjoy living and working in an attractive landscape. But it is usually difficult for farmers to charge for the costs of landscape provision, thus they may be unwilling to bear the cost of the conservation or restoration of landscapes that are most valued by society. For this reason markets tend to undersupply public goods, improving landscape quality in this case, relative to their demand.

The essence of the policy challenge concerning landscape associated with agriculture is that there is no 'correct' level for landscape supply (Bromley 1997). Landscape can be depicted as a continuum from the least to the most desirable landscape, see Figure 12, with the current situation defined by L* which is a momentary assessment of the amenity attributes of the landscape, while L_u is the landscape quality demanded by non-farming interests, and L_f is the level of landscape quality that farmers consider they should supply in the absence of any legal restrictions or remuneration. It is between the points L_f and L_u that the political process will refer to resolve its disagreements, although many farmers also seek to maintain and restore landscape irrespective of remuneration.



Note:
L_f: level of landscape farmers consider appropriate in the absence of any restrictions / remuneration.
L*: current momentary assessment of the amenity attributes of the landscape.
L_u: the landscape desired by non-farming interest.
Source: Bromley (1997).

Figure 12. The policy space for landscape and amenity aspects of agriculture

The difficulty for policymakers is that there are few precise rules that indicate the 'correct' or optimal provision of landscape, which raises the questions as to how much is optimal, precisely which landscape features does society value, and to what extent do changes in policies and policy mixes affect landscape? (Sinner 1997).

EU countries' national agricultural acts typically set objectives for the protection and restoration of landscapes and provide public access to these landscapes (Wascher 2000a). Also under EU Regulation No. 2078/92 support is provided to farmers who adopt "farming practices compatible with the requirements of protection of the environment and natural resources, as well as maintenance of the countryside and the landscape" (e.g. the Environmentally Sensitive Area Schemes, see Bonnieux and Weaver 1996). Regulatory measures are also used to set minimum standards on the whole agricultural area and designate certain areas of 'high' landscape value, such as national parks, and impose restrictions on some farm-management practices in these areas (e.g. the national-park system created in France, see Bonnieux and Rainelli 1996); or protect specific landscape features (e.g. the Hedgerow Regulations in the UK).

The EU's 6th EAP (Commission of the European Communities 2001) notes that "at Community level, regional and agricultural policies need to ensure that landscape protection, preservation and restoration is properly integrated into the objectives, measures and funding mechanisms … . On the wider scene, the European Landscape Convention foresees measures to identify and assess landscapes, to define quality objectives for landscapes and to introduce the necessary measures" (for details of the October 2000 European Landscape Convention, see the Council of Europe web site: http://conventions.coe.int/treaty/EN/Treaties/Html/176.htm)

Future EU policy developments, agriculture and landscapes

The greater policy focus on agri-environmental issues and landscape conservation can be expected to intensify over the coming decades as a consequence of:

- reforming the Common Agricultural Policy (CAP);
- developing agri-environmental measures; and
- strengthening environmental policies domestically and multilaterally.

The 1992 CAP reforms gave higher priority to the environment within agricultural policy, and this trend was continued under the recent "Agenda 2000" programme. These reforms are beginning to improve the domestic and international allocation of resources, reverse the harmful environmental impacts associated with commodity and input-specific policy measures by reducing incentives to use polluting chemical inputs to farm environmentally sensitive land, and protect landscapes.

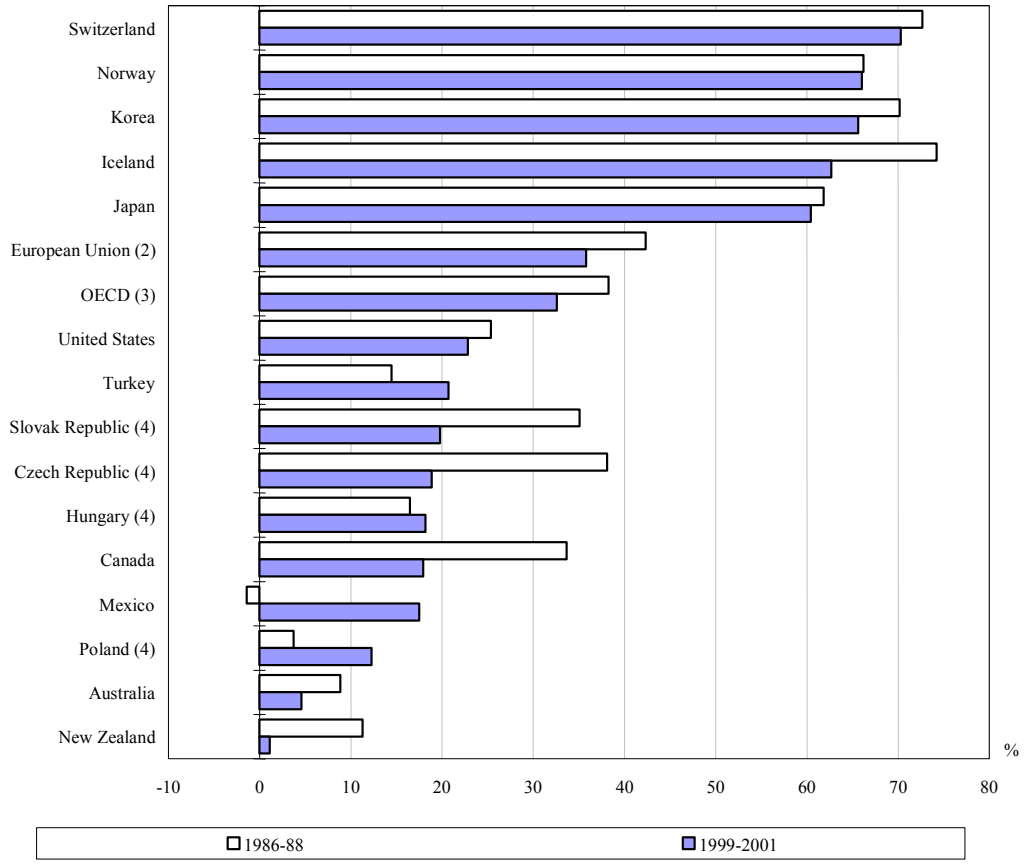
A report by the European Communities Court of Auditors (2000) noted that "the intensification of agricultural production, encouraged by high support under the Common Agricultural Policy and partly by agronomic trends, has created environmental problems which give cause for concern [para. 1]… the Community may have succeeded in "greening" its CAP but not necessarily agriculture. The expected environmental benefits of the changes made by the Reform of 1992 … are not yet realised to a significant extent" [para. 91].

Even so, the support to EU agriculture has declined over the past 15 years, as measured by the OECD Producer Support Estimate (PSE) (Figure 13). Also over this period there has been a shift in the composition of EU support, from market-price support, payments based on output and input subsidies, towards area and headage payments, which are less production- and trade-distorting. The share of the former

more production- and trade-distorting forms of EU support has fallen from 96% of the PSE in 1986-88 to 72% in 1999-2001 (OECD 2002). This development has the potential to reduce the damaging environmental and landscape impacts of agriculture by lowering production intensity.

Further reform of the CAP over the next two decades can be expected, because of both internal pressures in the EU including the desire to reduce the burden of CAP support on taxpayers and consumers, the need to address the inequity in the distribution of support (i.e. approximately 20% of producers receive about 80% of support), the increasing demand to shift support from commodity production-related support to support such as for environmental improvements, and because of external pressures, especially the ongoing World Trade Organization discussions to further liberalize agricultural trade following the Doha Development Agenda.

Progress in EU agricultural policy reform, leading to reductions in the level of support and trade protection, can be expected to change relative prices between commodities, regions and countries, farm inputs and outputs. In their decisions on how to allocate their resources, farmers will increasingly face market signals, as well as a different set of risks and uncertainties. This will result in changes in the levels, composition and location of production and in farm practices.



Notes: Countries are ranked according to 1999-2001 levels.

1. The Producer Support Estimate (PSE) is an indicator of the annual monetary value of gross transfers from consumers and taxpayers to agricultural producers, measured at farm-gate level, arising from policy measures which support agriculture, regardless of their nature, objectives or impacts on farm production or income. The percentage PSE measures the share of support to producers in total gross farm receipts.
2. EU-12 for 1986-88; EU-15 for 1999-2001. PSEs are not caculated by the OECD Secretariat for individual EU Member states.
3. For 1986-88, the Czech Republic, Hungary, Poland and Slovakia are excluded.
4. For the Czech Republic, Hungary, Poland and Slovakia 1986-88 is replaced by 1991-93.

Source: OECD (2002)

Figure 13. Percentage producer support estimate[1]: 1986-88 to 1999-2001

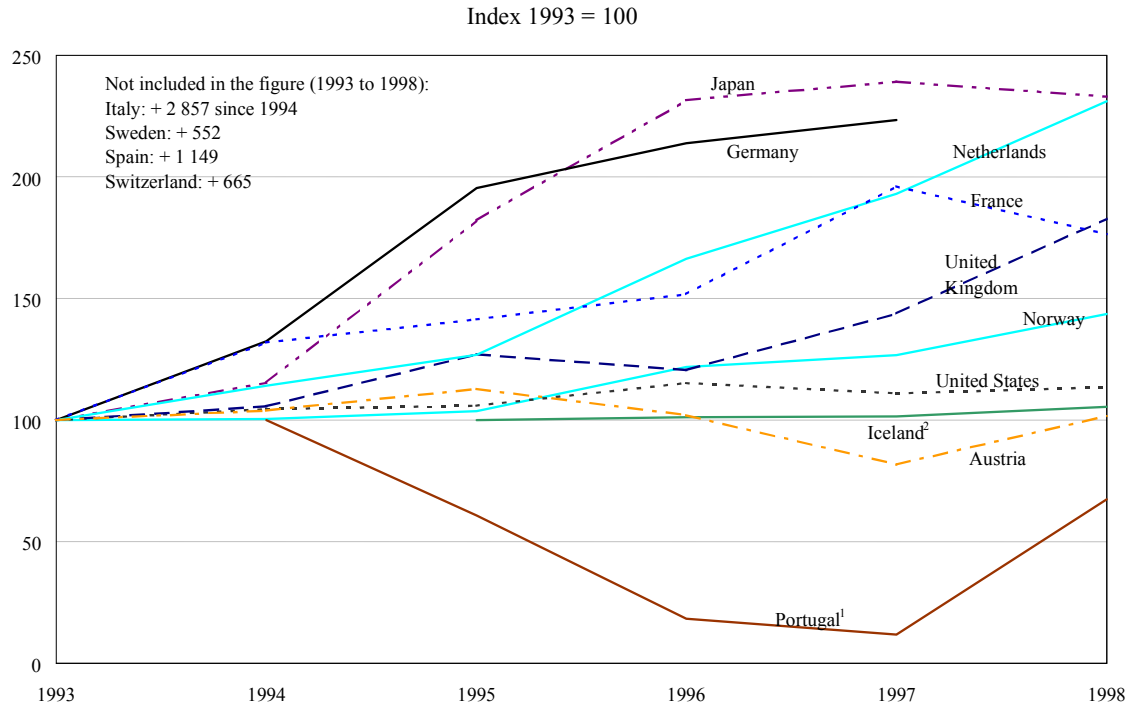
The effects on the environment and landscapes resulting from the agricultural policy reform process will depend on the extent to which relative incentives facing farmers change and the initial level and means of support afforded to farmers in different countries. The diversity of environmental outcomes and impacts on landscape will vary between farmers, regions and across countries, due to variations in the natural-resource base and to varying effects on farm-management practices and the production mix (such as between livestock and crops).

In lowering agricultural trade barriers, agricultural policy reforms are likely to increase the overall volume of international agricultural trade and cause an expansion of agricultural activity in some countries and a contraction in others. Both the expansion and the contraction of the agricultural activity may shift the pressure on the environment and landscapes of the regions concerned. It is thus necessary to ensure that any externalities arising from policy reform are adequately reflected in farmers' production costs, commodity prices and incomes.

The effects of different environmental standards and regulations on agricultural trade and the effects of general trade liberalization, agricultural trade liberalization

and associated domestic agricultural policy reform on the environment are complex and require further analysis.

As part of the CAP reform process the EU has also introduced various agri-environmental measures, the "accompanying measures", to encourage the adoption of environmentally friendly farming practices (Regulation No. 2078/92) and the afforestation of agricultural land (Regulation No. 2080/92). Consequently EU agri-environmental expenditure has increased substantially (Figure 14), but, nevertheless, remains less than 10% of total CAP budgetary expenditure. While the nature of measures introduced to implement Regulation No. 2078/92 has varied across countries, they have mainly focused on altering inappropriate farm-management practices that are incompatible with achieving environmental objectives, some of which were encouraged by high price-support levels.



Notes:
1. 1994 = 100.
2. 1995 = 100.
Source: OECD (2001b)

Figure 14. Public expenditure on agri-environmental goods, services and conservation: 1993 to 1998

Agri-environmental measures have also included the provision of payments if certain practices are adopted, such as conversion payments for changing to organic farming.

The EC Court of Auditors (2000, para. 93) in their assessment of the EU agri-environmental measures observed that they "have had some beneficial environmental impact, particularly in providing incentives to farmers to maintain their extensive farm practices, and avoiding the abandonment of farm lands or their conversion to intensive farming. But the agri-environmental measures have had very little effect in converting intensive practices to extensive farming. One of the main reasons for this

unsatisfactory performance is the Commission's and Member States' weaknesses in resource targeting, programme design, approval and evaluation."

With the further reform of the CAP anticipated in the future, the current set of agri-environmental measures might need to be strengthened as the level of agricultural output that would arise under more market-oriented conditions following reform, and the farm practices that emerge, might not correspond to the environmental outcomes desired by society. This is where market prices may not reflect the full environmental costs of agricultural production, and may neither be adequate in determining the quantity of environmental benefits demanded by society, nor fully capture the harmful environmental effects of agricultural activities.

Hence, there are some environmental effects that would need to be addressed by specific environmental measures and approaches in addition to agricultural policy reform: market orientation is necessary, but may not be sufficient for dealing with environmental effects of agriculture.

While agricultural policy reform will alleviate some environmental problems, others could persist and new ones could be created, especially with respect to land use. As agricultural trade also becomes more liberalized, agricultural production is likely to expand in some countries or regions and contract in other areas, which could change the pressure on the environment. To prevent any degradation of the land used in (or withdrawn from) agriculture following reform, complementary policy measures may be required.

Marginal land that was brought under cultivation as a result of high support levels, will be withdrawn from production if it ceases to be profitable as farmland, although in some situations might revert to lower-input "extensive" farming systems. While in some areas, such land might soon revert to a more natural state and form part of a balanced ecosystem, in other areas such land could, if left to itself, degenerate. Proper environmental management of idled land resources over time will become important. However, some of the alleged problems from abandonment of agricultural land are not environmental, but rather socio-cultural and relate to rural development.

Support reductions will free up not only land but also other resources used in agriculture, whose reallocation to other productive uses within and outside of agriculture may not follow a smooth path to the benefit of the environment. The farms that remain may not have the financial capacity to absorb the freed-up resources, and a move to less extensive production methods may not always be possible, as it often relies on the availability of off-farm income.

Where resources are permanently withdrawn from agriculture, there can be a danger that they depreciate (human-made resources, such as farm roads and buildings, irrigation and drainage systems) or degenerate (natural resources and landscapes). However, these effects can be mitigated where reductions in support levels are accompanied by efforts to ease the adjustment process in the sector. Such efforts could involve measures to increase labour mobility, stimulate rural development and provide temporary compensation to farmers (see also Primdahl et al. (2002) for an examination of the environmental effects of EU agri-environmental policies, and Edwards and Fraser (2001), who examined agri-environmental policies in the context of the Uruguay Round).

Future developments in domestic environmental measures and multilateral environmental agreements are also expected to have an increasing influence on the EU's farming sector for three reasons:

Progress in reducing environmental pollution from industrial and household waste is shifting the focus to the agricultural sector, as its share in total emissions for certain

pollutants, especially nitrates and phosphates, has risen. As a result there is growing pressure that the tax and regulatory measures that are commonly used to control pollution from industry and households should also be extended to cover the agricultural sector, which has often been exempt from such measures, that is to say the application of the polluter-pays principle. The EU's 6th EAP highlights the need to deepen the integration of environmental concerns in other policies, including agriculture, further.

Given that agriculture is the major user of land and water in most EU countries, environmental policies that address resource-depletion issues and the conservation of biodiversity and landscapes inevitably involve agriculture. In the case of landscapes, as noted above the EU's 6th Environment Action Plan, emphasizes the need to ensure that landscape protection, preservation and restoration is properly integrated into the objectives, measures and funding mechanisms of the EU at local, regional and national level, while the European Landscape Convention foresees measures to identify and assess landscapes, to define quality objectives for landscapes and to introduce relevant measures.

There are an increasing number of multilateral environmental agreements which have implications for agriculture, some operating at regional scales such as the European Landscape Convention, and others operating at the global scale, for example the Convention on Biological Diversity and the UNESCO World Heritage List (Mitchell and Buggey 2000). The commitments established under these agreements are already having an impact on agriculture in EU countries, for example, the implementation of national biodiversity action plans, which include biodiversity and landscape conservation in agriculture.

Future policy challenges

Policy measures

The OECD work on agriculture and the environment leads to several preliminary conclusions of relevance to policymakers, with a view to improving the environmental performance of agriculture, including landscapes (OECD 2001a):

- Improving the environmental performance and sustainability of agriculture will contribute to the long-term aim of ensuring the sustainable management of natural resources and landscapes;
- To ensure that agriculture is environmentally sustainable it is necessary that the sector is also economically and socially sustainable;
- A coherent approach to agricultural, environmental and rural development policies will contribute to achieving agricultural sustainability and improving the environmental performance of agriculture, while due recognition needs to be given to regional diversity and local priorities in policies;
- The reform of agricultural policies, as agreed at successive meetings of OECD Agriculture Ministers (OECD 2002) and further endorsed by the Doha Development Agenda, to allow for a greater influence for market signals in agricultural production, is necessary and needs to be strengthened, but may not be sufficient to improve environmental performance in agriculture where markets are lacking or incomplete, such as for landscapes;
- Well-targeted environmental measures to address environmental issues might be necessary to complement agricultural policy reform, such as hedgerow maintenance;

- Agricultural policies have often provided substantial support to agriculture and have distorted the allocation of resources in agriculture, the farm practices used, and thus the baseline from which to assess environmental performance;
- While agriculture generates both beneficial and harmful environmental effects, policy measures have in general not dealt with these effects in a balanced way; given the continued support from agricultural policies (including agri-environmental measures) and the rare application of the polluter-pays principle in agriculture, policies have tended to take more account of the environmental benefits than of the harm from agriculture;
- Reference levels (or benchmarks) and well-defined property rights to distinguish between the beneficial and harmful effects need to be established and made more transparent;
- OECD countries are committed to apply the polluter-pays principle to account for the harmful environmental effects of economic activities; although there may be some difficulty in implementing this principle in agriculture, greater efforts should be made to move in that direction;
- Farmers are often not well aware of the environmental costs and benefits of their activities, or of the practical possibilities to improve environmental performance; greater attention to the better application, provision and dissemination of knowledge to farmers and drawing up codes of "good agricultural practices" can help farmers to adopt sustainable farming methods, and to reflect the environmental effects in their decisions;
- A range of policy measures, approaches and mixes of policies to address environmental issues in agriculture are needed, to reflect the variety of agri-environmental situations and perceptions regarding the role of policy;
- Exploring the potential for markets and innovative market-based policy approaches to address environmental issues, and to reflect environmental externalities, deserves more attention, including for landscapes.

Regarding the use of alternative policy approaches and instruments, the analysis points to the following preliminary conclusions, although further work is needed to substantiate them:

- Regulatory measures may be most appropriate where environmental damage from a specific farm practice could be severe and the loss irreversible, such as destruction of historic farm buildings, where rapid results are required, and there is little diversity in agri-environmental conditions;
- Economic instruments – incentive payments or disincentive charges or taxes – can be applicable where there is diversity among farmers as to the environmental outcomes of farm practices, where farmers' responses can reflect their specific situations, and where possibilities exist to exploit differences through, for example, tradable permits;
- Cross-compliance (eligibility for farm-income support conditional upon farmers taking environmental actions) measures may apply where farm-income support measures remain in place and there is a correspondence between the activities covered by support measures and environmental problems;
- Co-operative approaches could be appropriate to address specific local environmental and landscape issues, where farmers can benefit from local experiences and demonstration projects to farm in more sustainable ways, and can internalize their efforts through lower costs or higher market returns.

Information, advice and training programmes might be applied to enhance the general awareness of farmers to farm in environmentally sustainable ways and protect certain landscape features, which would also be financially viable, complemented with research and development and co-operative initiatives. In designing and implementing any of the policy measures and approaches to improve the environmental performance of agriculture, they need to give the right incentives to encourage and not impede improved environmental and landscape-conservation performance by farmers; where existing agricultural policy measures are contributing to harmful effects on the environment and landscapes, these measures should be reformed before new measures are introduced.

Payments should only be used where necessary to achieve a programme's environmental objective, taking account of available alternatives. In order to ensure that any payments are cost-effective in achieving their objectives to provide environmental and landscape benefits and do not distort agricultural markets, they need to be:

- transparent in their objectives and operation;
- targeted to ensure the provision of the benefits, which would not be otherwise provided above the recognized reference level;
- tailored to particular environmental situations, limited to cover the costs of providing the benefits, and accompanied by adequate advice and information;
- evaluated as to their environmental effects, the results of which would feed back into the possible adapting of programmes to ensure that they meet environmental needs through alternative lower-cost solutions;
- monitored to ensure compliance and cost-effective implementation.

To the extent possible, any payments should be linked to environmental outcomes, such as landscape conservation or farming practices which determine those outcomes, rather than the volume or type of production or factors of production not directly related to the environmental outcome; payments should also be based on sound science of physical, biological and socio-cultural processes to ensure that farming practices attain desired outcomes and avoid unintended damages. To be consistent, incentives for environmental benefits should be used in parallel with penalties for environmental damage; any incentives and penalties should not be restricted to farmers, but available to any landowner able to contribute to improve environmental and landscape-conservation performance.

Policy monitoring

The process of nationally and internationally monitoring the state and changes in agricultural landscapes for policy purposes is at an early stage of development. There is, however, an active process underway in many countries and international organizations to improve understanding and monitoring of changes in agricultural landscapes. To inform policy-monitoring and decision-making in the landscape context better, future research might be strengthened by responding to a number of key questions.

What is meant by agricultural landscape, including "cultural" landscape? Improving understanding of the linkages between the various elements that create landscapes – i.e. structure, function and value – will help to explain and identify better the cause-and-effect relationships that are changing agricultural landscapes. It is also apparent that biodiversity and landscape processes, structures, functions and values are linked, but past research has given little attention to these relationships (Mac et al. 1998). In this context an issue that deserves special attention in the policy sphere, is

that the public demand for landscape in general is to maintain heterogeneity, while the process of expanding and improving the efficiency of agricultural production tends to lead to landscape homogeneity. In some cases, however, a homogenous landscape can be highly valued by the public (e.g. grassland). There is an active discussion in the scientific community as to the consequences of altering the mix between heterogeneity and homogeneity in the context of biodiversity (Mac et al. 1998). This discussion might provide useful insights in the case of landscape, so that it is possible to evolve beyond stereotyped 'industrial agricultural' and 'garden of Eden' views of landscape, to a more positive discussion of examining landscape in the wider context of sustainable agriculture (Williams 2000).

What aspects of the agricultural landscape should be measured? The development of landscape typologies and classification systems holds the possibility of providing a framework and reference base for identifying which elements of a landscape need to be monitored for policy purposes. This might enable the spatial delineation of homogeneous landscape units which can capture the site-specific character of landscapes necessary in those cases where agri-environmental measures are used for landscape conservation. In Europe, for example, the European Soil Bureau has undertaken extensive research concerning land-use information systems as they relate to landscapes, see the EEA (1995); Heinele, Eckelmann and Thomasson (1998); Mansvelt and Lubbe (1999); Meeus, Wijermans and Vroom (1990); and Wascher (1997; 2000b). For Norway, see Nersten et al. (1999) and Puschmann (1998); for Switzerland, see OFEFP (1998); and for work on the countryside character of England, see the Department of the Environment (Haines-Young et al. 2000).

Can comparisons of changes in agricultural landscape be made over time and across countries? Before comparisons based on indicators or other monitoring tools can be become more widely accepted and comparable across countries, it will be necessary to develop criteria to help better establish which landscape features, especially cultural elements, on agricultural land should be monitored. These criteria would mainly include determining whether the designated landscape feature: is commonly recognized as defining regional/national agricultural landscape character; is the direct product of agricultural activities or is clearly associated with agriculture; is linked to a particular public/private landscape-conservation initiative or measure; can be easily quantified; and has public resonance.

How can the changing state and trends in agricultural landscape be interpreted? The interpretation of trends of whether agricultural landscapes are deteriorating or improving in quality will ultimately depend on what society determines are important landscape features on agricultural land, which, in turn, is a reflection of public cultural and heritage values, aesthetic preferences and other values (Figure 7). Interpreting trends in landscape quality requires further research because of a number of difficulties, such as measuring societal preferences and values; determining the extent to which agricultural activity is the major cause of improvement or deterioration in certain landscape features (e.g. some linear features such as tracks and paths); and distinguishing between reversible and irreversible changes in landscape changes. A loss in dry stone walls, for example, is potentially reversible as they can be replaced, but the loss of an historic building, monument or site is clearly irreversible, and thus, a permanent loss to a nation's cultural heritage.

Is it possible to obtain better information on how different farm-management practices alter the quality (supply) of landscape and what costs are involved in farm-landscape conservation? Existing information on agricultural landscape-management practices and conservation costs could be further exploited, especially those covering

government measures that address landscape issues in agriculture, and surveys of farm-management practices. While information does exist concerning the payments to farmers for landscape conservation, it is not always clear as to the precise objectives of these measures, nor the methods by which they are being monitored and evaluated. Further information on regulatory measures, community/voluntary approaches and private initiatives in the landscape area would also be valuable, so that countries could share different experiences in addressing landscape-conservation issues.

How can the value society places on agricultural landscapes be better measured to inform policymakers of the demand for landscapes? One way to determine the value and demand for agricultural landscape conservation is through the use of various landscape-valuation techniques. While information on public landscape expenditures, such as on rural tourism appears limited, this is an area where possibly data sources have not been fully investigated or systematically collected. Some caution would be required, however, in using data related to such expenditures between regions of high touristic interest and less accessible remote areas, and also because of significant differences in the level of income between countries. With regard to the non-market valuation of landscape preferences, there remain considerable limitations concerning methodologies to achieve this. For example, it may be difficult to separate the relative importance of differing attitudes to money, cultural expectations and norms in valuing landscape. The brief review of contingent-valuation method (CVM) studies in this paper provides evidence that landscape valuation is possible at broad regional/national scales, which can help to inform the policy debate on landscape better. A more comprehensive effort to review non–market valuations of agricultural landscapes could be undertaken, while the utility of CVM and other such techniques might also be improved through an international effort to develop guidelines that would seek to harmonize data collection and valuation approaches. This would help to improve both the confidence and comparability of results from CVM studies within and across countries.

What role can projections of future changes in agriculture's impact on landscape play in helping policy decision-making? Providing policymakers with projections of possible future trends in agricultural landscapes can help highlight possible trends that merit specific policy actions and also facilitate the process of forward landscape planning. However, the research into projections of future agri-environmental trends is still at a fairly rudimentary stage, and to date largely draws on models used for agricultural commodity supply and demand projections (e.g. see OECD 2001b). Extending these models to cover agricultural landscapes presents an even greater challenge for researchers, although a better understanding of likely land-use changes, which can be more easily encapsulated into projection models, both between agriculture and other land uses and within agriculture, might initially provide a better grasp of future landscape trends.

The evolution of agricultural, environmental and trade policies over the period toward 2020 will present a major challenge to farmers, the agro-food industry, trade relations, and policymakers seeking to improve the quality of agricultural landscapes. This will involve reconciling the trade-offs between the need to increase agricultural production to provide food and other agricultural commodities at affordable prices, expanding trade, addressing the social concerns of rural communities, while enhancing environmental conditions in agriculture, including the conservation of landscapes.

Some progress has been made in reducing the environmental harm and enhancing the benefits from agricultural activities, such as improving in agricultural landscape

quality across Europe over the 1990s. In the future this progress can be built on toward achieving an environmentally sustainable agriculture that is compatible with agricultural policy reform and freer trade, and meeting societal expectations for improvements in environmental performance, including agricultural landscape quality.

Acknowledgement

The author wishes to thank OECD colleagues for comments and assistance in preparing this paper. Any remaining errors in the paper are the responsibility of the author, and the views expressed do not necessarily reflect those of the OECD or its Member countries. For further information regarding the OECD work on agricultural biodiversity and landscapes please contact Kevin Parris at the E-mail address above or visit the OECD website at: http://www.oecd.org/agr/env/indicators.htm.

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