Barling, D. (2011). The challenges facing contemporary food systems: European policy and governance pathways to sustainable food consumption and production. Agronomie, Environnement & Sociétés, 1(2), pp. 15-25.

CITY UNIVERSITY LONDON

City Research Online

www.agronomie.asso.fr
Décembre 2011
volume n°1 / numéro n°2

Agronomie
environnement & sociétés

Défi alimentaire et Agronomie

Enjeux alimentaires : quels défis pour l'agronomie ?

Rendements et qualité sont-ils conciliables ?

Nouvelles structurations et fonctionnement des bassins de production alimentaire.

Quelle utilisation de l'espace en zone rurale et périurbaine ?

Défi alimentaire, politiques agricoles, environnement.

La revue de l'association française d'agronomie

Association Française Agronomie

Agronomie, Environnement & Sociétés

Revue éditée par l'Association française d'agronomie (Afa)

Siège : 16 rue Claude Bernard, 75231 Paris Cedex 05.
Secrétariat : 2 place Viala, 34060 Montpellier Cedex 2.
Contact : douhairi@supagro.inra.fr, T : (00-33)4 99 61 26 42, F : (00-33)4 99 61 29 45
Site Internet : http://www.agronomie.asso.fr

Objectif
AE&S est une revue en ligne à comité de lecture et en accès libre destinée à alimenter les débats sur des thèmes clefs pour l'agriculture et l'agronomie, qui publie différents types d'articles (scientifiques sur des états des connaissances, des lieux, des études de cas, etc.) mais aussi des contributions plus en prise avec un contexte immédiat (débats, entretiens, témoignages, points de vue, controverses) ainsi que des actualités sur la discipline agronomique.

ISSN 1775-4240

Secrétaire de rédaction
Philippe PREVOST

Assistantes éditoriales
Sophie DOUHAIRIE et Danielle LANQUETUIT

Conditions d'abonnement
Les numéros d'AE&S sont principalement diffusés en ligne. La diffusion papier n'est réalisée qu'en direction des adhérents de l'Afa ayant acquitté un supplément
(voir conditions à http://www.agronomie.asso.fr/espace-adherent/devenir-adherent/)

Périodicité
Semestrielle, numéros paraissant en juin et décembre

Archivage
Tous les numéros sont accessibles à l'adresse http://www.agronomie.asso.fr/carrefour-inter-professionnel/evenements-de-lafa/revue-en-ligne/

Soutien à la revue

- En adhérant à l'Afa via le site Internet de l'association (http://www.agronomie.asso.fr/espace-adherent/devenir-adherent/). Les adhérents peuvent être invités pour la relecture d'articles.
- En informant votre entourage au sujet de la revue AE&S, en disséminant son URL auprès de vos collègues et étudiants.
- En contactant la bibliothèque de votre institution pour vous assurer que la revue AE&S y est connue.
- Si vous avez produit un texte intéressant traitant de l'agronomie, en le soumettant à la revue. En pensant aussi à la revue AE&S pour la publication d'un numéro spécial suite à une conférence agronomique dans laquelle vous êtes impliqué.

Instructions aux auteurs
Si vous êtes intéressé(e) par la soumission d'un manuscrit à la revue AE&S, les recommandations aux auteurs sont disponibles à l'adresse suivante :
http://www.agronomie.asso.fr/carrefour-inter-professionnel/evenements-de-lafa/revue-en-ligne/pour-les-auteurs/

À propos de l'Afa

L'Afa a été créée pour faire en sorte que se constitue en France une véritable communauté scientifique et technique autour de cette discipline, par-delà la diversité des métiers et appartenances professionnelles des agronomes ou personnes s'intéressant à l'agronomie. Pour l'Afa, le terme agronomie désigne une discipline scientifique et technologique dont le champ est bien délimité, comme l'illustre cette définition courante : « *Etude scientifique des relations entre les plantes cultivées, le milieu* [*envisagé sous ses aspects physiques, chimiques et biologiques*] *et les techniques agricoles* ». Ainsi considérée, l'agronomie est l'une des disciplines concourant à l'étude des questions en rapport avec l'agriculture (dont l'ensemble correspond à l'agronomie au sens large). Plus qu'une société savante, l'Afa, veut être avant tout un carrefour interprofessionnel, lieu d'échanges et de débats. Elle se donne deux finalités principales : (i) développer le recours aux concepts, méthodes et techniques de l'agronomie pour appréhender et résoudre les problèmes d'alimentation, d'environnement et de développement durable, aux différentes échelles où ils se posent, de la parcelle à la planète ; (ii) contribuer à ce que l'agronomie évolue en prenant en compte les nouveaux enjeux sociétaux, en intégrant les acquis scientifiques et technologiques, et en s'adaptant à l'évolution des métiers d'agronomes.

Lisez et faites lire AE&S !

Sommaire

Enjeux alimentaires : quels défis pour l'agronomie

Article

The challenges facing contemporary food systems : European policy and governance pathways to sustainable food consumption and production

David BARLING
City University London, United Kingdom

Résumé

La sécurité, la résilience et la durabilité de l'approvisionnement alimentaire sont récemment remontés dans l'agenda des politiques publiques. Pour un approvisionnement alimentaire durable, les décideurs doivent examiner une série de challenges structuraux et fondamentaux à long terme, tant dans le domaine de la demande et de la consommation, qu'à propos de la production et de la capacité environnementale. Un discours politique clé a émergé autour d'un cadre de production et consommation alimentaire durable (SCP) soulignant le besoin de rééquilibrer les parties offre et demande de l'équation.

En Europe, les initiatives de politique publique prises dans ce cadre SCP se sont focalisées sur des interventions légères, comme le conseil au consommateur sur les choix alimentaires plus durables. Ce faisant elles utilisent souvent des critères marchands existant dans le secteur privé et préservés dans des dispositifs et logos de certification alimentaire et agricole. La Commission européenne commence à examiner les bases scientifiques et méthodologiques de l'identifi-cation et de la mesure de l'alimentation durable en essayent de travailler avec l'industrie alimentaire pour définir le cadre méthodologique de l'analyse environnementale du cycle de vie et afin de promouvoir l'objectif politique d'une Europe utilisant plus efficacement les ressources naturelles.

Mots-clés : Alimentation durable ; production et consommation durable ; gouvernance alimentaire ; politique publique européenne.

Abstract

The security and resilience of the food supply and its sustainability has risen up the public policy agenda in recent years. Policy makers must address a series of longer-term structural and fundamental challenges to a sustainable food supply that are situated both in demand and consumption and in production and environmental capacity. A key policy discourse has emerged around the sustainable consumption and production (SCP) of food, linking the need to rebalance the demand and the supply parts of the equation.

In Europe, the public policy initiatives within the SCP framework have focused upon softer interventions such as advising consumers of the more sustainable food choices, often using existing private sector market based criteria enshrined in food and agricultural certification schemes and logos. The European Commission is beginning to address the scientific and methodological basis for identifying and measuring sustainable food by attempting to work with the food industry in framing environmental life cycle assessment methodology and promoting the policy goal of a more natural resource efficient Europe.

Keywords: Sustainable food; sustainable consumption production; food governance; EU public policy.

Introduction

The global food supply faces significant challenges in terms of meeting the rising demand over the next few decades. The price rises for different food commodities and oil in 2007-8 delivered an external shock for policy makers to focus increased attention on the sustainability of the food supply now and into the foreseeable future. Contemporary policy discourse in Europe is seeking to further identify and measure the connections between the sustainability of food consumption and production. The terms of this discourse, and the policy activities that it is framing, are constructing a more detailed picture of the respective roles of all stages of food chains as well as the consumption and production ends in the use of natural resources and other environmental and social impacts. These policy debates are incorporating the actors and institutions and their interactions from the wider food system within which the food chains sit. There are overlapping and interrelated challenges, in terms of food demand and supply, that are being identified as structural factors or the "new fundamentals" (Barling *et al.*, 2008; Ambler-Edwards *et al.*, 2009; Foresight, 2011). These new fundamental challenges are spelled out in more detail below, and include: ecosystem loss and natural resource depletion of water, air, soil, and biodiversity, and the depletion of fossil fuel and phosphate reserves. The spectre of climate change provides an overarching framework for further dislocations of ecosystems, ecosystem resources and weather patterns in ways that are continuing to unfold, and for the emerging mitigation and adaptation

strategies. The fundamental challenges at the food consumption end are an increase in diet related ill health with its attendant economic costs in the developed world. In the developing world, diet related ill health is an unfortunate consequence of the nutrition transition to a westernised diet and is situated next to hunger and malnutrition.

Particular attention is paid in this paper to the European Union's emerging policy recognition and actions that are linking sustainable food consumption to its production. There are attempts to convey the environmental and social impacts of food products to the consuming public to help guide their purchasing and consumption choices, with the private sector deploying governance strategies along food chains to set standards for more environmentally benign production methods, often validated by certification schemes and accompanying logos and labels. However, the European Commission is stepping into this policy space with the 2020 strategy that includes a resource efficiency road map, and its drive to implement framework methodologies for measuring the environmental impacts of food and drink products.

Agronomy already fits into this picture of food system change as a key means of providing a more sustainable approach to the use of natural (and social) capital at the production end of the food chain through innovative and low impact growing approaches which manage better balanced resource use and provide mitigation and adaptation strategies to climate change. From this activity, agronomists can also provide the data and strategies to enable more accurate deployment of environmental footprint methodologies for food and drink products, such as through life cycle assessment methodology. Finally, agronomy can contribute to strategies for providing the means for the diversity of produce needed for a more sustainable and healthy diet for Europe's populations.

Structural challenges facing the food system and costing the externalities

The nature of the fundamental and structural challenges facing contemporary and future policy makers can be aligned in terms of supply and demand to reflect the production to consumption link, however some elements can fit under either heading. Land use, for example, is both a demand and supply factor, as demand for good fertile land for food production is often in heavily populated coastal and estuarial areas and river valleys and plains where there are residential demands. Equally, land is a prerequisite for food production while competing with a range of other demands, not least other non-food crops such as the large-scale production of biofuels to meet the competing demands for new energy sources. Some of the key natural capital elements that engage agronomists are: the natural resource depletion of air quality, water quality and availability alongside aquifer pollution and depletion, and the erosion of soil and decline in its fertility. The depletion of biodiversity and ecosystems are key further challenges that have been exacerbated by some modern intensive farming techniques, but at the same time are pre-requisites for maintaining future food production.

Climate change provides an overriding structural challenge to production, both in terms of potential regional climatic shifts and so changes in production locations, and rising sea levels effecting not just major population settlements but also highly productive agricultural land alongside salination of estuarial fresh water rivers. More immediately, recent years have witnessed more variable and extreme weather patterns and so the potential for severe harvest loss around the globe. Agriculture and the food chain are major contributors of greenhouse gases and so to the ill effects of climate change. In the UK, for example, the estimation of the food sector's contribution to greenhouse gas emissions is put at around 19% of the national total (Garnett, 2007). The approximation of food's contribution is that: agriculture contributes 38%, transport-related 16%, with around 10.5% each from food manufacture, household food activity and fertilizer manufacture. Retail, catering and packaging approximate at 5% each (Garnett, 2007). In terms of EU consumption it is estimated that the food sector contributes 31% of total GHG emissions (Tukker *et al.,* 2006). Modern agriculture and the food supply chain and its distribution are dependent upon fossil fuel based energy, and in the case of the former declining amounts of easily extractable phosphate. The just in time ordering upon which food distribution and

delivery increasingly depends to meet the demand side of the equation is also fossil fuel based bringing with it a new set of resilience and risk related problems (Ambler Edwards *et al.,* 2009). Some sectors of the food chain are low paid, such as food service, and in wealthier economies highly dependent upon migrant labour at key stages of food harvest and packing raising further resilience issues in terms of labour availability. The UK's Global foresight on *The Future of Food and Farming* summarised the challenges as six fold: balancing future demand and supply sustainably; addressing the threat of future volatility; ending hunger; meeting a low emissions world; and maintaining biodiversity and ecosystem services while feeding the world (Foresight, 2011).

The FAO has forecasted a world population peaking at around 9 billion in 2050, necessitating an increase in production by 70% from 2005-7 levels (FAO, 2009). Yet against this picture, we see a current world population of 7 billion with close to 1 billion people hungry and under nourished and another 1.6 million estimated as obese (FAO, 2010). These figures point to the inadequacy of the current food system to feed people correctly as there is enough food being produced currently to meet the world population's needs. The over consumption of wrongly balanced diets are prevalent in the developed world's populations, and are increasingly being imitated by growing urban and affluent populations in developing countries, reflecting a shift from more traditional culturally evolved diets to more western industrialised food diets, or what is termed the nutrition transition (Popkin, 2002). In these developing economies there is an increasing incidence of diet related non-communicable diseases side by side to extreme poverty and hunger. The demands for an increasingly high protein animal meat and dairy based high in saturated fats, puts further pressure on land use to raise the required animal stock and cereal and oil based animal feed.

Supply	***Demand***
Climate change	Land use
Fuel / oil / energy	Labour
Water	Population (9bn 2050)
Soil	Urbanisation
Biodiversity/ ecosystems support	Affluence + Nutrition transition
	Healthcare costs

Table 1. The fundamental challenges facing the food supply Source : adapted from Barling *et al.,* 2008.

The environmental damage caused by contemporary food production and supply practices and the public health costs of diet related non-communicable diseases generate external public costs, or externalities, that are not reflected in, or internalized, in the price of food. The real costs if our current food supply can be given a value and priced; and, is an evolving area of work where new methodologies are being developed.

For example, the environmental externalities of a product have been quantified providing a truer cost of food production and transfer to price in the market place. There are problems with agreeing the value of some impacts, for example: the value of individual wildlife, and the relationship to the willingness of the public to pay these costs. As a result, attempts to assess the annual costs of pesticides in the USA undertaken in the early 1990s varied from $1.3 billion to $8 billion (Pretty, 1998). Work has been done on costing the environmental impacts of UK agriculture (Defra, 2002). One study estimated the costs by analyzing what is spent to deal with the externalities of production and reached a figure of £1.566 billion (Pretty *et al.,* 2000). Another sought to estimate the depreciation of the stocks of natural capital associated with agriculture and the environmental services generated and then arrived at costs by matching values to evidence from willingness to pay studies (Hartridge & Pearce, 2001). This latter study came up with a total of £1.072 billion, but taking away the benefit value of carbon sinks raised the external costs to £1.432 (Defra, 2002). The environmental and ecosystem benefits that the farmed landscape can provide, both in terms of biodiversity support and habitats and maintenance of soil and water properties of the land, as well as landscape value and carbon sequestration (or carbon sinks) are illustrated in this work.

The costs of these diet-related externalities to national health care systems are beginning to be calculated and the evidence presented in policy debates. Diet related non-communicable diseases, notably coronary heart diseases, chronic type 2 diabetes, and some cancers are incurring rapidly rising costs to health care systems in the UK. This evidence is being collated in a variety of ways and the methodology is being improved continually. One area of calculation is to cost the effects of rapid growth in obesity, as the condition of obesity serves as a signal of both an indicator and a precursor of diet related diseases. In 2001, the National Audit Office estimated the cost of obesity to the English National Health Service to be £480m (€720m) per annum (National Audit Office, 2001). This cost was revised in 2004 to be £3.3-3.7 billion (€4.95-5.55 billion) for obesity alone, and a further £6.6-7.4 billion (€9.9-11.1 billion) for obesity plus overweight (House of Commons Health Select Committee, 2005). The yearly costs to the National Health Service of food related ill health have been estimated at £6 billion (€9 billion), that is 10% of morbidity and mortality (Rayner and Scarborough, 2005).

The role of the private sector and market based policy instruments for the sustainable consumption and production of food

Private sector actors play important roles in food policy and governance (Barling 2008; Clapp & Fuchs 2009). The balance of food chain relationships has altered over the past two decades as the buyers have come to exert more control over the producing sectors of the food chain and the terms of trade for food products. Buyer led supply chains have lead to a relative decline in the trading power of the food producers in relation to the manufacturers in the first instance, and, in more recent decades, both producers and manufacturers to the retailers and large food service corporations (Barling *et al.,* 2009: Burch & Lawrence, 2007). The rise of retail led standards and governance is a very discernible feature of contemporary food chain relations (Henson & Reardon, 2005; Fulponi, 2006; Clapp & Fuchs, 2009). The growth of private certification schemes is another feature providing a new realm to the private governance of food standards and inter-firm trade along supply chains. The certified products meet retailer standards or bear logos signalling the process characteristics of the food product to buyers along the chain, be they the retailers or food service companies or the final consumers.

Certification schemes covering an increasing range of environmental, ethical and social dimensions around food products, and their ingredients have augmented the earlier explosion in the number of food safety assurance schemes that began in the late 1980s. Environmental schemes around natural resource conservation such as: sustainable fisheries or sustainable palm oil and soybean planting, or integrated farming methods (IFM) for crop production and biodiversity enhancement, are examples; as are ethical standards around animal welfare schemes. This newer generation of certification schemes point to an increasing range of sustainability criteria for food that have social credence and market identity. Non-governmental and civil society organisations engage in some of these newer certification schemes as they seek to implement their policy priorities, often around specific single issues such as sustainable fisheries or animal welfare or fair trade, often engaging industry in the implementation of the schemes.

These developments point to the interaction of public and private governance, and the respective interactions between the state, industry and civil society in moving the food system to more sustainable practices. State supports for agriculture have been redirected towards Green Box compliance under the World Trade Organization's Agreement on Agriculture, where supports must qualify as "non or minimally trade distorting". Consequently, European supports under the Common Agricultural Policy are contingent upon the delivery of public goods including the protection of the agri-environment, biodiversity habitats and landscape conservation, and are buttressed by regulations such as the Framework Water Directive to prompt farm management solutions in nitrate vulnerable zones. Equally, the use of market-based instruments has been viewed as a successful approach to enhance sustainable agricultural practice at farm level (Buller and Morris, 2004). Strategies to reduce pesticide use at the farm level have led

to the introduction of IFM and integrated pest control techniques and grower protocols. In addition, these protocols have been certified for the market place through schemes with logos attached. These protocols include international and collaborative corporate led standards such as the European Retailer Good Agricultural Practice standards (EUREPGAP) – later renamed GLOBALGAP to signify its reach. The large European food manufacturers, in turn, have also set up collaborative compliance schemes for suppliers such as the Sustainable Agriculture Initiative (SAI) platform created by Unilever, Danone and Nestle in 2002 (CIAA 2005).

At the national level, the farm certification scheme Linking the Environment and Farming (LEAF) was set up 1991 in the UK, and promoted by the some of the larger scale retailers. LEAF promotes and disseminates best practice through a network of demonstration farms and open farm visits for the public (LEAF, 2012). The desire of retailers to be part of LEAF means that farms participating in better sustainable agricultural practices across the farm are rewarded with contracts from these companies. The scheme faces along the food supply chain as well as outwardly facing the consumer. A survey of UK consumers' awareness of the main sustainable food certification schemes found that just 3% of the shoppers recognised the LEAF label (Which, 2010). Yet, for LEAF this may be a respectable score as long as the retail partners continue their support. The onus for success is not just on the consumer but also on the supply chain actors to do the right thing to achieve environmental improvements. The participating retailers are aware of their strategic role and responsibility in the food supply chain to promote more sustainable agriculture. A key challenge for policy makers is how to motivate consumers and citizens to make step changes towards sustainability in their behaviour (Sustainable Consumption Roundtable, 2006). The UK Sustainable Consumption Roundtable report identified the role of choice editing as important, with the retailers amongst the key choice editors or gatekeepers along food chains. In other words, retailers continually make choices about the type of goods that they offer to consumers in their stores. The role of choice editing takes the onus off the consumer as the main decision maker, one that they are not necessarily well equipped to undertake on sustainable food, and transfers more responsibility to the supply chain actors. The supply chain actors are in a position to edit choices in way that promote sustainability in the food system, implementing the links between sustainable consumption and production. The question remains, however, to what extent will the best practice retailers continue to take a lead role without recognition and reward from the state ?

Sustainable food consumption and production: towards new metrics and policy guidance in Europe

The challenges of the new fundamentals have lead to strategies for approaches to increasing food production to meet future projected demands while seeking more sustainable production methods, but have not fully addressed many of the natural resource depletion challenges or the consumption end of the picture. In the UK a major initiative led by the life sciences and food technology based research institutes, was the call for "sustainable intensification", that is the application of life sciences technology to increasing crop yields while using fewer natural and industrial produced inputs (Royal Society, 2009). The UK Government has adopted "sustainable intensification" as a key response to addressing the future challenges facing food and farming identified in the UK Foresight report. Again, the more complex consumption demands and governance factors shaping the direction of the food supply are either missing or appear only in passing in this strategy.

Sustainable consumption and production links have emerged as policy initiatives from some Western European governmental agencies and from the European Commission at the EU level (see Table 2). This policy activity has evolved, in part, from commitments made by governments at the World Summit on Sustainable Development in Johannesburg in 2002, which gave a fresh impetus to policy actions and strategies in relation to sustainability. At national level, governmental or government sponsored bodies or agencies have utilised softer policy tools, often in the form of advice or recommendations aimed at the consuming

public. A series of different national level initiatives have focused upon identifying best practices in order to aid consumers to more sustainable and environmentally friendly informed choices in their food purchase and consumption. The growth of private certification schemes signaling differing sustainability related characteristics for food products has led to their being adopted under these public agency endorsed consumer directed strategies. Hence, the German Council for Sustainable Development produces an annual shopping basket, including food items, addressing such schemes and labels (German Council for Sustainable Development, 2011). Similarly, the Netherlands' *Sustainable Food* policy strategy emphasized the role of consumer education campaigns in relation to sustainable food production practices and innovation (LNV, 2010).

The Swedish Food Administration provided a scientifically based guide for the most sustainable forms of key food groups for consumption. It recommended these guidelines to the EU Council for endorsement as official standards but the Polish Presidency refused on the grounds that they were anti-competitive under internal market rules (National Food Administration, 2009). The Swedish example presaged the development of initial recommendations for more sustainable diets, in the form of collating expert opinions, from advisory bodies to the Governments' of the UK and the Netherlands (Sustainable Development Commission, 2009; Health Council of the Netherlands, 2011). The considerations around sustainable diets not only make a firm link between consumption and production but also ask what forms of production and what food groups need to be given priority for a healthy population while lowering the impacts upon the environment.

Table 2. Sustainable food consumption and production - emerging policy advice in European Countries

Country & Date	Government Agency or Department	Policy Document & Scope
UK 2006	Sustainable Development Commission (SDC) & National Consumer Council set up the Sustainable Consumption Roundtable	Sustainable Consumption Roundtable report *"I will if you will"* - generic identification of challenges in moving to more sustainable consumption and identified the concept of "choice editing"
Germany 2008 onwards	German Council for Sustainable Development	*Sustainable Shopping Basket: a guide to better shopping* produced since 2008 and updated regularly. Includes food and lists labels and certification schemes including organic, fair trade, sustainable fisheries etc.
Netherlands 2009	LNV Ministry Ministry of Agriculture, Nature and Food Quality	*Sustainable Food: Public Summary of Policy Document*. Policy outline for achieving Sustainable Food; emphasised the role of sustainable food production & consumer education campaigns
Sweden 2009	National Food Administration (& Swedish EPA) - notification to EU Council for adoption as official standards	*The National Food Administration's Environmentally effective food choices: Proposal notified to the EU*. Science based assessment by range of product groups e.g. meat, fish & shellfish, fruits and berries etc.
UK 2009	Sustainable Development Commission (SDC) report to Department Environment Food Rural Affairs (Defra)	*Setting the Table: advice to Government on priority elements of sustainable diets* Recommendations based on literature review, stakeholder and expert opinion on a low impact (sustainable) healthy diet
Netherlands 2011	Health Council for Ministry Economic Affairs, Agriculture & Innovation	*Guidelines Healthy Diet: Ecological Perspective*: Review based on expert advice

In the case of the Swedish study different food groups were identified, such as: meat - beef, lamb, pork and chicken; fruits, berries and leguminous plants; potatoes, cereal products and rice; and, cooking fat. The production of these food groups was measured against a set of environmental impacts: reduced climate impacts; non-toxic environment; varied agricultural landscape; and rich diversity of plant and animal life. In the case of the latter two impacts, natural pasture grass fed livestock grazing for beef and lamb offered benefits, but not pork and chicken production. Also, in the cooking fat food category, the landscape and diversity benefits followed more clearly from rapeseed oil production as a break crop, and indirectly from butter from natural pasture fed cows, whereas olive oil production was less beneficial (National Food Administration, 2009). Some clear implications from the Netherlands and UK studies are that reduction in meat consumption will be a key change, and that mixed farming and natural pasture feeding of livestock and more seasonal and varied plant and fruit/berry production will contribute positively to more sustainable diets. Clearly, this has challenging implications for policy makers when considering state supports for agriculture (Barling, 2007). In addition, the evidence base underpinning these recommendations needs to be robust, all the more so because the recommendations may work against the interests of established economic actors in the food chain, and therefore encounter strong political opposition.

Life cycle assessment (LCA) of food products and their supply chains provides a method or a set of methodologies that can provide an evidence base to aid policy makers in decisions around the environmental impacts of particular food products and supply chains. Particular attention has been paid, to date, to energy use and greenhouse gas emissions in LCA assessments around food. For example, the energy use hotspots in supply chains are identified, such as the baking stage in bread production and so on. However, it is clear that the environmental impacts of agriculture and food chains are widespread. One consequence of this is that there is an ongoing debate around where to draw the boundaries for assessing the metrics around the environmental impact of a food product. The introduction of different criteria and boundaries for conducting an LCA can lead to very different results and implications. The popularity of the food miles concept has led to debates over the accuracy of the energy impacts of imported versus domestically produced food. For example, a New Zealand study found apples and lamb grown in the New Zealand and exported to the UK for sale to be more energy efficient than the equivalent UK domestically grown and reared produce (Saunders *et al.,* 2006). The study failed to distinguish between UK lamb reared and fed on lowland grasslands (more energy intensive) versus hill fed lamb (less intensive) and the energy figures have been challenged (Williams *et al.,* 2006). Likewise, the New Zealand study failed to allow for seasonality in the UK apple crop - where the greatest domestic energy use is from cold storage for consumption beyond the natural season. Here the evidence can show that at some times during the year transporting produce from other countries may have a lower environmental impact than refrigerating produce grown in the UK, but not at other times of the year (Garnett, 2007). There are other examples of comparing domestically produced food in the UK with imports sold in the UK, in energy terms. Tomatoes produced in UK hothouses use ten times the energy and emit nearly four times as much CO_2, as the same quantity in produced in unheated poly tunnels in Spain and road freighted to the UK market. Conversely, UK tomatoes are often grown using fewer pesticides and closed irrigation systems to minimize the release of excess nutrients to the environment (AEA Technology, 2005). In short, studies making such comparisons need to be: spatially precise, adjusted for growing conditions, seasonality and inputs; and to factor in the variety of supply chain logistics, such as refrigeration and storage time and period between harvest and placement in the retail market, alongside mode and costs of transport (Edwards-Jones *et al.,* 2008). In addition, a key component in the LCA along the food chain is the domestic consumer. For consumers, driving six and a half miles to a shop to buy food produces more carbon than air freighting a pack of green beans from Kenya to the UK (DfID, 2007).

LCA accounting can be extended to consider the social (and health) dimensions in addition to environmental aspects (McGregor and Vorley, 2006). For example, UK imports of fresh produce grown in sub Saharan Africa (excluding South Africa) have been estimated to support over 700,000 workers and their dependents (Natural Resources Institute, 2006). Hence, the development of LCA metrics and the application of the methodology and the boundaries addressed are open to dispute. This has provided a rationale for policy makers in the European Commission to step in and establish frameworks and guidelines for the application LCA methodologies across the single European market.

The European Commission is developing a range of policy initiatives that address the sustainability impacts of food products within the sustainable consumption production framework (see Table 3). The EU's Sustainable Development Strategy highlights the challenge to "gradually change our current unsustainable consumption and production patterns and the non-integrated approach to policy-making" (Council of the European Union, 2006). Subsequently, the European Commission's Sustainable Consumption Production (SCP) and Sustainable Industrial Policy Action Plan's (2008) addressed action areas for environmental policies and industry as a whole (Commission of the European Communities, 2008). The Action Plan included some areas linked to food such as: greening public procurement, improving supply chains' environmental efficiencies, raising consumer awareness and extending the use of the EU's Eco label. In the case of the Ecolabel, the signs are that the methodologies for application of the label to food products are not considered to be robust enough at present for this to proceed any further (Sengstschmid *et al.,* 2011).

A more explicit extension to food came with the setting up of the European Food Sustainable Consumption Production Roundtable at the instigation of FoodDrinkEurope (formerly CIAA), the European Food and Drink Manufacturers trade association, supported by other major European trade associations around the food supply chain. The trade associations collectively co-chair the SCP Food Roundtable in partnership with DG Environment from the Commission. The Roundtable's declared objectives were: "to facilitate agreement on uniform and scientifically reliable environmental assessment methodologies for food products….put an end to consumers seeing inconsistent environmental information on products…(and) identify suitable means of voluntary communication to consumers" (CIAA, 2009). In addition, DG Environment is working with the European Commission's Joint Research Centre's (JRC) Institute for Environment and Sustainability (IES) in leading the development of a harmonised methodology for the calculation of the environmental footprint of products (including carbon footprint) covering a wide range of products sectors, and encompassing agriculture and food products (DG Environment, 2011). The degree of harmonisation in the outcomes of these different parallel efforts remains to be seen, but the JRC is involved in both projects

Table 3. Emerging policy developments around sustainable food in the European Commission 2008-12 –
Source : The Author

Policy initiative	Details
Sustainable Consumption-Production & Sustainable Industrial Policy Action Plan (2008)	Voluntary initiatives on environmental policy and industry - but little food focus
Suitability of the potential extension of the *Ecolabel to food* products	Background report recommended against this on the basis of lack of clear and agreed methodologies etc. making extension unlikely
European Food Sustainable Consumption Production (SCP) Roundtable (2009-) co-chairs DG Environment & European Food & Feed Trade Associations. Based in FoodDrinkEurope) & supported by JRC	Facilitate agreement on environmental assessment methodologies for food products & environmental information on products via agreed voluntary communication to consumers
DG Environment & JRC (2011 -2012): *Harmonised framework methodology for the calculation of the environmental footprint of products*	Framework methodology for most main industrial sectors including agriculture and food to be finalised by late 2012
Roadmap to a Resource Efficient Europe (2011) part of the actions form *Europe 2020: A strategy for smart, sustainable and inclusive growth* (2010)	Long-term policy goals with milestones: e.g. • 20% reduction in the food chain's resource inputs by 2020. • Develop a methodology for sustainability criteria for food commodities by 2014

In 2010, European Commissioner Barosso launched the Commission's broader *Europe 2020* strategy for smart, sustainable and inclusive growth that included the goal of moving to a more resource efficient Europe (European Commission, 2010). The follow up document detailing the *Roadmap to a Resource Efficient Europe* included a series of key milestones to be achieved by 2020. The milestones included a commitment that "healthier and more sustainable food production and consumption will be widespread and will have driven a 20% reduction in the food chain's resource inputs". A step towards this goal is to "develop a methodology for sustainability criteria for food commodities (by 2014)", which it is anticipated will result in a Communication on Sustainable Food (European Commission, 2011). This process signals the further and more significant entry of DG Environment leading and co-ordinating the other Commission services into the debates and policy formulation around the SCP of food, and in steering what the key criteria for assessing sustainable food should be. To date, the key criteria for defining sustainable food have been left largely to private actors in the market place as outlined previously. The commitments made in the road map to a resource efficient Europe's and the embrace of food and agricultural systems, reflects official awareness and concern with the need to address the finiteness of natural resources and their decline.

Conclusion

The food system faces some real and long-term challenges to provide a food supply that is sustainable in environmental and social terms. The sustainability of the contemporary food supply is being questioned and the complexities of finding adequate policy solutions identified. Attempts to improve the sustainability of the food supply will need to address their solutions within the private as well as public governance realities of the food system. The challenges to the food system are increasingly being understood and considered as being beyond simply food production but involving all stages in the food chain up to and including consumption. In turn, changing consumption patterns and habits are seen as a key driver for more sustainable production. To this end the move towards attracting consumers towards more sustainable food products has been led in the market place through innovative certification schemes and private sector governance mechanisms with the sustainability criteria of food products conveyed through the certification logos and labels. Public policy makers are articulating the sustainable consumption production approach, also. In the Western European states this is taking the form of softer policy interventions in the form of collating expert opinion for policy recommendations and promoting consumer advice on areas such as more sustainable food product choices and low impact diets. The development of a scientific base to justify such opinions is leading to the costing of environmental externalities and the rapid development of LCA methodologies. However, initial studies of food products have revealed tensions and differences around the framing and accuracy of the evidence and the boundaries for what should be included in the LCAs. The European Commission has recognized the challenges faced and the need for more consistency and evenness in the application of market based instruments within the single European market. As a result the Commission is seeking to establish more clear ground rules for the framing of assessments of the environmental impacts of products, including food products. Industry is co-opted into this process through the established round table procedure. The most recent European Commission policy iteration of this move to assess the sustainability of food products comes under the banner of a Resource Efficient Europe, and points to the framing of the metrics around sustainable food as the major form of public policy intervention in the near future. To this end it can be argued that the European Commission's strategies are recognizing the challenges that the food system faces around natural resource constraints and the production-consumption context for resolving these challenges. Agronomists have an important role to play within the consumption - production policy frame.

Bibliographie

AEA Technology, 2005. *The Validity of Food Miles as an Indicator of Sustainable Development Final Report produced for DEFRA*. ED 50254. London: Defra.

Ambler-Edwards, S., Bailey, K., Kiff, A., Lang, T., Lee, R., Marsden, T., Simon, D. & Tibbs, H., 2009. *Food Futures: Rethinking UK Strategy*. London: Chatham House.

Barling, D., 2007. Food supply chain governance and public health externalities: upstream policy initiatives and the UK State, *Journal of Agricultural and Environmental Ethics*, 20 (3): 285-300.

Barling, D., 2008. Governing and Governance in the Agri-Food Sector and Traceability. In Coff, C., Barling, D., Korthals, M. and Nielson, T. eds. (2008) *Ethical traceability and communicating food*. Dordrecht: Springer: 43-62

Barling, D., Sharpe, R. & Lang T., 2008. *Towards a National Sustainable Food Security Policy: A project to map the policy interface between Food Security and Sustainable Food Supply*, report to the Esmee Fairburn Foundation. Centre for Food Policy: City University London.

Barling, D. Lang, T. & Rayner, G., 2009. Current Trends in European retailing and consumption and key choices facing society in Rabbinge, R. & Linnemann, A. eds. *ESF/COST Forward Look: European Food Systems in a Changing World*. Brussels: European Science Foundation (ESF) and European Co-ordination on Science & Technology (COST). 117-136.

Buller, H. & Morris C., 2004, Growing goods: the market, the state, and sustainable food production. *Environment and Planning A* 36, (6): 1065 – 1084.

Burch, D. and Lawrence, G. eds., 2007. *Supermarkets and Agri-Food Supply Chains: Transformations in the Production and Consumption of Foods*. Cheltenham: Edward Elgar: 192-215.

CIAA, 2005. *Managing Environmental Sustainability in the European Food and Drink Industries: issues, industry action and future strategy*. Brussels: Confederation of the Food and Drink Industries in the EU.

CIAA, 2009. Key food chain partners to launch sustainability roundtable. CIAA Press Release 26/02/2009. Brussels: CIAA.

Clapp, J. & Fuchs, D. eds. 2009. *Corporate Power in Agrifood Governance*. Cambridge Mass.: MIT Press.

Council of the European Union, 2006. *Review of the EU Sustainable Development Strategy*. Brussels: Council of the European Union.

Commission of the European Communities, 2008. *Sustainable Consumption and Production and Sustainable Industrial Policy Action Plan, COM (2008) 397 final*. Brussels: Commission of the European Communities.

DEFRA, 2002. *Foundations for our Future: DEFRA's Sustainable Development Strategy.* Department for Environment, Food and Rural Affairs, London, UK.

DFID, 2007. *Fair and accurate food pricing needed to protect environment and support poor farmers*. Press Release http://www.dfid.gov.uk/news/files/pressreleases/airfreight.asp
(accessed 20 June 2008). London: Department for International Development.

DG Environment, 2011. *Environmental footprint of products*, http://ec.europa.eu/environment/eussd/product_footprint.htm (accessed 12/10/2011).

Edwards-Jones, G., MilàiCanals, L., Hounsome N., Truninger, M., Koerber, G., Hounsome B. *et al.,* 2008. Testing the assertion that 'local food is best': the challenges of an evidence-based approach. *Trends in Food Science & Technology*, 19 (5): 265-274.

European Commission, 2010. *Europe 2020: A strategy for smart, sustainable and inclusive growth*. COM (2010) 2020. Brussels: European Commission.

European Commission, 2011. *Roadmap to a Resource Efficient Europe*. COM (2011) 571 final. Brussels: European Commission.

FAO, 2009. *How to feed the world in 2050*. Rome: Food and Agriculture Organisation.

FAO, 2010. *State of World Food Insecurity 2010*. Rome: Food and Agriculture Organisation.

Foresight, 2011. *The Future of Food and Farming: Challenges and choices for global sustainability. Final Report*. London: Government Office for Science.

Fulponi, L., 2006. Private voluntary standards in the food system: the perception of major retailers in OECD countries. *Food Policy*, 31: 1-13.

Garnett, T., 2007. *Overall UK consumption related GHGs*. April. Guildford: Centre for Environmental Strategy University of Surrey.

German Council for Sustainable Development, 2011. *Sustainable Shopping Basket: a guide to better shopping*. Berlin: German Council for Sustainable Development.

Hartridge. O. and Pearce, D., 2001. *Is UK Agriculture Sustainable? Environmentally Adjusted Economic Accounts for UK Agriculture*, London: CSERGE Economics UCL.

Health Council of the Netherlands, 2011. *Guidelines for a healthy diet: the ecological perspective*, 2011/08E. The Hague: Health Council of the Netherlands.

Heller, M.C. and G.A. Keoleian, 2000. *Life Cycle Based Sustainability Indicators for Assessment of the U.S. Food System*. Ann Arbor, MI: University of Michigan. Center for Sustainable Systems.

Henson, S. & Reardon, T. (eds.), 2005. Special edition: Private Agri-Food Standards *Food Policy,* 3: 241-370.

House of Commons Health Select Committee, 2005. *The Government's Public Health White Paper (Cm 6374). Oral evidence: Taken before the Health Committee on Wednesday 23 February.* London: House of Commons.

LEAF, 2012. *Linking Environment and Farming*, http://www.leafuk.org/leaf/home.eb

LNV, 2010. *Sustainable Food: Public Summary of Policy Document*. The Hague: Ministry of Agriculture, Nature and Food Quality.

McGregor, J. & Vorley, B., 2006. *Fair miles? The concept of 'food miles' through a sustainable development lens. Sustainable development opinion*. London: IIED.

National Audit Office, 2001. *Tackling Obesity in England, Report by the Controller and Auditor General*, HC 2200 Session 2000-2001, 15 February.

National Food Administration, 2009. *The National Food Administration's Environmentally effective food choices: Proposal notified to the EU*. 15.05.09. Stockholm: Livsmedels Veket National Food Administration.

Natural Resources Institute, 2006. *Mapping different supply chains o f fresh produce exports from Africa to the UK. Fresh Insights no. 7*, DFID/IIED/NRI.

Popkin, B.M., 2002. An overview on the nutrition transition and its health implications: the Bellegio meeting, *Public Health Nutrition*, 5, 1A: 93-103.

Pretty, J., 1998. *The Living Land*. London: Earthscan.

Pretty, J. N., Brett, C., Gee, D., Hine, R. E., Mason, C. F., Morison, J. I. L., Raven,H., Rayment, M. D. and van der Bijl, G., 2001. An assessment of the total external costs of UK agriculture. *Agricultural Systems*, 65: 113-136.

Rayner, M. & Scarborough, P., 2005. The burden of food related ill health in the UK, *Journal of Environmental and Community Health* 59 : 1054-1057.

Royal Society, 2009. *Reaping the benefits: Science and the sustainable intensification of global agriculture*. London: The Royal Society.

Saunders, C., Barber, A. & Taylor, G., 2006. *Food Miles - Comparative Energy/Emissions Performance of New Zealand's Agriculture Industry - Research Report 285.* Christchurch: Agribusiness and Economic Research Unit Lincoln University.

Sengstschmid, H., Sprong, N., Schmid, O., Stockebrand, N., Stolz, H., Spiller, A., 2011. *EU Ecolabel for food and feed products - feasibility study (ENV.C.1/ETU/2010/0025)*. Report for DG Environment, European Commission, October 2011. Aylesbury: Oakdene Hollins Research & Consulting.

Sustainable Consumption Roundtable, 2006. *I will if you will: Towards sustainable consumption*. London: National Consumer Council and Sustainable Development Commission.

Sustainable Development Commission, 2009. *Setting the Table: advice to Government on priority elements of sustainable diets*. London: Sustainable Development Commission.

Tukker, A., Huppes, G., Guinée, J., Heijungs, R., de Koning, A., van Oers, L., and Suh, S. Geerken, T., Van Holderbeke, M., & Jansen, B., Nielsen, P., 2006. *Environmental Impact of Products (EIPRO): Analysis of the life cycle environmental impacts related to the final consumption of the EU-25*. EUR 22284 EN. Brussels: European Commission Joint Research Centre.

Which, 2010. *Making Sustainable Food Choices Easier.* http://www.which.co.uk/documents/pdf/making-sustainable-food-choices-easier-which-report-231317.pdf#

Williams, A., Audsley E. & Sandars, D., 2006. *Determining the environmental burdens and resource use in the production of agricultural and horticultural commodities. Main report.*