Session 5C

Changes in Land Use

Chairman & Session Organiser:	Professor Melvyn Askew *Census-Bio, Wolverhampton, UK*
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Land use policy with particular reference to UK

M F Askew
Census-Bio, Haddo House, Keepers Lane, Wolverhampton, WV6 8UA, UK
Email: mfa@census-bio.com

During World War II there was an obvious need in UK to maximize food production from both agriculture and horticulture, even in less favourable areas of the country.

Immediately post World War II formalisation of future objectives for land use led to the introduction of a longer term and subsidised food production policy for farmers and some horticulturalists UK. Fundamentally this strategy involved the British Government in paying deficiency payments based upon the difference between the average market price and the guaranteed price for the particular product concerned. This guaranteed price was arranged each year under annual price review arrangements put into place by the Agriculture Act of 1947. At this time too there was a considerable supply of food coming into UK from former and existing British colonies worldwide.

In addition to this key element of a cheap food policy a range of other regulations and grant-aided initiatives were in place. These were primarily targeted at enhancing production of produce *per se* (e.g. Drainage grants; upland improvement grants; liming grants) or at enhancing wider agricultural business profitability (e.g. buildings improvement grants; farm business/ horticultural management schemes).

At the same time however came the recognition of the environmental and non-agricultural value of some areas of the UK countryside and over a long time period a range of National Parks and similar sites of outstanding natural beauty or value were designated and managed to maintain their special characteristics. This management impinged upon both agricultural and wider issues in the rural environment and economy.

However the accession of UK to the then European Economic Community (EEC), now the European Union (EU), created a need for standardisation of agricultural and horticultural strategy within the so-called Common Agricultural Policy (CAP). The intention of CAP was to provide 'a reasonable income' for farmers and horticulturalists. The key difference between the CAP approach and that of the former deficiency payments schemes was that the latter supplemented the farmers' income where there was a deficiency between the guaranteed price and the average market price achieved for the particular produce whereas the EEC CAP attempted to manage markets and through a simple concept of managing supply relative to demand and thereby maintaining market prices with a beneficial knock-on effect upon incomes for farmers.

Market management schemes have varied over time but have included the purchase from the market of primary foods and their denaturing; intervention buying, storage and frequently, their being sold off at a discounted price to countries outside EEC/EU. Hence farmers received a 'reasonable' income from the marketplace but the cost to the EEC/EU treasury was very significant, CAP being the major cost item in its expenditure. The impact of this change in policy for British agriculture and land use was a significant increase in arable crops production, especially in combinable crops like cereal and oilseeds. There was similar reaction in other EU member states.

Impacts of EEC/EU land use policy and the production coming from it was clearly unsustainable in the longer term and had some negative impacts on wider world trade. Under the General Agreement on Tariffs and Trade (GATT) legal challenges were made and in the case of EU oilseeds led to the decoupling of aid from tonnage production. Instead, payments for the crop in question, for example oilseed rape, were transferred to a land area basis. This occurred following the US claim to GATT about unfair competition and lead to the EC/US Oilseed agreement which effectively capped production of aided oilseeds in the EU food sector. In essence this was the beginning of the decoupling of aid from production and in the oilseeds situation took place under the Oilseeds Transition Scheme. This latter was quickly subsumed by the MacSharry reforms of EU farm policy with concomitant impact upon land use, no least since the concept of non-cropped arable land was launched, as set-aside. Some production of crops to produce products or the non-food sector was permitted on set aside land tough the rules were complex and sometimes expensive to comply with.

However since Agenda 2000 in EU and the revision and reform of CAP (with some exceptions) decoupling of production from aid has continued, as Pillar II of CAP with its emphasis on managing land for environmental benefit had superseded the old system (Pillar I) with its emphasis upon direct aid for production. This has occurred or is occurring throughout EU 27.

The upshot of this has been the introduction of Single farm Payment, payable to farmers provided they farm in an acceptable environmentally sensitive way. This is called cross compliance; it could mean that land is not farmed in the traditional sense at all, but remains free of traditional arable crops.

Whilst the general thrust of land use has been to 'abandon' food production in the directly aided sense, some other policy changes which impinge heavily on land use have occurred. These include revision of the EU sugar regime and its effects upon cutting sugar beet production in UK and causing a total cessation of production in countries like Republic of Ireland and Finland, with potentially very significant impact of land use and land stability in some cases; a range of initiative under several EC Directives upon the introduction of renewable energy and fuels. These include biodiesel and bioethanol as substitutes for fossil derived diesel and gasoline respectively. The impact of these new initiatives has been to cause significant sifts in production of some crops both in UK and elsewhere. This in turn has led to the potential conflict of production of food versus the production of fuel. Whilst the evolution of second generation biofuels in particular may ease this conflict estimates of the time for commercialization of such developments vary from 10 to 20 years. In the interim, small land area countries like UK have the dilemma of how to achieve all the targets set in terms of food and on-food produce for their primary industries.

Clearly one approach may be to grow what is feasible and environmentally acceptable as home produce and then import the remainder from, for example, Brazil or Africa, in the case of bioethanol. This, however, is now creating some ethical concerns in terms of potential exploitation of less economically developed countries as well as having suggested adverse impacts upon important ecosystems and associated wildlife. The 'biofuels are bad for you' slogan has been seen several times recently. How countries like UK resolve their land use policies to overcome such conflicts and concerns remains to be seen.

Land use after CAP reform

J S Marsh
15 Adams Way, Earley, Reading, RG6 5UT, UK
Email: johnmarsh27@ntlopenworld.com

The reform of the CAP is an ongoing project rather than an abrupt shift to a new policy. The 2003 reforms took further the MacSharry reforms and attempted to give effect to the radical principle that production should be determined by markets and environmental and social issues should be targeted by policies that were decoupled from production. This shift was prompted by the need to prepare for a further round of WTO negotiations and the wish to assert the multifunctional nature of EU farming. However the changed philosophy has not been put fully into effect. At this stage some countries continue 'partial coupling' to production. Some commodities still have to be reformed and others, sugar, wine and milk although changed are still essentially product focused. The environmental and social policies that are intended to be covered by rural development (Pillar II) expenditures are still not fully operational.

In 2008 the Community is to undertake a 'Health Check', examining how successful the reformed policies have been and undertaking adjustments to make them more effective. The Commissioner for Agriculture, Mrs Fischer-Boel, has been at pains to indicate that this is not another 'radical' reform. More significant in the long run may be the negotiation of a new financial perspective. This is likely to involve greater demands from new member countries and reduced willingness to pay by the more affluent Western European countries, including those that have been net recipients under the existing CAP. What is clear is that both the market and the regulatory factors determining land use will change.

Traditionally land use has been determined by markets and the preferences of land owners. The current appearance of the rural landscape is largely the outcome of this process – one that has embodied continuing change and yet given rise to a countryside that is treasured. Currently this approach to land use is being overtaken by the preferences of people who neither own land nor make their living from it. What land owners are allowed to do with their land is constrained by a multiplicity of planning law, regulations about farming practice, the institution of a 'right to roam' and prohibition of some traditional country sports. The economic justification for this is that autonomous processes have given rise to market failures ranging from pollution of land, water and air to the loss of biodiversity and the habitat for some treasured species. More elusively there has been a change in the flow of 'public goods' resulting in changes in the appearance of the countryside and in wildlife that are regarded by powerful pressure groups as a loss. In response to this a complex web of regulations and subsidies has been developed, most recently in the Pillar II, rural development programmes of the CAP.

The greater freedom allowed to commodity markets in the reformed regimes means that the level and mix of farming activity will change and become more volatile. The critical issues relate to global product prices and European factor costs. Global product prices are expected to be firm as a result of rising real incomes in many emerging economies and increased demand for bio-fuel. This expectation may not be fulfilled. Given the prospect of profitable markets the potentials of productive technology are likely to be more vigorously pursued. Land use becoming more intensive in the process. At the same time, bio-fuels,

whilst having specific role in energy supplies will have to compete with enhanced production from other sources, coal and nuclear, which have very heavy start up costs but relatively low running costs.

European factor prices, both labour and land, are likely to remain higher than those in other parts of the world. This is partly the result of a relatively high real income level and partly because Europe is densely populated. Thus to compete in the market farmers will have to achieve higher levels of productivity. In seeking to do this they may be impeded by the readiness of the state to outlaw new technologies that seem to have high political risk factors. If this is the case a competitive agriculture in Europe will be smaller and sustained farming activity over a substantial area depend upon publicly funded subsidies.

New technology will play a major role in determining the shape and size of profitable agricultural industries world wide. Precision farming has the potential both to increase productivity and to reduce the environmental impact of agricultural production. Targeting more precisely the use of any fertiliser or feed inputs, the supply of water and minimal cultivation is a win- win situation. The use of both plant and animal breeding to overcome pests and diseases and to secure a much better match to the needs of markets will add value to output. Such developments require substantial investment both in research and in farming and related businesses. Sadly, the neglect of public support for production related research and for its application in much of Europe has diminished the capacity of the sector to develop and take up new technologies. Europe may well find itself to be a net importer of improved methods developed in the private sector for global markets with less regard both to their appropriateness for European conditions or their impact on public good values. A key to competitiveness is management. Substantial changes have been taking place within the UK. The post war model of a state provided advisory service seeking to raise the standards of all farmers has disappeared. In its place there are private consultancies, sometimes receiving ad hoc funding from government, that advise farmers who are prepared to pay. In addition, an important part of UK farming is now controlled by management companies. These organisations can hire educated, energetic and adequately funded managers to secure very high levels of productivity. Farming is no longer a traditional life style but a science based business. The supply of people of talent into this sector is critical and for much of Europe a growing problem as agricultural universities decline.

It seems probable that, even making use of the best technology, markets will not justify the continued use of less productive land in traditional commodity production. In a market based farm sector productivity will grow but this will be largely the result of the least efficient dropping out. Significant upland and remote regions may resort to extensive farming, such as ranching, to forestry or to abandonment. The outcome is likely to depend upon the willingness of the state to fund, under rural development or environmental policies. In effect their occupiers will depend like other state employees on the sustained generosity of the taxpayer.

Land use will also reflect changes in climate. The pace of change on the ground is relatively slow compared with the speed at which policy shifts. Thus it is more likely to be policy rather than climate that results in changed land use in the immediate future. Policy has two options, mitigation and adaptation. In practice mitigation at the scale of the UK can have very little impact on climate change.

Future land use and the provision of public goods

M I Avery
Royal Society for the Protection of Birds, The Lodge, Sandy, Bedfordshire, SG19 2DL, UK
Email: mark.avery@rspb.org.uk

Future land-use and the provision of public goods

Our understanding of the role that farming and land management play in the delivery of public goods and ecosystem services is growing. Agricultural policy needs to evolve further to ensure the provision of these benefits. This paper describes why public payments should be made to landowners to encourage the delivery of public rather than private goods. It also argues that new pressures resulting in changes in land use could threaten the continued delivery of public benefits from farming and overwhelm the evolving system for securing their delivery. This makes the need for better quantification of environmental public goods from land management an urgent imperative.

Public goods from farming

Farming provides Society with private, material goods, including food, fibre and fuel, which are marketable. In addition, however, and in contrast to many other industries, farming also produces public goods which we all benefit from, such as clean water, a stable climate, healthy ecosystems, wildlife and beautiful landscapes. Markets fail to value public goods appropriately, and they are often therefore delivered at sub-optimal levels unless Government intervention, in the form of tax incentives, subsidies or regulation, corrects the market failure.

Support for public goods from farming

The system of public support for agriculture is changing. We are moving from subsidising marketable products to supporting delivery of public goods. Successive CAP reforms have resulted in decoupling of direct support for agriculture, along with the introduction of cross-compliance and diversion of funds to the Rural Development Pillar of the CAP. However, the framework for supporting the public benefits from farming remains at a primitive stage in its development and funding is extremely limited.

Cross compliance, whereby receipt of public funds depends on respecting a common baseline of environmental protection, has been implemented inconsistently across the EU and in many countries fails to protect landscape features and farm habitats.

Agri-environment, the key tool in the CAP for delivering targeted environmental public goods, now receives approximately 5% of the CAP budget. Whilst there are many examples of its effective use, such as the cirl bunting special project in England and the Castro Verde scheme in Portugal, there are equally many examples of schemes that pay for practices that have no clear environmental benefit above the baseline. As experience in scheme design and implementation has increased, it has become increasingly evident how effective schemes should be designed and in many countries, including the UK, these lessons are being applied.

Future land use change

This embryonic system for supporting the public benefits of farming needs to continue to develop both in terms of size and quality of programmes if the UK and the EU are to meet their environmental commitments, including halting biodiversity decline by 2010. However, there are new pressures on land use that threaten the continued delivery of public goods from farming, and unless these are accounted for and managed, these could threaten the current framework for supporting environmentally positive land management.

A number of trends that will affect land-use over the next decade are evident:

- The growing market for bioenergy may result in large areas being devoted to this management;
- The incentives to produce will be further amplified by demand from a global population that is growing in size and affluence;
- Building new homes will reduce the overall area under agriculture;
- The requirement to bring water bodies into good ecological status by 2015 will result in some areas being taken out of production;
- Adaptation to climate change and water quality objectives will require wetland creation and river catchments to be restored to a more natural function;
- New public goods, such as carbon sequestration, may be identified and prioritised for increasing public support.

These potential changes pose both opportunities and threats to farming and to the continued delivery of public benefits. Successfully managing this transition will require further changes to how agriculture is supported to ensure that sufficient funding is available to pay for the management required for public good delivery.

Securing the delivery of public goods from farming in the future

The need to move from the current CAP to a policy designed to support and incentivise the public benefits of land management is an urgent imperative if Europe's countryside is to meet the environmental challenges it faces over the coming decades. In 2008, the European Commission will be reviewing the 2003 CAP reform as part of the CAP health check process. Following this, the EU is committed to a comprehensive review of all areas of EU spending as part of the budget review process that will set the EU's budget for 2014 to 2020.

The opportunity must be taken to ensure all CAP funding is explicitly linked to the delivery of public goods via Rural Development and agri-environment measures, and the performance of these schemes must be improved if farmers are to maximise their role in delivering public benefits and maintaining ecosystem services.

Global biofuels production trends and impacts on cropland use

R Wisner
Iowa State University, Ames, Iowa, USA
Email: wisner@iastate.edu

Global production of farm-based biofuels (ethanol and biodiesel) has expanded at an explosive rate in the past three years and appears likely to increase even more rapidly in the years just ahead. The most rapid expansions are occurring in the US, EU and Brazil. At least 41 nations are encouraging biofuel production in response to high crude oil prices, global warming, and energy security concerns. For the September 1, 2007-August 2008 marketing year that began on, the US Department of Agriculture projects the volume of US maize processed into ethanol to be 58% larger than in the previous season. The accelerated expansion follows a 38% increase in 2006-07 that allowed the US to displace Brazil as the world's largest producer of ethanol. Maize is the major ethanol feedstock used in the US, while cane sugar is used in Brazil. In some other countries, manioc is being used. Increased construction costs and higher maize prices have slowed construction activity some, but the industry continues to expand and likely will increase in size for another three or four years. Forces that will gradually slow the expansion include (1) higher maize and vegetable oil prices as the industry draws more land from other crops into maize and encourages production on fragile lands, (2) infrastructure challenges and an increasing ethanol supply that have already shifted the long-time premium of wholesale ethanol prices over gasoline to a discount and will likely cause increased discounts in the future, and (3) a downward trend in prices of distillers grain relative to maize and high-protein feed ingredients as supplies increase. Crude petroleum prices and government policies also will be key factors affecting the future size of the industry.

Dramatic changes in crop rotations are ahead

The major limiting factor in expanded production of corn-based ethanol is available cropland. With the rapid expansion in the ethanol and biodiesel processing industries, the next few years will see a substantial economic battle among crops for cropland. The economics of ethanol production suggest that maize is likely to come out ahead in that struggle in the US, with the soybean industry losing export share of beans and oil to South America. Already, in 2007 in the US, maize planted area increased by 19%. The increase was made possible by decreases of 16% for soybeans, 24% for cotton, 4% for rice, 7% for oats, and 12% for non-durum spring wheat. Current US distilleries under construction will more than double the existing ethanol production capacity. Most of these plants will come into production within the next 12 to 20 months. Several more planned plants are about to begin construction soon. These developments virtually guarantee that maize prices will need to be high enough to attract substantially more cropland and marginal land from other crops into maize.

Where will the maize-based ethanol industry level off?

The US ethanol industry likely will begin to level off at about 5.5 billion bushels of maize (about 140 million tons) processed into ethanol – with the industry probably reaching that level in three and one-half to four years. Ethanol production likely will equal about 11% of US gasoline usage, in volume terms. After that level is reached, a slow expansion appears likely for several years. The 5.5 billion bushels is equivalent to slightly over half of lastyear's US maize crop being processed into ethanol. The transition of US and foreign

agriculture to a major producer of energy as well as food and fibre is one of the most rapid changes in history of North American agriculture. It is creating dramatic shifts of cropland into maize and sharply increased demand for fertilizer, seed corn, other inputs for corn production, and a sharply increased need for grain handling, drying and storage facilities as well as farm and agribusiness transportation equipment. Challenges in the crop input industries and sharply increased land rents are increasing the cost of producing corn and will be two of several factors behind rising corn prices.

Key issues for the future

Key issues for the future of the US maize-based ethanol industry include (1) the timing of an economical break-through in converting cellulose feedstocks to ethanol, (2) changes in automotive technology and possible production of biodiesel from algae, (3) trends in global crude oil supplies and demand, (4) impacts of increased maize use for ethanol on the level and variability of food prices and the livestock industry, and (5) US and foreign government mandates and subsidies for biofuel production. In the US it would not be surprising to see pressure from several sources to incorporate a type of 'Counter-Cyclical' ethanol blending credit or subsidy as an alternative to the present 51 cent per gallon (13.49 cents per litre) fixed blending credit. A counter-cyclical version would reduce the subsidy when ethanol and biodiesel prices are high, but might retain the current $0.51 per gallon for ethanol when prices are low.

A global perspective

Increased US ethanol production already has substantially tightened world coarse grain supplies, and more tightening will occur in the next few years. As an example of the global impact from the US ethanol industry, just the added capacity of US corn-based ethanol plants currently under construction is about 3.5 times the volume of US corn exported annually to Japan. The capacity under construction represents a volume of maize that is 15 percent larger than the record EU maize crop, and is equal to nearly 70% of global maize exports. Current economic indicators suggest that within four to five years, the US corn-based ethanol industry may use an annual volume of corn that is equivalent to 175% of current global maize exports. Global supplies are being tightened further by biodiesel and ethanol programs in Europe, Brazil, Canada, and a number of other countries. In Brazil in the past year, a moderate amount of cropland has been shifted from soybeans crops into sugar cane for ethanol. Aggressive biodiesel programs in Europe, Canada, the US and an emerging industry in Brazil also are increasing the demand for land to be used for palm oil production. Maize prices in the US have risen about 70 percent in the past year, despite the second-highest corn yield per acre in 2006. In the last two years, the US has not produced enough maize to meet market demand. Maize and feed grain supplies have been adequate only because large stocks had been built up before the current boom in ethanol production emerged. Sharply increased plantings this year will only provide temporarily adequate maize supplies.

With the growth of a large new relatively inelastic demand for crops for motor fuel, any serious weather problems in major US or foreign crop-producing regions can be expected to bring sharp increases in crop prices and, with time lags, sharply increased food prices. Just how inelastic the demand for corn for ethanol proves to be will depend both on the world crude oil market and on government mandates for ethanol and biodiesel production. It will also depend on whether there is an escape clause in the mandates in case of adverse weather and poor crops.

RELU-Biomass: social, economic and environmental implications of increasing rural land use under energy crops

A Karp, A Riche, I Shield, A Haughton, D Bohan.
Rothamsted Research, Harpenden, Hertfordshire, AL5 2JQ, UK
Email: angela.karp@bbsrc.ac.uk

A Lovett, G Sunnenberg, A Bond,
School of Environmental Sciences, University of East Anglia, Norwich, NR4 7TJ, UK

J Finch, P Rosier
Centre for Ecology and Hydrology, Wallingford, Process Hydrology Section, Maclean Building, Crowmarsh Gifford, Wallingford, OX10 8BB, UK

M Turner, J Farrar, G Martin
Centre for Rural Research, School of Geography, Archaeology and Earth Resources, Lawfroda House, St German's Road, Exeter, EX4 6TL, UK

R Sage, M Cunningham
The Game Conservancy Trust, Fordingbridge, Hampshire, SP6 1EF, UK

Government policies are encouraging more land use under biomass crops. In the UK the most advanced biomass crops are willow, grown as short rotation coppice (SRC), and Miscanthus grass. These crops will make an important contribution to the UK's commitment to reducing CO_2 emissions and are grown under low input agriculture. However, they are quite different from arable crops and it is not clear how planning decisions based on climate, soil and water should be balanced against potential impacts on the landscape, social acceptance, biodiversity and the rural economy.

RELU-Biomass will assess the potential impacts of increasing rural land use under SRC willow and Miscanthus in comparison with arable crops and grassland, by comparing rural economics, social acceptability, landscape character, water use and biodiversity. The results will be used to: (1) Develop an integrated scientific framework for Sustainability Appraisal (SA) of conversion of land to energy crops; (2) Evaluate the implementation of the SA framework; (3) Update Best Practice Guides for planting short rotation coppice (SRC) willow and Miscanthus; (4) Provide the scientific tools for Environmental Impact Assessments and Strategic Environmental Assessments of planting of energy crops

Two contrasting regions of the UK are being used as study areas: (i) The arable cropping dominated system of the Midlands and Eastern Counties and; (ii) A grassland-dominated system more typical of the South West. Both have been classified as being within contrasting geographic, farming and Environmental Zones. They also contain some of the greater densities of existing energy crop plantings and are likely to see new plantings in the near future. To assess the public acceptability of landscape impacts, GIS-based 3D landscape visualisations will be used within a framework of stakeholder consultations and focus groups. In the hydrological studies, measurements are being taken in SRC willow and Miscanthus fields. Data are being input into a physically-based, numerical model, the Joint UK Land Environment Simulator (JULES), to predict the impact of land cover change resulting from planting energy crops on river flows.

For the research on impacts on farmland biodiversity the methodology developed for the Farm Scale Evaluations (FSE) of genetically modified, herbicide-tolerant crops is being used. The FSEs developed techniques that can be applied in a wide variety of cropping situations using repeatable sampling protocols. Employing these sampling protocols in this study will allow direct comparison of measures of biodiversity associated with biomass crops with the biodiversity of arable crops for the first time.

The economic assessment is encompassing both farm-level and wider rural economy impacts, and is closely integrated with other areas of the research programme through being informed by and, in turn, informing work modules in other disciplines. The initial construction of farm economic models is using information from the GIS, bio-diversity and hydrological study areas to build case-specific models; these will later be validated and augmented by the extended dataset derived from the farm survey work. The models will compare baseline and alternative scenarios to estimate the implications of change on the wider rural economy, the outcomes for which will be used in completing the scientific conclusions.

A Sustainability Appraisal (SA) approach is being used to provide an integrated assessment of the implications of greater energy crop planting. SA is an environmental assessment methodology that systematically examines the extent to which the implementation of a plan or strategy would achieve sustainable development. The SA approach has been chosen for RELU-Biomass because it: (i) encompasses social, economic and environmental objectives (ii) is suitable for landscape scale evaluations (iii) can be adapted to compare the implications of different planting scenarios (iv) is currently being used in a range of regional and local planning frameworks (v) utilises much existing work on sustainability indicators but permits some flexibility in the measures employed.

The RELU biomass project has only completed one full year and it is, therefore, too early to provide many results. Energy crop plantings have been located for both crops (Miscanthus and willow) and biodiversity and hydrological measurements are currently being conducted for the second of two successive sampling years. Observations so far indicate patchiness for weeds within sites and variability between sites which is probably related to management. Both crops do have weed and invertebrate diversity, including moths. The first bird studies for Miscanthus are being conducted now and have revealed birds within the crop. Scoping activities for a large social survey suggest that in many areas the public have little knowledge of energy crops. Photographs of planted areas in different locations showing different visibility from the roads/homes have been taken and general fact statements prepared to use in public surveys. GIS suitability mapping for energy crop plantings for both regions are being carried out in which the different constraints are being layered in. Stakeholder meetings (in the South-West and East Midlands) were held at the beginning of 2006 and 2007 for the sustainability appraisal. Objectives for each region have been drawn up and compared with objectives for the regional strategies. Indicators and targets are now being identified. The project is on schedule to deliver an holistic assessment of the impacts of increasing rural land use under biomass crop in 2008/09.

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