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ENABLING TRANSFORMATIVE CHANGE IN RURAL LAND USE

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List of acronyms

BECCS	Bioenergy with carbon capture and storage
CAP	Common Agricultural Policy
EIA	Environmental Impact Assessment
EU	European Union
GHG	Greenhouse gas
IEEP	Institute for European Environmental Policy
MS	Member State
SEA	Strategic Environmental Assessment
WWII	World War II

Summary

European needs *from* rural land are mostly food and fibre, generally supplied through the market, while its needs *for* rural land are mainly biodiversity and the ecosystem and cultural services it provides. European society's needs *for* land are significantly under-provided. Rural land management is characterised by pervasive failures to align with environmental objectives and the food chain is characterised by imbalanced power relations. Food consumption is also characterised by inappropriate diet for a sizeable share of the population, leading to extensive non-communicable disease and societal costs.

In short, the EU food and land use systems demonstrate unsustainable consumption and production. These failures will not self-correct, they require collective purposive interventions to steer the system to deliver what society wants from and for land. Transformation of the EU food system and land use is imperative to meet the challenges of climate and biodiversity emergencies, to improve diets and health and to establish more durable, economically viable land management businesses. The European Green Deal proposal is an attempt to grasp this challenge.

Rebalancing food consumption and the way land is used in the EU has to be achieved within the institutions and structures of Europe's pluralistic democracies operating mixed market economies. In particular, this requires engagement of the fragmented, mostly private family landowners and managers, a group with diverse rather than uniform motives.

Reorientation of the food and land use systems cannot be achieved through policy action alone: there is a significant contribution to be made by consumers and the powerful players in the food chain, including the retailers.

Policy also is important, not only with respect to land use and agriculture. Co-ordination will be required across six flanking areas of policy: broad societal objectives (e.g. social justice), sustainable food consumption, reduction of food waste, renewable energy, international trade and research and development.

There are significant as yet strategically undecided questions about how to resolve some key tensions between policy goals. What is the right balance between reallocating agricultural land for climate and biodiversity protection as opposed to food production? How does this interface with de-intensification of land use to protect biodiversity? What are the implications for food prices, and thus social welfare and for international trade? A more focused

effort to address these issues would strengthen the foundations of a transition and increase engagement.

A Europe wide transition requires a strong guiding EU framework, which needs to be based on a clear rationale for European as well as more local interventions. So it is important to establish the ways in which individual Member State decisions over land use impinge on genuine Europe-wide interests in order to create the political space for initiatives where these are needed, all the more so if EU funding is offered as part of a package. Environmental evidence and pragmatism will both be important.

The large number of actors involved in land use, the variety of their motivations, the diversity of activities falling within scope, the variability and uncertainty associated with biological systems makes for a more complex challenge for the necessary transition of the food and land systems than in most other sectors. In addition, there is a delicate balance to be struck between climate mitigation, adaptation, ecosystem restoration, the supply of food and fibre and responsible management of Europe's external environmental footprint. The multiplicity of poles involved is striking and probably exceptional. It helps to explain the relatively slow pace of advance in this sector to date and indicates that a sophisticated, multi-layered, iterative and interactive approach will be required in future.

To bring about land-use change, ten main fields of policy intervention are identified:

- Awareness-raising
- Information, skills and training
- Land use planning
- Financial incentives
- Financial disincentives
- Controls and regulations
- Greater enforcement
- Market intervention
- Sustainable consumption indicators
- Land acquisition

What we want from and for rural land are reasonably well defined and agreed in broad terms, as are the policy levers which will have to be pulled to move the system in the desired direction. A prerequisite is the general societal acceptance of a narrative that system transformation is necessary and that it requires different behaviour in both consumption and production.

The consumption issues concern public and private health messaging, education, the food processing, retailing and service sectors, and government food procurement.

The land management issues concern rural societies, the land managers – farmers and foresters – and their up-stream suppliers.

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The types of policy intervention required are principally a mixture of inducements on the one hand and controls and regulations on the other. Both are needed to change the allocation, mix and intensity of management of rural land.

The challenge which remains is to understand better how to combine these interventions and the relative vigour with which to apply each.

1. Introduction

It has been accepted for some time that energy and mobility systems require a transformation in view of the climate crisis. It should be no surprise that, faced with a wider set of challenges, the **food system has to confront a similar transformation**. These transformations will take time, some maybe decades. What is important is to identify the characteristics of the required transition path and the inducements needed to spur the necessary change. These changes will not come about spontaneously. They require collective coordinated action in a way which helps create and then build on the active engagement and support of the stakeholders in each field of action and of the general public.

The first paper in this series was entitled 'What do we need from EU rural land?' Noting that rural land, comprising agricultural, forestry and wilder land occupies about 95% of the EU surface area, it distinguished between the needs society has *from* the land and the needs we have *for* the land. The former can be summarised as food, forest products, fibre, fuels and fun¹ which are mostly supplied through decentralised, private, market processes. The latter, what we want *for* the land, can be summarised as the functioning of land providing: flora, fauna, fixing carbon, fire, flood and freshwater management. The first two of this group make up biodiversity which, in turn, is the basis of a provision of a range of ecosystem services. A critical characteristic of the services we want *for* the land is that they are generally not supplied through market processes². Their very nature inhibits this. Yet they are essential components of a well-functioning land-use system that is able to provide commodities and services indefinitely into the future. The result is European society's needs *for* land are significantly under-provided.

The purpose of this paper is to tease out the broad suite of components of what might be considered an effective set of collective and coordinated

¹ Fun encapsulates the variety of recreational activities which take place in the countryside, from numerous forms of exercise (hiking, cycling, horse riding), camping, fishing, canoeing, nature watching, shooting and hunting. It also includes the joys of pure solitude.

² Market failures are situations where decentralised suppliers are unable to set up and make viable business from supplying certain goods and services citizens desire because of the intrinsic properties of the goods. The key such properties are what economists call non-rivalness in consumption (my enjoyment of a beautiful view does not diminish yours) and non-excludability (it is impossible, or costly, to exclude non-payers). The under-provision of some of these services also sometimes results from the impacts of negative externalities (pollution, habitat and biodiversity degradation) associated with the production of the market goods.

actions capable of steering the EU food system and rural land use taken together as an integrated system onto a sustainable path.

The status quo is not sustainable

Land management in Europe is not functioning in an optimal way for a variety of societal needs. There are complex political, economic and natural forces at work which result in a land management system which prioritises market products to the detriment of other services. The very success of market processes in satisfying most material needs of the majority of the population has encouraged a predisposition towards maximising the freedom of markets to operate and a caution to extend the reach of collective or government actions in relation to rural land. Yet it turns out that in food consumption and land management, market failures are pervasive, and furthermore the economic structures in the food chain demonstrate what economists call market imperfections³.

These market failures and imperfections will not self-correct, and they require collective purposive interventions to steer the system to deliver what society wants from and for land.

The focus on provisioning services from land has led to the deterioration of natural capital which threatens sustainable production of these services. Tensions arise because agricultural and forest production, which occupy the majority of the land area, are based on the manipulation of natural processes and interactions between thousands of species of microorganisms (bacteria, fungi, mycorrhiza), and invertebrates in the soil, and plants and animals above ground. Policymakers and society are increasingly aware that when intensification of our food and forest production systems are pushed too far, this disturbs the underlying water, carbon and nitrogen cycles and the ecosystem functioning in soils and in these managed ecosystems⁴. This happens at every

³ **Market imperfections** refer to the emergence of unbalanced, oligopolistic or monopolistic, market power when a highly-fragmented, price-taking, business sector comes to buy from or sell to highly concentrated input supply or output processing sector. This description captures the position of farmers who operate between large, often multinational, machinery, feed, fertiliser and agro-chemical companies and the similarly large (but less-frequently multinational) downstream food retailers, food processors and some food service businesses.

⁴ Bas-Defosse et al. (2018) Feeding Europe: Agriculture, and sustainable food systems, Policy Paper produced for the IEEP Think2030 conference, Brussels, October 2018.

scale from the very local where soil erosion or salination can halt crop production, to the global impact on climate which can so change temperature, precipitation and disease threat that it can ultimately prevent farm and forest production.

BOX 1: IMPACTS OF STRUCTURAL CHANGE IN EU AGRICULTURE

Immense technical and structural changes have taken place in food production and in the food chain in the last seven decades. In agriculture, these have been driven primarily by economics and emerging new technologies resulted in the wholesale substitution of capital for labour with millions leaving low-productivity subsistence and semi-subsistence living on the land often for different lives in cities. Employment in primary agriculture has shrunk during this period from comprising the majority to less than 5% of the workforce. At the same time, the proportion of total consumer expenditure devoted to food and drink has considerably fallen, and a high proportion of food expenditure accrues to the services added downstream of the primary sector.

The intensification, specialisation and increase in the scale of farming businesses, which have been world-wide tendencies observed under very different economic systems and agricultural policy regimes, have been accompanied by significant negative impacts on the environment. These are: pollution of water (by reactive N and P), air (NH₃) and atmosphere (GHGs), soil erosion and loss of soil organic matter and ecosystem functioning, degradation of biodiversity (terrestrial and aquatic) and loss of cultural landscape features. These technological innovations brought about tremendous economic development, as conventionally measured. However, it has also degraded natural capital on which society depends: clean air and water, stable climate, fertile soils and the biodiversity which powers functioning ecosystems⁵.

⁵ EEA (2019) The European environment – state and outlook 2020. Knowledge for transition to a sustainable Europe. EEA report. Available at: <https://www.eea.europa.eu/publications/soer-2020>

Our food system is also making us ill

The destructive impact of insufficiently restrained and directed markets does not just occur in the production of food, it shows up in food consumption too. The reductions in real food prices observed in the post-WWII period, and developments in the food industry have brought about changes in lifestyle and dietary behaviour which are now reducing human longevity through ill health associated with over-consumption and insufficient exercise. These changes are also associated with large-scale waste of food. The impacts of cheap, highly processed foods dense in calories, fat and salt, and the strong rise in consumption of livestock products have precipitated an alarming rise in the proportion of the population which is overweight or obese and suffering non-communicable disease; diabetes and coronary heart disease. Overconsumption, compared to dietary needs for a healthy life, together with food waste constitutes a large, wasteful and in principle, avoidable, pressure on land and its associated natural capital⁶.

How can we do better?

The challenge for the EU's rural land-using sectors is to realign both production and consumption of the principal marketed food and fibre outputs from land onto a sustainable development path and in the process reallocate land and reorientate land management towards environmental services. The current agricultural production systems have large sectors which can be described as environmentally, economically and socially unsustainable. Not all stakeholders are agreed that our land use, and food system are unsustainable. This poses a challenge in defining a feasible new policy framework, this issue is taken up in the third paper in this series.

As well as contributing significantly to environmental degradation, the EU farm sector is in a disadvantaged position in the food chain and has become dependent on the receipt of taxpayer support⁷. In parallel, inequalities in European society are such that significant food poverty is still a serious concern in

⁶ The most cited reference on this is the Eat-Lancet Commission on food, planet and health. <https://eatforum.org/eat-lancet-commission/>

⁷ These supports, are subject to severe criticism about their purpose, distribution and distortive effects. See Matthews A (2020) CAP thinking outside the box, RISE Foundation, Brussels.

most countries⁸. This is a matter of social welfare which goes considerably beyond policies for land use and the food system but nonetheless represents a very real consideration in the formulation of future policies.

Meeting these multi-faceted challenges means providing sustainable, affordable food and fibre, whilst addressing the climate and biodiversity emergencies, the diet and health challenge, and the chronic farm income problem. This requires a strategic, integrated approach, not only to land use, but to a wider system of changes in the way we produce and consume food.

The issues under consideration are, of course, not new. Most of them individually have been under debate for many years. What is newer is the need to consider the broader suite of policies necessary to address the challenges to the food system and overall land use together and the realisation that stronger and sooner action is required. This is necessary given the multifaceted challenges and to take on board the trade-offs and tensions which emerge when we seek to address them together.

Chapter 2 starts by indicating some fixed points including the fragmented and diverse nature of rural land ownership and management. These can be a barrier to change if not addressed. Chapter 3 suggests that the broad challenges will require coordination of policies considerably wider than those directly interfacing with land. It indicates some areas where further research and analysis is required to understand the broad parameters where certain tensions arise and trade-offs are faced. It also considers the appropriate level at which the required policies operate as between the EU, national and regional and local levels. Chapter 4 then considers ten kinds of interventions which will be required to bring about the transformation envisaged. The final chapter draws some broad conclusions. This paper will be followed by a third paper in the series which will suggest how a living road map might be delivered to give effect to the policy changes discussed here.

⁸ And this has been amplified by economic impacts of measures taken to control the Covid-19 pandemic.

2. Rebalancing land use with sustainable production and consumption?

Some givens and the diversity of rural land managers

The EU Member States are pluralistic democracies operating mixed market economies. Generally, health, education, welfare and security are mostly public services and most other consumer goods and services are provided through a decentralised capitalist market system. In Europe, the market system operates under a legal frame which enshrines and enforces rules of contract and secure property rights.

Property rights are particularly sensitive politically and socially, especially in relation to land occupation and also to aspects of land use. Large or abrupt changes in the control and ownership of land often have been associated with violence as in the case of Soviet control over Central and Eastern Europe in the 20th Century. Each EU Member State has its own story of how land ownership has evolved through history, even recent history, and the legal institutions for its occupation and use. Strong emotions can be involved in matters that threaten the status quo. Ownership of European farmland in the 21st Century is characterised as being highly fragmented and dominated by private individual property rights generally owned and operated by families. Forestry land is similarly mostly in private individual hands although there are substantial state forests in some Member States and there are also some very large private forests.

Farm and forest land-use decisions are therefore determined largely by the individual motives of these farm and forest resource managers and the market opportunities open to them. These are a diverse set of rural; “businesses”, with a range of situations, goals and motives different from those found elsewhere in the economy (BOX 2).

BOX 2: A SPECTRUM OF FARMING STRUCTURES

At one end of the scale are large, highly commercial farms – most are family owned and run, but some have company structures, some the product of post-war collectivisation in Central and Eastern Europe. These may manage thousands, or in a few cases tens of thousands, of hectares of land, with € multi-million turnover businesses. They may employ tens or hundreds of workers, often making use of specialist

consultancy services for technical, financial or legal services. They supply food processors (breweries, mills, dairies, meat processors), food retailers and foodservice companies, and some may retail their own branded foods.

At the other end of the scale, several Member States have significant areas of rural land occupied by subsistence and semi-subsistence farmers, mostly quite aged. Most of these have limited appetite or capacity for new investment on any scale or for transformational change.

In between are a wide variety of owner-occupied holdings, wholly tenanted holdings and many with mixed tenure. These cover a wide range of sizes whether measured by turnover or land area managed. These farms can have a range of economic dependence on their farming activities from 100% to near zero on highly diversified rural holdings, some in which the operator has significant off-farm earnings.

Motives of land managers

Economic motives are important in this sector but for some (an increasing number of 'farms' in some regions) the farming activity is a small contributor to turnover and often an even smaller contributor to profits. The attraction may be to maintain family roots or a rural lifestyle. On larger holdings which resemble conventional businesses more closely, farming may or may not be the first choice when it comes to investment. There may be the opportunity to diversify into food retailing (farm shop or farmers' market supplier), hospitality (B&B, camping), rural recreation (hunting, equine activities) or the redeployment of redundant farm buildings for commercial or housing purposes. In short, the motives of the farmer and the co-decision makers in the family in these diverse structures and contexts will be different: So too will be their response to incentives and controls to change their behaviour. Some respond quickly to economic incentives, for others economic factors are much more marginal to their decisions, especially in the short term.

For those who own land, however, the pride of ownership is a strong theme in most of rural Europe. Typically, owners feel they know their land far better than bureaucrats or others in the capital city or in Brussels, and often say they wish to pass on the land to the next generation in better condition than they

found it⁹. These attitudes sometimes appear as resentment towards those interpreted as telling the owner how to manage their land.

Decades of regulation are gradually reshaping such attitudes. In addition, as farmers in the EU have become recipients of annual cash payments for a quarter-century¹⁰ they have begun to appreciate that it is not unreasonable that, in return, society should wish to pay closer attention to how they manage their land. The regulatory framework impacting rural businesses ranges from food and worker safety, many aspects of the environment, animal and plant health and welfare, food hygiene, technology, development planning, zoning and access to land. Farmers have learned that individual private property rights are steadily, as they see it, encroached and restricted, and this is an on-going process.

The highly fragmented, micro-business structure of farming poses a challenge where spatial coordination across the landscape would be helpful. Self-employed, individualistic farmers can show a variety of different attitudes towards their relations with their neighbours. For many, joining the cooperative is a vital act of solidarity and economic survival. Yet at other times and in other contexts there can be intense rivalry and even conflict between farmers (for example over water rights or drainage). The issue of coordinating farmers actions in local areas is becoming more important to achieve broader river-basin or landscape level goals. Also, more collective action is likely to be required where the owner's land management has been reduced in a so-called abandoned land and more active management, especially for biodiversity, is in the public interest.

⁹ The deteriorating state of rural natural capital demonstrates the delivery of this promise for the last couple of generations has not matched the ambition.

¹⁰ For the first 25 years of Europe's Common Agricultural Policy the protection of farms was arranged through price support mechanisms and border controls which maintained EU farm-gate prices considerably above international market prices. This was an indirect system of support. From 1995 these price supports were gradually phased out and replaced by direct annual cash payments to individual farmers. The detail and conditions for receiving these direct payments have changed through successive CAP reforms, but the fundamentals have not. Farmers' organisations have learned in this process that they can maintain access to continued financial support by engaging in negotiation about the conditions which apply to the receipt of such support. Many of these conditions concern the environmental performance of their land management.

3. The range of policy interventions needed to engender change

Given the judgement that the current food system is not sustainable, especially in relation to Europe's climate and biodiversity goals, it is clear that the current suite of regulations and incentives and their implementation is not correctly balanced and neither is it sufficiently enforced. This series of papers focuses on the range of core policies which relate to land use. But the foregoing arguments have indicated that specific agricultural and land use policies must be coherently embedded within a set of wider flanking policies for the climate, environment, nature conservation, the food system and some aspects of energy. These should be supportive of a new approach to land use and not in conflict with it (BOX 3).

BOX 3: FLANKING POLICIES SUPPORTING TRANSFORMATION IN LAND USE

Amongst the most critical of the 'flanking' policies will be the following:

1. A suite of policies pursuing **broad societal objectives such as social justice, public health, affordable food, economic stability and adequate budgetary resources**. Governments will need the capacity to devote a sufficient flow of public funding inter alia to assist the needed transformation in rural areas and to pay for the continued flow of public goods in the long term. This will be important even if there is much more scope for using market measures to achieve change. Managing the implications of potentially higher food prices and addressing food poverty are particularly important. These matters have the power to block the transformation if ignored.
2. More specifically, policies will be needed to promote the shift to **sustainable consumption**, especially to healthier, environmentally conscious, diets to improve well-being. There will be significant roles for the food industry (processors, foodservice and retailers) and public procurement policies as well as policy initiatives targeting education, labelling, fiscal and other measures in bringing about this change. A mixture of EU, Member State and more local interventions can be envisaged.

3. Policies to bring about a more systematic and ambitious pursuit of **waste reduction for food, fibre and biomaterials**. In all scenarios, a reduction in waste is both inherently desirable and helpful in reducing the multiplicity of demands on land. In Europe, the largest share of food waste occurs in homes and the foodservice sector and there is a close link to consumer behaviour, not only improved efficiency in the supply chain.
4. A more refined **renewable energy/bioeconomy plan** including a role for perennial bioenergy crops and utilisation of wastes and residues, where appropriate with carbon capture and storage that looks towards the mobilisation of local resources in a joined-up way, utilising wastes, residues, smaller patches of vegetation as well as bulk commodities.
5. More active and directional management of **international trade flows** consistent with sustainable as well as efficient production and consumption. This may necessitate the use of such tools as carbon border taxes to prevent the movement of production to areas with lower carbon and environmental standards outside the EU, thus “off-shoring” Europe’s environmental footprint and undermining the livelihoods of EU producers abiding by standards that are set to rise over time.
6. Intensified investment in **research and technology** covering a wide spectrum including: (a) innovative approaches such as intensified vertical farming, insect culture, cultured meat, the place for precision agriculture, robotics and new breeding techniques, (b) discovering how to incentivise regenerative farming systems which work by restoring ecosystem function in soils and fields, (c) specific GHG reducing technologies for crop and ruminant livestock production, (d) farming and other land management practices that reconcile different environmental objectives, including lower GHG emissions and enhanced biodiversity.

Internal tensions in land use policy

Over many years now in the EU there has been considerable research, debate and even policy development through the Common Agricultural Policy on how to manage rural land to slow and reverse *biodiversity degradation*. The results to date have been disappointing, but much experience has been gained on the kinds of policies and actions which can produce the desired results. In a nutshell, it means managing farmed landscapes in ways that avoid or reduce products and processes which are harmful to biodiversity, giving more space for nature and better joining-up the protected spaces. The diagnosis of decades has been that agricultural intensification has been a major factor causing environmental damage so it is not surprising that part of the remedy is a degree of de-intensification.

Comparable thinking and policy development on agriculture with regard to *climate change* has been slower to emerge but is now gathering pace. It is clear that agriculture and other land management activities have to reduce their GHG emissions just as in all other sectors of the economy. However, in the case of rural land using sectors, there is also an opportunity to build sinks to help capture carbon in a natural way. It is generally acknowledged that agriculture's non-carbon emissions of methane and nitrous oxide are such that, whilst there is scope for substantial reductions, it is probably impossible to eliminate them. Methane emissions are an intrinsic product of metabolising cellulosic (grass and other herbage) feeds, and some level of nitrous oxide emissions are an intrinsic and inescapable product during the soil nitrogen cycle whether farmers use mineral or manure fertiliser. Therefore, to contribute to net-zero emissions continuing, albeit reduced, agricultural emissions will have to be accommodated by reallocating part of the soil resource and the agricultural area to carbon sequestration¹¹. Strategies to deal with the land sector contribution towards Europe's goal of net-zero GHG emissions by 2050, therefore, have a dual approach: reducing agricultural emissions and reallocating agricultural land. The expected land-use changes are to restore peat, (usually by rewetting), increase the forest area, trees and other vegetation on farms, in woodlands and agroforestry). There may also be a role for increased production of perennial biomass (e.g. short rotation coppicing). These crops are to be used to produce bioenergy in conjunction with carbon

¹¹ In 2018 agriculture accounted for about 10% of total EU direct GHG emissions and LU-LUCF provided a net sink of about 6% of total EU emissions. Source: European Environment Agency (2020) Annual European Union greenhouse gas inventory 1990–2018 and inventory report 2020, Table ES 5. It has to be noted that accounting for peat emissions is currently under review and may change these statistics. This would heighten and not diminish the scale of required actions on agriculture and land use change.

capture and storage (BECCS) and done where it can be shown there are net emission reduction benefits taking land-use change into account.

In short, the climate and biodiversity policies under discussion require reallocating some agricultural land towards fixing carbon rather than producing food, and some more land on farms to be devoted to natural habitat. This is in addition to land management changes in which climate and biodiversity can benefit without detriment to food production, and sometimes even to the benefit of food production too. How might this create tensions? What questions are raised?

Many of the policy measures for regenerating biodiversity involve reducing the intensity of food production. This specifically refers to reducing nutrients and plant protection products, the use of longer rotations, and shifting to lower-intensity farming systems such as regenerative and organic/bio-agriculture. Many questions are posed by the combination of simultaneously reducing the agricultural area for climate and biodiversity protection and reducing the intensity of use of part of the agricultural area for biodiversity regeneration. What is the technical feasibility of such actions? What do the farm-level economics of such combinations look like, what are the market implications? At the farm level, de-intensification will save some costs from lower quantities of purchased inputs, but these will be offset by lower crop yields and potential erosion of price premia for bioproducts as the volume of 'sustainably' produced output increases.

At a broader level, if the intention of changing the food system is to internalise the environmental externalities of production, there is no objection in principle if the consequence is higher food prices, so facing consumers with the real social costs of production. Such higher food prices can also incentivise a reduction in waste and over-consumption. But there is an obvious conflict between higher food prices and legitimate concerns about food poverty; this has to be addressed as part of a fair transition. Can this be squared by credible changes in social welfare policy and what is the role for public support to land management during this change?¹²

¹² The European Commission has not yet published an assessment of the economic implications of the de-intensification measures contained in the Commission's Green Deal and the subsequent Farm to Fork and Biodiversity strategies. Some initial evidence on these impacts were published in late 2020. One was conducted for the European Parliament, Guyomard, H., Bureau J.-C. et al. (2020), Research for AGRI Committee – The Green Deal and the CAP: policy implications to adapt farming practices and to preserve

At the same time, there are new technological developments pushing agriculture in the opposite direction. This is often referred to as sustainable intensification, and some refer to 'Agriculture 4.0', which characterises systems which promote both higher productivity and higher environmental performance, principally in relation to resource efficiency¹³. These include the development of precision farming (which utilises GPS control, artificial intelligence, robotics). Such technologies offer the possibility to reduce the leakage of nutrients and the collateral damage to non-target species from pesticides. They may utilise big data processing techniques to assemble and use meteorological, soil and pest infestation data to anticipate and deploy crop protection actions which reduce reliance on pesticides. Another line of development is towards contained and vertical farming systems using hydroponics, LED lighting, controlled environment, recycled water and nutrient recovery and biological control of pests. These systems could locate closer to consumption zones (cities) and transform the production of small-volume, high-value salad, fruit, vegetable and herb crops. The deployment of developments in gene editing, if socially acceptable, could speed the development of resistant varieties for farming systems of all intensities. These genomic techniques are seen by supporters as allowing progress towards higher productivity (as conventionally measured) and consequent reductions in environmental footprint. It remains to be seen which of these technologies are acceptable too, and consistent with, the move towards lower intensity sustainable farming systems. Helping to balance the right combinations of different approaches at a larger scale would be one of the aims of a more integrated land use focused policy in the EU.

Inevitably discussion of reducing area and intensity of use of agricultural land sparks questions about European food security. Such debate often focusses on simple indicators such as the degree of self-supply of key commodities

the EU's natural resources. European Parliament, Policy Department for Structural and Cohesion Policies, Brussels. The other by Beckman J et al (2020) Economic and food security impacts of agricultural input reduction under European Union Green Deal's Farm to Fork and Biodiversity Strategies, Economic Research Service of the US Department of Agriculture. Nov 2020. These studies offer some quantification of the output, price and trade effects of the proposed strategies. But it is not clear to what extent they have embraced changes in consumption behaviour and the adoption of new technologies or take into account the full range of benefits to climate, health, biodiversity and water quantity and quality.

¹³ <https://www.oliverwyman.com/our-expertise/insights/2018/feb/agriculture-4-0--the-future-of-farming-technology.html>

(grains, meat, dairy produce). In value terms, the EU is a large net exporter of agri-food products. It exports relatively high value processed products and imports beverages, tropical products and animal feed (BOX 4). Judging food security in the EU and how it fits with wider concerns about global food security demands considerations which go much wider than the balance of EU agricultural commodity production, consumption and trade.

BOX 4: THE EU FOOD SECURITY QUESTION

On the demand side, the key variables are population trends and food consumption patterns. The population of the EU27 is currently projected to peak just below 450 million around 2030 and then slowly decline. This is the result of continued population growth in 10 Member States, offset by declining or static population in the other 17 MS¹⁴. Overall, total EU food consumption for major commodities is fairly static. In many Member States, there are established trends towards lower red meat and dairy consumption per capita. Continued public health messages that good health requires further substitution of plant protein for animal protein and that the over-consumption of carbohydrates and fat should be curbed will support these trends. It remains to be seen how vigorously further policies are pursued to reduce harmful over-consumption, and how effective they turn out to be.

On the production side, growth in agricultural productivity has slowed since the 1990s compared to earlier decades. At the same time, the policy debate on reducing agricultural area and intensity in the EU sends a signal to the agricultural supply sector about where they might invest their research efforts in conventional yield-increasing technologies.

Whether these developments in production and consumption threaten Europe's food security is not obvious. But, in any case, agricultural commodity self-supply statistics ignore more fundamental questions about food security. Domestic production systems which undermine natural capital and are suggested to be environmentally unsustainable

¹⁴ Eurostat population statistics, Feb 2020. <https://www.statista.com/statistics/253383/total-population-of-the-eu-member-states-by-country/>

do not sound like the basis of a secure food system. Also, commodity self-supply indicators pay no attention to wider security issues (in energy, in rare earth metals for vital telecommunication equipment) nor to the relative risks of domestic production versus supplies coming from a well-functioning global trading system which can dissipate and share production and consumption shocks from any continent.

The appropriate role of international trade is another difficult challenge. If the EU embarks down the route towards a transformed food system characterised by higher food safety, environmental, animal welfare and other standards, and if this, in turn, involves higher costs and prices for EU food, is there a danger that cheaper imports will displace domestic supplies? To the extent that the food system change is driven by concern about such global commons as climate stability and biodiversity and ecosystem protection then there is no sense in off-shoring the environmental damage. Is there a readiness to use the remedies potentially available for this, such as controls on the standards that imports must meet or border pricing?

In summary, critical strategic decisions are required as the EU moves towards defining the policy mix to bring about the transformative change in its food system and rural land use: these require clarifying the EU stance on real food prices, acceptable technologies and international trade. The analytical frame to set out these choices is emerging but not yet sufficiently developed so an urgent research agenda to do this is required alongside the political process.

Coordinating policy at different levels in Europe

The individual policy measures to induce changes in food consumption and changes in the area and management of agricultural land will have to be developed, deployed and monitored at the national or regional level. However, a Europe wide transition requires a strong guiding EU framework and the deployment of European resources as well. For reasons of protecting the EU single market, respecting the transboundary nature of nature, and also for European solidarity there has to be a common, or at least coordinated approach to policy for the food system and larger land use questions.

Most of the key environmental targets, including for climate mitigation and for biodiversity conservation, are set at the EU level and this is also the locus of most strategic regulations for water quality (the Water Framework and

Drinking Water Directives), for biodiversity (the Habitats and Birds Directives) for renewable energy, for the use of pesticides, food safety, and new technologies in agriculture. The key primary use of rural land, agriculture, is guided mainly by the EU's Common Agricultural Policy although with growing discretion for national authorities. This is funded mainly at the EU level. The EU has exclusive competence over trade policy which bears on many aspects of rural policy and the EU is the largest funder of relevant research and development.

The EU does not have competence over specific local land use and management decisions, including land use planning and most aspects of development control. One exception is the EU wide requirement to follow certain assessment procedures for projects and plans under the Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA) directives. Member States are sensitive about EU incursions into their control over land use and not infrequently there are conflicts over specific cases of alleged breaches of the nature directives, typically where site-specific developments have been authorised that appear to be (and frequently are) in conflict with the conservation requirements of the directives. The European Commission's ability to engage in individual and use decisions is limited by its capacity as well as the limits to its authority.

However, the current dividing lines between different levels of governance over land use are not immutable. The Member States have accepted a somewhat expanded, although still limited, degree of EU activity in the sphere of forestry policy although this is formally reserved to them. If individual Member State decisions over land use impinge on genuine Europe-wide interests then the rationale for EU interventions will strengthen and there may be more political space for initiatives where these are needed, all the more so if EU funding is offered as part of a package. Pragmatism can be as important as the strictures of the Treaty.

The assumption here is that there will be some willingness to bring a stronger EU dimension into land-use policy, but this will be limited and the prime responsibilities will continue to reside within national frontiers. In future, as now, finding the right level for different initiatives to influence land use and seeking to ensure coherence between the different governance levels will remain a significant issue.

4. Bringing about land-use change

A new approach to land use requires changes in behaviour by a range of actors, including farmers, foresters, nature conservation bodies, corporates and

other land managers. But those with immediate responsibility for land management do not work in isolation. Adjustments also will need to be made by other users of land (e.g. for leisure and sport), by enterprises in the food and fibre supply chains, by water supply, drainage and flood management bodies, by banks and credit organisations, by energy supply companies, by technology developers and suppliers, and by local and regional land-use planners.

One part of the transition exercise is to motivate and mobilise the multiple necessary actions by all these players individually in their own spheres, to secure a response with the necessary degree of specificity. This requires many different interventions at various points in the galaxy of activities that fall within the wide span of the transition.

However, this has to be achieved in a coherent way, joined up and in an appropriate sequence as much as possible. Another part of the exercise is the co-ordination of these interventions within an overall strategy or living road map, with a clear eye on meeting objectives within a firm timescale. As part of this steering system, it is vital to have mechanisms to measure progress, to assess the further action required, test assumptions about the best courses of action, keep up with changes in science and technology, follow lessons from elsewhere, adjust models of best practice and re-calibrate detailed plans and objectives as required. Interactions between the land use and other sectors must be constantly reviewed and adjustments to the pattern of effort and co-ordination made as necessary.

The need for a combination of diverse detailed interventions within a coordinated structure and strong strategic direction is certainly not confined to the land use transformation. It applies also to the decarbonisation of the energy supply sector for example. However, **the large number of actors involved in land use**, the variety of their motivations, the diversity of activities falling within scope, the variability and uncertainty associated with biological systems makes for a more complex challenge than in most other sectors. In addition, there is a delicate balance to be struck between climate mitigation, adaptation, ecosystem restoration, the supply of food and fibre and responsible management of Europe's external environmental footprint. The multiplicity of poles involved is striking and probably exceptional. It helps to explain the relatively slow pace of advance in this sector to date and indicates that a sophisticated, multi-layered, iterative and interactive approach will be required in future.

To take the panoply of actors along the chosen road will require their active engagement, as has been established in many spheres of social transformation. Thought must be given to ways of achieving this as part of a more

general effort to establish robust multi-tier governance designs to move the agenda forward locally as well as at a European scale. These requirements are not unfamiliar in Europe, but the challenge should not be under-estimated given the far from uniform conditions and preferences in the 27 Member States at present.

Recognising the breadth of this challenge is the starting point for creating the larger policy canvas.

Interventions for change

In short, the objectives of the transformation of the food system and rural land use in Europe are to steer towards: a healthier population, provided for by a food and land system which is consistent with climate stability and ecosystem restoration and managed by a variety of socially stable, economically viable farms and other organisations. For most of these dimensions, there are reasonably well well-established indicators which can register progress. Thus the ultimate targets are reasonably well understood although not yet sufficiently embraced. The policy challenges are the level of momentum required to change and that so many actions on multiple fronts have to be invoked and coordinated over many years.

Policy interventions are most crucial where they are needed to steer actions and behaviour in ways that social inspiration, discourse and pressure, and the unaided operation of the market are unlikely to achieve on their own. There is a potentially wide spectrum, including but going well beyond agriculture and the CAP. It can be summarised under 10 headings.

1. **Awareness-raising:** Measures to raise awareness of landowners, managers and others of the overall climate and biodiversity challenges for European society and the ways in which they will affect land use and ownership. Creating awareness of policy goals, their rationale, the measures being taken and the ways in which they will develop is an important element of attaining the required goals. Local and national initiatives are critical here, although they can be assisted by European level support and the adoption of a coherent approach within the EU.
2. **Information, skills and training:** Measures to equip the core actors to make appropriate decisions. This should include information on the technical, agronomic, market, legal, financial options open to them. It should assist with ways in which they can obtain information, advice and support, access relevant research, and make contact with peers, neighbours and potential new partners. Help with understanding future market adjustments and opportunities may be necessary in certain circumstances. Enabling access to attractive forms of training at an acceptable cost is likely to be a priority. Keeping up to date knowledge of policy developments and the kind of financial support that may be available to them is another important strand. The role of the EU here could be larger, setting frame

conditions to encourage or compel Member States to take the necessary action in their own settings. The availability of EU funds to assist this effort could increase the level of commitment and activity as well. Closely allied to this form of support is the effort that will be required to influence the choices that they make through targeted information and advice, including the deployment of advisory services, the provision of budgets for promoting new approaches and products, organising demonstration and pilot measures, investing in coordination and facilitation work to get multi-actor initiatives working.

3. **Land-use planning:** Spelling out new land-use priorities through local and regional plans, zones, and designations for protection, restoration or specific use, (including the creation of new linear habitats, corridors and wetlands for example) and controls on development will be another mechanism needed both for influencing the pattern of land use and development and for controlling it. A more proactive system of land use planning than obtains in many areas now would create the additional leverage likely to be necessary.
4. **Financial incentives:** Already used on a considerable scale, incentives will enable European land managers to provide environmental and other services which are not sufficiently provided through market processes. These so-called payments for public goods are an important category of intervention to be deployed to steer change. They should be tied closely to specific environmental outcomes to steer change and there could be support for different types of incentive such as aid for one-off investments and initiatives, for time-limited transitional activities and for providing more permanent environmental services such as ecosystem management. The funding of such interventions can be from public or private sources with different elements organised at EU, national and local levels. Coordinating these streams of support and ensuring they are effective is a challenge in itself.
5. **Financial disincentives:** A quid pro quo of financial incentives for positive action is the deployment of financial disincentives for actions which pollute or degrade natural capital. This can include taxes, charges, penalties and fines. These could be used to penalise the inappropriate use of polluting inputs such as fossil fuels and agrochemicals, for damaging forms of land management, for failing to comply with agreements.
6. **Controls and Regulations:** Balancing these is a requirement to disincentivise some forms of activity by the use of controls and Regulations. The current system of regulation varies by country and does seek to control some aspects of land use such as preventing deforestation, the destruction of protected habitats and applying nutrients to farmland above certain, relatively high, levels in certain zones. However, it is not currently geared to helping drive a transition of the ambition now needed.
7. **Greater enforcement:** A much greater focus on compliance with regulation so that it delivers more than it does now. Compliance with environmental regulation in the agriculture sector tends to be low and it is more difficult to enforce. This effort will require more resources, better technology e.g. enhanced use of satellites and remote sensing and investment in stronger institutions to operate a more effective system in which verification rather than superficial compliance becomes the modus operandi.
8. **Market interventions:** The influence of markets for individual crops, timber, and for greener products such as organic foods will of course continue to be a primary driver of land-use decisions. Market processes will also dominate the inputs to agriculture, genetics, mechanisation, synthetic fertilisers, feedstuffs, and plant and animal health products as well as for land of different qualities and locations. One important arena for new

policies will be to aim to steer and shape markets in ways that help the transition. Two ways this can be done are through raw material sourcing and helping establish new markets for environmental services.

- a. **Raw material sourcing:** As food processing and foodservice companies develop meaningful sustainability strategies this can drive their raw material sourcing through mechanisms which assist their suppliers to meet more demanding standards.
- b. **New markets for environmental services:** There is also great scope to develop new markets for environmental services such as flood control, the supply of clean water, the sequestration of carbon.

These are newer and less developed aspects of policy than most of those listed above. Market adjustments will occur at their own pace in response to changing societal demands, which encourage policy adjustment with more demanding targets. But some adjustments may be held back by institutional or other blockages in the absence of policy interventions. To overcome such hurdles significant interventions and investments by the state may be required to set up novel markets. A prime example is the creation and gradual improvement of the Emissions Trading System in the EU. Creating the markets for Carbon sequestration on biomass, soils and peat will require similar collective interventions.

9. **Indicators for sustainability in consumer markets:** Stimulating shifts in consumer choices and the supply chains that play an important role in shaping those choices is another relatively new area for policy where there is likely to be a requirement for action at both the EU level (as signalled by the Farm to Fork strategy) and within Member States. Interventions to encourage food markets to more strongly indicate sustainable production could cover quite a wide field, including controls over marketing, requirements on retailers and other actors to support longer-term changes in supply chain agreements and relationships, enhanced education, public procurement and new labelling systems.
10. **Land acquisition:** Historically most EU countries have not spent large sums on direct land purchase for environmental purposes, although some have invested in purchasing limited areas for nature reserves, as in the Netherlands for example. Using public funds to acquire land or to improve the management of land that is already in public ownership is another tool that could be used to aid transition, along with variations on this approach such as the use of tax concessions to steer management on private land.

5. Conclusions

The package of changes necessary to bring the EU food system and rural land management onto a path of sustainable development is broadly understood. Significant changes are required in both food consumption and the principal land-using production activities.

The food consumption changes are: to reduce over-consumption of protein, and switch the balance from animal towards a predominance of plant sources,

and to reduce consumption of sugars and salt and increase that of fruit, vegetables and fibre.

The production and land management changes are more complex. Some land will have to be reallocated from food production to carbon sequestration and biodiversity restoration. The management of the land remaining in agriculture will have to change. It will all have to be farmed in a much more knowledge-intensive way. Such is the diversity of natural conditions, farm structures and farmer motivations that there cannot and will not be a uniform shift across all agricultural production systems and regions. Even the same crop may be produced using quite different technologies in different areas.

Some land should shift towards more nature-based farming systems which are less reliant on mineral fertiliser and synthetic plant protection products thereby regenerating soil fertility and restoring ecosystem functioning. This especially demands the acquisition of new management knowledge. Through trial and error and experimentation it generally takes several years for farmers to acquire the knowledge and experience to manage such systems.

At the same time, other land may be farmed in an even more capital-intensive way requiring new knowledge to be embodied in machinery, technology and management which confers much greater precision to crop and livestock production. To be sustainable it must significantly reduce leakages to the environment and damage to the ecology. At the extreme, some high-value crops (and perhaps protein too) may be produced in completely contained 'industrial' vertical farming units, and often in non-rural settings. Socially acceptable developments in genomics can in principle assist the development of plant and animal genotypes with greater in-built disease resistance and resilience to changing conditions, and in principle, these could be used in all systems of farming.

These components of change are understood, but the blend of these elements is not. It is difficult with the current state of knowledge to describe the mix of land use and farming systems which optimises over the four dimensions of (i) human diets, health and well-being, (ii) climate, (iii) other environmental impacts (biodiversity, pollution, landscapes) and (iv) enabling viable land-based businesses and rural communities. Missing ingredients are an analytical framework which can adequately handle all four dimensions, and empirical data on the variables and relationships of interest. It is also unclear that the necessary institutional and administrative structures are in place to implement the optimal blend of these changes.

This multi-dimensionality of the land and food system challenge goes part of the way to explain why it is that these issues have been debated for so long and yet the transformation of the underlying systems has made insufficient progress. It is compounded by the fact that there are so many actors whose behaviour has to be managed. Food choices are made individually and daily by the entire population. Management decisions by farmers are taken annually in most cases and they operate over the entire territory –in a wide variety of climates and environment. These are strikingly unlike the considerations for the transformation of power or transport systems.

Amongst this complexity and uncertainty, what *is* known with clarity are the goals sought from the system transformation. Broadly, also known are the policy levers which will have to be pulled to move the system in the desired direction. It should be clear from the foregoing that a prerequisite is the general acceptance of a narrative that system transformation is necessary and that it requires different behaviour in consumption and production.

Because there are quite different audiences and policy approaches for consumption versus land management issues, these two have to be tackled independently yet with close coordination. The challenge which remains is to understand better how to combine the interventions and the relative vigour with which to apply each. It should be clear from the foregoing that there is no simple list of alterations to Europe's Common Agricultural Policy to fund land managers in a way which will bring about the transformation required, although undoubtedly this policy will play an important role.

Following this broad discussion of what is wanted from the transformation of the food and land systems and the mix of policies which will be required, the final paper in this series will explore how to build from existing policy and institutions to work towards the goals.



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