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Fekete-Farkas, M.[a], Rounsevell, M.[b], Audsley, E.[c]

[a]Institute of Economics, Szent István University, Gödöllő, Hungary, farkasne.fekete.maria@gtk.szie.hu, **[b] Department of Geography, Université Catholique de Louvain, Belgium** rounsevell@geog.ucl.be, **[c] Mathematics and Decision System Group, Silsoe Research Institute, United Kingdom,** eric.audsley@bbsrc.ac.uk

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SOCIO-ECONOMIC SCENARIOS OF AGRICULTURAL LAND USE CHANGE IN CENTRAL AND EASTERN EUROPEAN COUNTRIES

Fekete-Farkas, M.[a], Rounsevell, M.[b], Audsley, E.[c]

[a] **Institute of Economics, Szent István University, Gödöllő, Hungary**
[b] **Department of Geography, Université Catholique de Louvain, Belgium**
[c] **Mathematics and Decision System Group, Silsoe Research Institute, United Kingdom**
***Correspondence:** UCL, Dept. of Geography, Place Pasteur 3, 1348 Louvain-la-Neuve, Belgium; rounsevell@geog.ucl.be, farkasne.fekete.maria@gtk.szie.hu

Abstract

The study presented in this paper is part of the ACCELERATES (Assessing Climate Change Effects on Land Use and Ecosystems from Regional Analysis to The European Scale) project whose main goal is the construction of integrated predictions of future land use in Europe. The scenarios constructed in the project include estimates not only due to changes in the climate baseline, but also estimates due to possible future changes in socio-economics. The overall aim of the ACCELERATES was to assess the vulnerability of European agroecosystems based on economic and environmental considerations in term of both their sensitivity and capacity to adapt changes. The historical background, the type of economy, the policy aim and governance and importance of agriculture in the overall national economy have created large differences between Western and Central and Eastern European countries (CEECs). This paper focuses on vulnerability of the farm sector and rural economy of CEECs.

Keywords: ACCELERATES, climate change, agricultural land use, scenario

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1. Introduction

The socioeconomic scenario has generally been developed to aid decision making under conditions of great complexity and uncertainty, in which it is not possible to assign a level of probability to any particular state of the world at a future point in time. Therefore it is not usually appropriate to make a statement of confidence concerning a specific socioeconomic scenario (IPCC, 2001). Socioeconomic impact assessment has tended to focusing on quantitative characterisation of key drivers and to ignore a narrative description of a scenario, "storyline", highlighting the main characteristics, dynamics and relations between key driving forces.

As the world has become more affected, changing patterns of land use have raised the interest of the public, the policy makers and scientists in different fields. The overall aim of the project ACCELERATES is to assess the vulnerability of European agro-ecosystems to environmental change. This information could provide policy makers with ideas on how to adapt to these changes. The aspect of the ACCELERATES project presented in this paper, is the construction of coherent future scenarios of the drivers of agricultural land use change in Europe (Rounsevell at al., 2002).

When farmers decide what and how to produce, they face different resource constraints arising from differences in geographic and climate conditions, type of soil, location, the physical and financial size of farms, current production pattern or mode of land ownership. These factors cause differences in the rate of adapting to changes, which in turn depend on the time horizon of a study (Fekete-Farkas and Audsley, 1997).

Most recent studies make projections of land use changes for the period of 5-10 years. During this period of time the land use, having changed in response to market and policy drivers, could have negative impact on the environment. Making corrections in land use patterns could then cause extra costs for both the society and individuals, which indicates the necessity for more knowledge about the

possible future. The long term nature and uncertainty of climate change and its driving forces require extending the time horizon to 20, 50 or 100 years.

The expected climate changes will alter regional agricultural systems with consequences for economic and social welfare. The specifics of the impact will depend on how the effects of climate translate into the factors that determine the competitiveness or viability of the agricultural system. A brief summary of the interactions between climate changes and agriculture are as follows (Abildtrup and Gylling 2001):

- Land use change has been identified as a major driving force for global climate change through the emission of greenhouse gases, related to the intense use of natural resources;
- Climate change may influence the socio-economic context of farmers, for example through changes in the physical yields of crops and livestock production; in the performance of farmers (profit, gross margin or total utility); in the optimal farming system (changes in rural production mix and pattern and in allocation of production factors); in income distribution; in the function of rural areas and in heritage and life style.

This paper is focusing on the second interaction. Climate change impact assessment requires understanding of current socioeconomic vulnerability and the adaptation capacity of farms and farmers as well as the driving forces of future changes. The general expectation is that agriculture should supply goods that meet consumers' demand both in quantity and quality. The main assumption here is that agricultural demand/supply has to be divided into two parts:

- demand/supply of agricultural products, food and non-food commodities as private goods;
- demand/supply of "environmental goods" as public goods, which can be produced as a joint products or as a main products.

The main consequence of these is that agricultural land-use change is not only caused by increasing food demand due to population growth, but also by changes in food preferences and lifestyles which are driven by economic growth, modernisation and urbanisation. Agriculture is a special type of activity which guarantees qualitative and quantitative food security and being multifunctional in nature, occupying a large area, and being important for employment especially in Central and Eastern European Countries (CEECs), it contributes to economic, social and ecological equilibrium.

Future trends in the factors determining land use are full of uncertainties. In such a context, prediction of socio-economic trends and the environment, changing in space and time, is clearly impossible. Given these constraints, an alternative technique for the exploration of uncertain futures is used: the application of scenarios.

The ACCELERATES scenarios, based on the IPCC, SRES scenarios were derived for some regions of EU-15 and have been extended for the CEECs as well. It was important that a uniform assessment was carried out to compare and evaluate the local, regional and global impact of climate change on agricultural land use, but the results and development pathway differ significantly due to differences in their baseline date and the historical backgrounds.

2. Methodology

Figure 1 shows a schematic illustration of methodology.

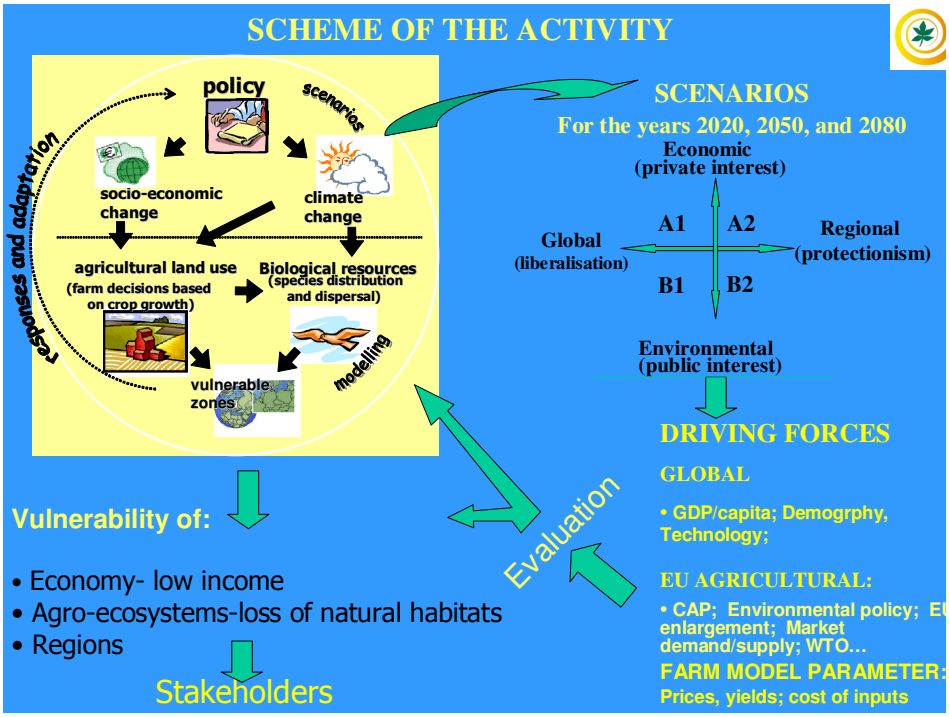


Figure 1. ACCELERATES Methodology

2.1. Global driving forces

The global driving forces are based on the scenario storylines described in the Special Report on Emission Scenarios (SRES) (Nakicenovic et al., 2000). The storylines are short narratives describing possible future developments during the 21st century. They are called A1, A2, B1, B2, and there is no particular order among them. Each storyline represents different plausible demographic, social, economic, technological and environment developments.

The two-digit code of the four families locates them in a four-quadrant chart. The vertical axis represents a distinction between a more economical future development, driven by private and short-term interest (A) versus a sustainable, more environmentally oriented (B) future. The horizontal axis represents a range between more globally (1) versus more regionally oriented developments (2). They reflect the type and principle of governance as globalisation and liberalisation (1) or regionalism, localisation and protectionism (2).

The storylines also represent different social and economic values. In storylines A1, A2 development, people are primarily concerned with material well-being, driven by private, and short term interest, and on the contrary in B1, B2 driven by mainly public and long term interest achieving a balance between economic, social and environment objectives.

The SRES scenarios aim to represent a range of plausible driving forces and emissions for different world development pathways. These scenarios allow us therefore to study the combined effect of future climate and socio-economic developments. However, the latter need to be 'downscaled' (or translated) to Europe. Whilst the use of climate scenarios as input to vulnerability, impact or adaptation assessments is well established, there is far less experience of using socio-economic scenarios (UKCIP, 2001).

In ACCELERATES, the four SRES marker scenarios were selected, each of which is described by a narrative storyline representing plausible demographic, social, economic, technological, and environmental development alternatives: A1, World Market (WM); A2, Regional Enterprise (RE); B1, Global Sustainability (GS); B2, Local Stewardship (LS). The following concise description of the four scenarios is taken from the IPCC Special Report „Emission Scenarios-Summary for Policy Makers" (IPCC, 2000).

„The A1 storyline and scenario family describes a future world of very rapid economic growth, low population growth, and the rapid introduction of new and more efficient technologies. Major underlying themes are convergence among regions, capacity building, and increased cultural and social interactions, with a substantial reduction in regional differences in per capita income. The A1 scenario family develops into four groups that describe alternative directions of technological change in the energy system. The A2 storyline and scenario family describes a very heterogeneous world. The underlying theme is self-reliance and preservation of local identities. Fertility patterns across regions converge very slowly, which result in high population growth. Economic development is primarily regionally oriented and per capita economic growth and technological changes are more fragmented and slower than in other storylines. The B1 storyline and scenario family describes a convergent world with the same low population growth as in the A1 storyline, but with rapid changes in economic structures toward a service and information economy, with reductions in material intensity, and the introduction of clean and resource-efficient technologies. The emphasis is on global solutions to economic, social, and environmental sustainability, including improved equity, but without additional climate initiatives. The B2 storyline and scenario family describes a world in which the emphasis is on local solutions to economic, social, and environmental sustainability. It is a world with moderate population growth, intermediate levels of economic development, and less rapid and more diverse technological change than in the B1 and A1 storylines. While the scenario is also oriented toward environmental protection and social equity, it focuses on local and regional levels".

Figure 2 shows some results for OECD and Eastern European countries based on the SRES scenarios.

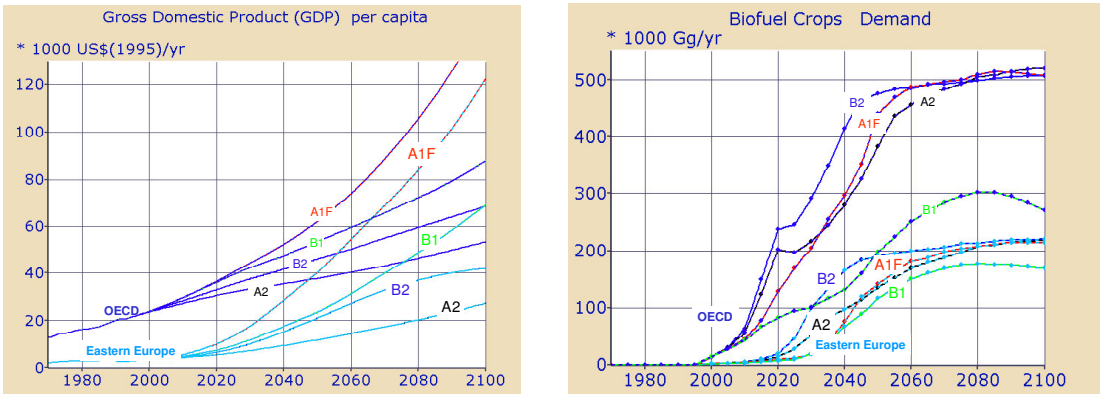


Figure 2. Some results based on IPCC SRES scenarios

The SRES storylines do not describe explicitly the decision-making structure, institutions and type of government, but the ACCELERATES project should take them into consideration due to their historical importance and substantial differences between EU-15 and CEECs.

2.2. European driving forces

The European perspective identified specific regional concerns and priorities in relation to the global scene and based on the current situation. The importance and intensity of these driving forces are different between scenarios, time horizon, or by countries, and the final outcomes result from willingness and ability of people to change.

The key drivers shaping future agricultural land use were identified (Fekete-Farkas et.al., 2003):

geographical situation (including market accession), *demography* (population growth, density; population breakdown: by age and urban-rural; migration: international flow; from urban to rural; from rural to urban), *economy and policy* (GDP/capita; growth of the national economy; changes of income level and distribution; world market situation: demand/supply, prices; domestic demand for

agri-food production; technological innovation and deployment; food quality regulation, food safety; role of WTO; role of Foreign Direct Investment (FDI); pattern of market chain; development of infrastructure; energy demand; EU enlargement), *agricultural policy* (national; Common Agricultural Policy (CAP): price support, intervention, direct payments, rural development, environment protection), *environment policy and regulation* (national; international agreements (Kyoto, etc.); public awareness), *other sector and social policies* (because of finance, of education, social benefit, sources of alternative income, support of S&M enterprises), *land market regulation* (ownership, leasing), *resource competition* (land, water), *farm structure* (size and legal form), *personal characteristics of farmers* (education, age).

2.3. Land use model

The construction of socio-economic parameters for the agricultural sector model scenarios was based on a pairwise comparison approach to obtain quantitative judgements from verbal comparative judgements of experts (Rounsevell et al. 2002, Giupponi and Rosato 2002). The construction of ideas and data in the scenarios are borrowed or adapted from vast international literature and widespread consultations have been undertaken with other experts in this field and also with stakeholders in the field of policy. The agricultural sector model uses these data to estimate the decisions that farmers will take to maximise their income (Annetts and Audsley, 2002).

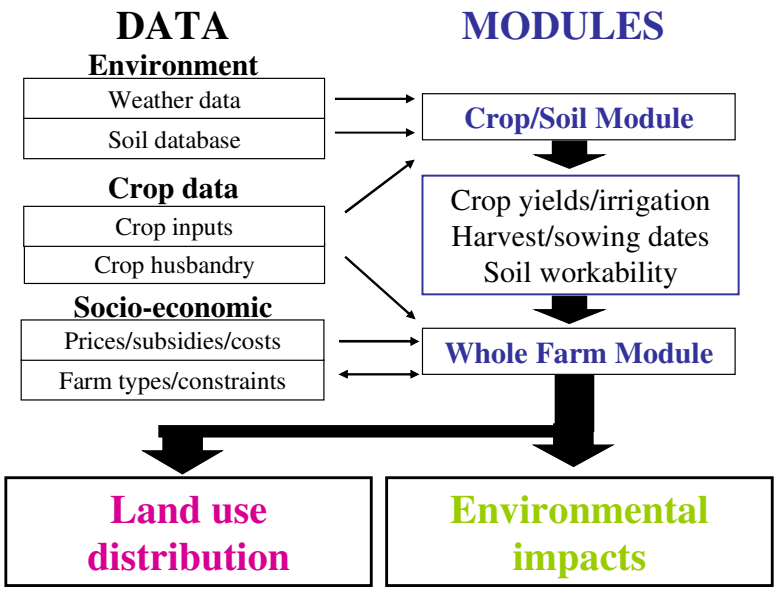


Figure 3. Land Use Model

2. 4. Vulnerability assessment

A vulnerability assessment should provide a framework for identifying the social, economic, and environmental consequences and underlying causes of global change impacts.

Vulnerability, defined by UNEP, provides various definitions of vulnerability focusing on human welfare. “Degree of loss resulting from a potentially damaging phenomenon.” “[Vulnerability] is an aggregate measure of human welfare that integrates environmental, social, economic and political exposure to a range of harmful perturbations” (UNEP 2001).

Agriculture is at the core of environmental vulnerability such as soil degradation, soil, water and air pollution, water scarcity, deforestation, and threat to biodiversity. Many factors contribute to social vulnerability, including rapid population growth, high population density, depopulation, income inequality, poverty, low level of education, high share of old population, lack of access to resources,

low level of research and development. This study is focusing on economic vulnerability. Economic vulnerability of agriculture is related to a number of interacting elements including its importance in the overall economy, in income generation of special regions, food safety and food security, its role in trade balance, investment, and characteristics of food chain, farm sizes, ownership structure, tax and subsidies (Iglesias, 2003).

Everyone is vulnerable, although their vulnerability differs in its causal structure, its evolution, and severity of likely consequences. Vulnerability is a relative measure - critical level of vulnerability must be defined by the analyst.

In this project, vulnerability is assessed as a function of the sensitivity of the system to the imposed stress and its adaptive capacity. By adopting this approach two critical questions can be addressed: (1) What determines the relationship between a scenario and its effects? (2) Who is vulnerable and where are the vulnerable located? (Rounsevell, 2004)

Analytically, we consider that adaptive capacity is determined by the interaction of social, economic, institutional and environmental processes that combine to affect farmers' decisions at the moment that they face climatic risk and change. IPCC (2001) recognised two types of adaptation: autonomous (or spontaneous) adaptation and planned (or societal) adaptation. Autonomous adaptation refers to farmers' ability to recognize present and future climatic risks, respond to and cope with risk (through reorganization of activities, investments, resource allocation, etc.) in order to minimize risk of future negative consequences. Planned adaptation refers the intervention of society through policy.

The results of the land use modelling indicate that farmers, to optimise profit, should change their crop rotation if the climate changes. Therefore, the decoupling or abolishing of agricultural subsidies will remove barriers for autonomous adaptation to climate change. However, total liberalisation of the EU agricultural system will not lead to a solution that is optimal for welfare. This is especially the case in regions with small farms and marginal land where abandonment may be a consequence of the declining relative productivity of agricultural land use. It is important to note, however, that intensification may have positive effects on biodiversity and minimise environmental pollution. Conversely, intensification would benefit farmers but may have negative effects on biodiversity. What is good for the large farmers with good soil is bad for environment (society). This example demonstrates the problem of conflict of interest.

The impacts of climate change will vary between the regions. This implies that the agricultural policy should be designed to deal with regional differences and should manage the problems of interest conflicts of different groups in a society.

3. CEECs scenarios- storylines

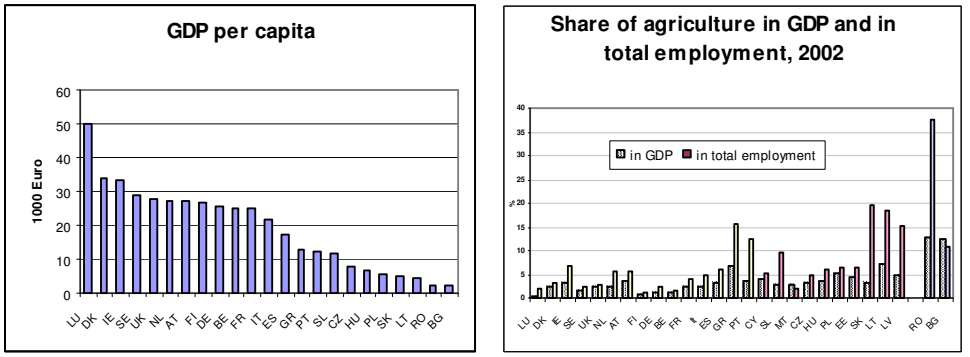
CEECs countries are likely to have considerably more difficulty adapting to climate change in all scenarios due to many factors deriving from their history and the transition process from central planned economy to market economy. The various historical backgrounds create differences between the dominant driving forces and their importance in the European Union compared to the Central European countries. The year 2020 is considered a transition year, i.e. the scenarios include mechanisms on how to get to the future. The adaptation of the agricultural sector to a market economy was not an easy or clear process, and the sector is in fact still struggling with severe socio-economic constraints. Thus it was necessary to separate the impact of transition from the effect of long term drivers. By the year 2050 CEEC countries will be close to the EU-15 status and by the year 2080 they are assumed to have converged with EU-15, so the socio-economic input parameters of the land use model will be the same.

3.1. Baseline

The basic assumption is that the change of future land use strongly depends on the current pattern of land use. Some characteristics that will cause differences between EU-15 countries and CEECs in future scenarios (CEE, 2002; EEA, 2004 and Novak et.al. 2005):

- Low level of GDP/capita (Fig. 4a)

- Larger share of agriculture in the GPP and total employment (Fig. 4b) ,



a. b.

Figure 4. Differences between EU-15 and CEECs

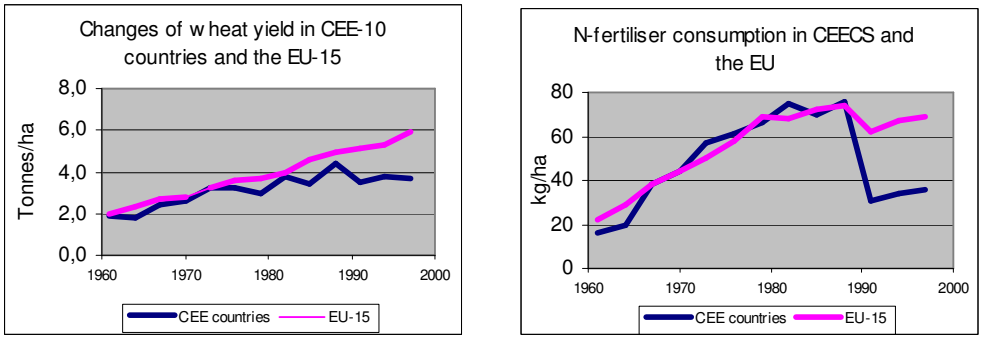
- Low level of agricultural productivity (Table 1)

Table 1: Comparison of agro-economic factors

Country	AE	AL	AE / 100 ha	GVA	GAP	GVA / AE	GVA / GAP	GAP / AL
Bulgaria	795	6,2	12,8	1 794	2 973	2 256	289	479
Czech R.	267	4,3	4,8	935	2 885	3 501	217	671
Hungary	279	6,2	4,5	1 956	4 366	7 011	315	728
Poland	2 926	18,2	16,1	5 178	11 946	1 770	285	656
Romania	4 342	14,8	29,3	5 152	9 612	1 187	348	649
Slovakia	180	2,4	7,5	479	1 444	2 661	200	602
CEECs	9 478	59,9	15,8	16 913	-	1 784	282	-
EU-15	6 891	136,4	5,0	144 492	263 372	20 968	1 059	1 931

Source: National Development Plan of Hungary (2003)
Notes: AE = Agricultural employment (million capita),; AL = Agricultural lands (million ha); GVA = Gross Value Added of agriculture (million EUR); GAP = Gross Agricultural Production (million EUR)

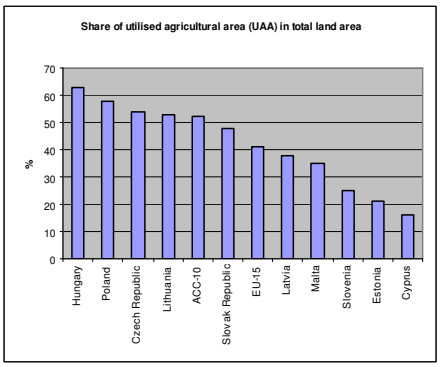
- Extensification: lower use of pesticides and fertilizers, strongly decreasing yield (Figures 5a, b) higher associated biodiversity (Zellei, 2003).



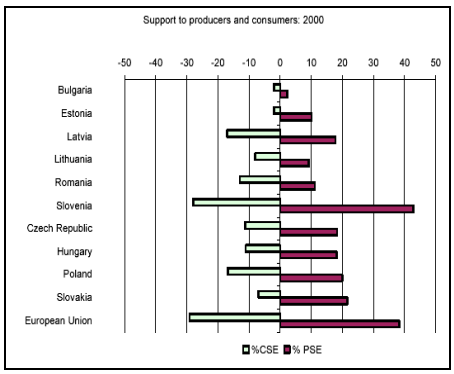
a. b.

Figure 5. Extensification of Agriculture in CEECs

- Larger share of food expenditure: The share of expenditure on food in the total expenditure of households is very high at present, standing at about 30-60% compared to less than 20% average in the EU-15; and the income elasticity of food demand is much higher than in developed counties.
- Larger share of agricultural land area (Fig.6a)
- Lower level of subsidy (Fig.6b) (Baker, 2002)



a



b

Figure 6. Some indicators of CEECs' agriculture

- Strong polarisation between large and small farms (Table 2)
- Large proportion of subsistence and semi-subsistence farms

Table 2: Farm structure in selected CEE countries

	Year	Share of UAA used by family farms/household plots (%)	Average size of family farms/household plots (ha)	Average size of private and state-owned holdings (ha)
Slovenia	2001	94	6	290
Poland	1996	82	7	426
Romania	1997	67	3	2 491
Hungary	2000	55	9	312
Czech Rep.	2001	27	28	1 035
Bulgaria	1999	26	1	519
Slovakia	2000	23	4	1 399

Source: EAA, 2004

- Under-capitalisation, outdated equipment: today the average tractors are 10-15 years old.
- Not well-defined property rights
- Lack of suitable regulations and market institutions.
- The main issues for CEECs are the new institutions relating to EU memberships. In case of the new members and countries preparing for the membership CAP and its variables, the instrument of the Common Market Organisation (CMO) and its second pillar, and other instruments linked to the CAP have to be considered for future development.

3.2. The key issues of Scenarios for the year 2020

In the ACCELERATES project, four scenarios are developed, picturing the fundamental direction of social, economic and climate change, which produces four different directions in which agricultural land may be used and managed. Due to limited space, we have chosen two of these four scenarios for detailed explanation: the A1-world market scenario and the B1-global sustainability scenario. The main reason for this is that A2-regional enterprise scenario shows a trend which is quite similar to the current direction and impact of the CAP. For the period being examined, the B2-Local Stewardship, seems to be an unlikely assumption for most of CEEC regions due to the lack of local capital and funds.

A1-World Market Scenario

In this scenario firms are concerned with short-term profit maximisation and people with their material well-being. The role of the state (government) decreases and changes; its main goal is to provide a better economic environment through the investment in transport and other infrastructure, and through the tax system. The private sector, especially multinational firms and international organisations (WTO, IMF), have an increasingly strong influence on development. Prospects for

improvement over the next 20 years appears favourable, with all regions projected to have positive and higher rate of economic development. By historical standards, economic growth is rapid in the world and the growth rate is higher in the CEE countries than in the old EU members. In the development of these countries foreign direct investment (FDI) plays the greatest role, together with fast technological development.

The share of food consumption will decline slowly relative to other commodities under a continuous recovery in the CEECs. Food consumption is lower today (see summary of current situation) than before the transition, which creates a high level of extra inward demand for the food sector. As a consequence of the increase in the number of people with middle and higher incomes, food consumption patterns will shift from traditional to western type (preferring vegetable oil to animal fat and white meat to red). Due to increasing life expectancy - as people become older - health concerns will become predominant and nutritional requirements will also change food consumption patterns. But in this scenario the influence of multinational food processing firms will be one of the most important driving forces of change in consumption patterns

The role of agriculture in the economy remains higher than in the developed EU countries (except in the Czech Republic and Slovenia), however its share in GDP decreases and it will have an increasing role in tackling rural unemployment problems (Poland, Romania, Bulgaria). Agricultural activity in CEECs gets more and more involved in a supra national and global context.

Farm structural changes will continue to be the most important microeconomic determinant of agricultural supply. The structure based on the basic assumption of A1 will be driven by the economic value of farm size. In the world market scenario land structure remains in duality: large commercial farms complemented by a high share of small subsistence farms. It is expected that the size of the large scale farms in Slovakia, Bulgaria, and Czech Republic will remain or decrease (because of larger management costs) and one part of the middle and small sized farms will become larger and more market oriented, whilst a substantial part of these will continue farming in a conventional low-input way. The importance of social type farms (subsistence or semi-subsistence producing mainly for own-consumption) will increase in the countries, which will face huge rural unemployment problems (for example in Poland, Romania, and Bulgaria). These farms are traditional mixed farms and help to keep diversification at a higher level.

Because of the low level of farm income and accumulation possibilities by farmers, plus the lack of national capital, multinational firms will have a big influence on the technology applied and the quality of production, through contracts with strict protocols. This market channel fits only farms up to a limited size and encourages increasing farm sizes or the creation of farm associations such as co-operatives. The larger commercial farms will use increased levels of chemicals and industrial inputs (but only because of their low level compared to the preceding period versus the EU average), resulting in increased yields, and also increased competitiveness in the market of the developed countries (mainly because of lower labour cost and the economies of scale). On the other hand, they will manage chemical use much more carefully because of their cost sensitivity and the food safety regulations introduced by international food companies. Some technological developments, such as improvement in services, weather forecasting, and agricultural research will also improve their competitiveness.

A second type of commercial farm will produce at a lower quality standard to sell their products in developing countries, mainly their less developed neighbouring countries. Meeting the increasing and changing food needs, rising income and changing lifestyle in developing countries will be a fundamental challenge.

Nevertheless in the first period, despite price increases, agricultural production will only increase at a moderate rate (2-3 %). Agriculture in some countries where the proportion of subsistence farms is higher will adjust more slowly to the favourable world market environment. Subsistence farming is not price sensitive at all. The commercial farmers that are able to adjust their production mix to western market requirements will buy new farm machinery (tractors, harvesters etc.). The capacities of these machines will fit to farm size which, with decreasing repair costs, will increase their competitiveness and allow them to take over their weaker neigbouting farms.. Due to abolishment of trade barriers the import of second hand farm machinery will increase in the second type of commercial farms.

Commercial farmers will be concerned with environmental effects only if there is an economic interest. The share of leased land will increase, because the cost of leasing is low, so the farmer with a large area of land is not encouraged to buy the land, and the farmers with small farms do not want to sell their land because of the security, and will wait for land price increase. The large share of leased land is in danger if leasing is not regulated properly, or the agreements are short-term, as is the case currently in the CEECs.

At first (during the accession process and in the first years after joining the EU) the CAP will positively influence farm and rural income due to intervention and direct payment. Later the CAP will play only minor role. Agricultural prices (farm gate prices) in the CEE countries are quite close to the world market prices. When the price subsidies are abolished in the EU and USA, and if food policies in the OECD countries were completely liberalised, (an important assumption in this scenario) agricultural world market prices would rise by about 30% on average and the degree of price instability would decline (Schmitz, 1997). The price level induced welfare effects in CEECs differ depending on: level of protection, the degree of insulation of domestic agricultural markets from world markets, the ratio of agricultural export and import, the transmission .of price impulses from producer to the retail level, the share of food expenditure in total.

In the CEECs seed prices increase because of technological development and quality requirements. Fertiliser prices remain unchanged because of increasing demand (pushing them upwards) and international competition in supply (pushing them downwards). Due to the export and import of fertilisers and pesticides the prices are estimated to be very close to their level in the EU-15. Land prices will increase at a high rate because of land market liberalisation and the increasing demand for land for non-agricultural use (transport, industrial green-field investment, urbanisation, increasing demand for recreation areas).

Energy demand in 2020 will depend on different drivers and on the initial situation, based on the specific historical development of the economies and differences in natural resources. In A1, the area of energy crops and use of traditional biofuels will increase rapidly - especially in countries where there is not enough internal energy resource and the per capita income is low. Maize and woody fuel production are expected to increase by 200- 300 per cent.

Both forest area and yields are expected to increase. During the communist system most of the forest area belonged to the state, but during the transition period some (differing from country to country) parts were privatised. The privatisation of forest area will continue in scenario A1. The short-term profit interest of foreign companies and emerging national companies may increase the risk of over-exploitation of national resources and environmental degradation. Because of low income there is low but increasing demand for public goods (landscape diversification, forest for leisure) provided by agriculture. The forest exploitation rate will increase because of the increasing demand for wood products, which may cause problems in CO_2 accumulation and soil erosion. Some activities such as hunting will spread among the wealthier people, which will also increase the demand for forests.

Due to the high level of international competition, arable and forest production will move towards more fertile areas. Land abandonment will become a more serious problem. Both intensification and land abandonment are projected to increase the vulnerability of some regions. Agricultural areas are estimated to decrease by about 10-12 percent (but arable about 20%) and forest areas to increase by about 3-5 %. As the profitability of farming increases, the demand for water will follow and compete with industrial and households use.

The enlargement will be continued, because there is no budget barrier. The agricultural subsidies, which take up more than half of EU budget at present, will be decreased or abolished. The main goal of EU enlargement is enhancing political stability, destroying non-trade barriers for international cooperation inside Europe. The co-operation of European firms (creating mergers) could help to increase the returns of scale and create labour divisions based on comparative advantages. Liberalisation of the agricultural market raises the question of competitiveness.

B1-Global sustainability scenario

While identifying driving forces and their effects on sustainability, it may be good to recall the various dimensions of the sustainability concept: sustainability includes not only the environment dimension but also the economic and social dimension. The definition of sustainable development

that was approved by the FAO Council in 1988 is as follows: the management and conservation of natural resources based on the orientation of technological and institutional changes in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future generations.

Compared with the A1 scenario, growth rate is less, but economic growth in the CEECs will still be fast, and faster than in the western part of the EU. Population growth is the same. In B1, demand and supply of public goods are increasing and the economic value of natural resources and externalities will be measured and priced. Government will spend more on research and development. Infrastructure will develop with more concern for equity in access. Infrastructure development in rural areas means the urbanisation rate is lower than in A1, but smaller towns are developing faster than large cities and the capitals. The green area in new cities will be larger, and land demand for urban areas and transportation will increase.

Technological changes along with the globalisation of markets are transforming industrial countries into knowledge-driven economics. The main task of national governments is to implement standards agreed at international and EU level and mobilise the local sources for catching up in a sustainable way. The impact of multinational firms is very important: new firms - even national ones - will be established on the base of the new technology and environmental standards. The environment conditions will improve rapidly. Due to the structural changes and rapid improvement in energy efficiency, energy demand increases at a much lower rate than in A1 and the bio-fuel area is increasing less rapidly than in A1.

In the CEECs an increasing awareness of environmental concern is taking place. However, at the beginning financial constraints are large and, given the initial state of agriculture, do not favour the social, economic and environmental sustainability of farming. Generally, production level and productivity in agriculture are low compared to both its earlier and potential level. Constraints on economic sustainability are more evident, and sustainable development of farming units seems to be related both to inadequate resources and equipment and to the lack of extension and training. Survival of the farms and having a minimum income in the short run are the first priorities. Natural resources and environmental management, therefore appear to be secondary factors when farmers decide upon agricultural production. Soil acidification, soil degradation and soil erosion are among the most serious environmental problems mentioned as the main ecological barriers to sustainability in most CEECs. However, during the transition period agricultural production has taken on a more extensive, and at the same time, less environment polluting character, yet the environment conditions have not improved significantly. Soil quality and soil processes are influenced by human activities such as industry, traffic, urban development, landfill, mining, waste deposits and agricultural practices. In scenario B1-2020, in most of the CEECs countries there are lots of improvements, but the abolition of negative impacts requires a longer time and more support from international funds.

One of the major issues is the promotion of an efficient farm sector and the promotion of efficient farm units. In this scenario the number of small and medium sized farms will increase, but sustenance and semi-sustenance farms will be developed and commercialised. In some countries, like Poland, Romania and Slovenia, structural changes that occur are geared towards enlargement of small, sustenance or semi-sustenance family whilst in a number of others the trend and the policy objective are aimed at a decreasing the average farm size (Slovakia, Czech Republic).

In scenario B1 the service sector increases rapidly and the state support policy focuses on rural development. Industrial development will be much more rural oriented and less concentrated. It is evident that rural problems cannot be solved by agricultural policy. International policy, including the CAP, and state policy give priority to the development of non-agricultural businesses in rural areas. Emerging enterprises give jobs to people living on agriculture, and increase the incomes of the agricultural and rural population, preventing a depopulation of villages and facilitating the expansion of the infrastructure. After building up the basic infrastructure the development of agro-tourism is seen as an important factor for creating alternative income possibilities in the rural areas. The emerged enterprises, especially in the food industry, will be encouraged to be closer to the raw material, labour resources and consumers, leading to lower transportation cost and pollution caused by transport and creating new jobs.

However, it is a liberalised world and the international trade of agricultural products will increase though at a lower rate than in A1. The main reason it is lower, is the international effort which

encourages development of the agricultural sector and increases the level of self-sufficiency in developing countries, and because of the costs and regulation of transport increase. The main important motivations for agricultural trade are to meet the more diversified consumer needs and the demand for lower total cost of food including transaction costs and externalities. An increase in agricultural exports from the countries with comparative advantages is expected. The level of production in the developed countries will decrease because of their higher input prices (they should cover the external cost as well) and the level of production support will decrease due to the WTO. More extensive farm practices result in decreased growth rate of yield and eliminate overproduction. Many environment schemes will encourage the use of marginal land for uses other than agriculture (deforestation, nature conservation, protected area etc.)

For the CEECs the agricultural support level will be similar to the current development pathway of the old EU members, with a large proportion of agricultural and environmental measures. Support for farm investment is clearly a case of a measure designated for different trends and conditions in the CEECs.

The experts predicted that in the B1 scenario, a flat direct payment will be introduced, which will be applicable to all products, including fodder crops, grassland, vegetables and landscape features, which currently are not supported by direct payments. The head age payment will be replaced by this flat direct payment as well, which could bring benefit for environment and nature. The advantages of this system can be summarised as follows: it will put an end to the unequal distribution of subsidies; intensive farming system will no longer be favoured; it will help to maintain traditional and extensive farming systems; it will significantly reduce the expected shift towards coarse grains and specialised beef production; because the flat area payments is applicable to the whole agricultural land with conditions on cross-compliance, environmental, food safety, animal welfare and occupational safety standard will be reinforced; it is an instrument that will help to maintain the land threatened by abandonment or help currently abandoned lands to be reused by agriculture. Cross-compliance requirements will be introduced as a common EU framework providing a set of minimum standard for "good agricultural practice" and establishment of farm advisory systems will be encouraged.

While the pressures of international institutions and EU environmental policy (in the new member states) are high, intensification of production is expected especially in regions with more fertility soil. The use of fertilisers and pesticides will increase in contrast to old EU members. The main reason is the low level of use at present (except Slovenia). Most of the CEEC countries face the problem of nutrient deficits. The eco-taxes or green taxes, which are applied widely in this scenario, push the prices of chemicals up. As a result of the price increases, the farmers use inorganic fertilisers only at the level that crop can use efficiently. The appropriate amount of fertilisers and pesticides vary greatly depending on the productive potential of soil and climate condition in the region.

Precision farming systems will expand. Sustainable agriculture based on diversity of crop species will enhance the farm's biological and economic stability, for example, through rotations, cropping and inter-cropping; selection of crop varieties and livestock that are well-suited to the soil and climate conditions and resist pests and diseases; preferences for farm-generated resources over purchased materials, as well as for locally available off-farm inputs over those from remote regions. Mixed farms are preferred, and farmers use fertilisers only in cases where livestock manure and legumes cannot cover nutrient deficits.

The imperative needs for improvement of farming efficiency in CEECs, combined with the requirements for environmental neutrality of production systems, as well as household and country-level food security, will most likely lead to the adoption and development of such farming system that are at the same time intensive and sustainable. The ability, skills and knowledge of people who farm the land has been recognised as a major factor of efficiency. The service and research sector will increase rapidly in this scenario. There is a rapidly increasing demand for expertise in economic and institutional issues surrounding the evaluation of the environmental effects of agricultural systems and the design of schemes aimed to reduce their negative effects. Also there is a need to analyse climate change and the structural adjustment on farm income, rural development, quality of environment and landscape. These create needs for wider co-operation between countries and regions. Agricultural research and development are public goods, which are provided by governments and international institutes as public services.

The main aim of public policy is to educate private sector decision makers about harmful effects of intensification, of use of fertilizers, pesticides herbicides. In term of perceived benefits, investment in education requires sacrificing present benefit for higher expected future returns. That is younger decision-makers are also more likely to attach utility to future environmental pay off (they have longer time horizons and lower discount rate) (Goetz et al. 1997). In the short run one of the major barriers to adoption of new environmental friendly technologies in CEECs is the ageing structure of farmer societies. Early retirement and setting–up of young farmers' schemes represent a key area of agricultural support in the B1 scenario.

Several of the initial tasks of transforming the inherited structure into market based systems have not been fully resolved yet in the CEECs, such as land privatisation, completion of land titling and registration, leasing and land use regulation and reconstructing and consolidation of the new farm units. In the B1 scenario, land ownership should be clearly defined. The definition and enforcement of property or user rights is the basic precondition for individuals to include sustainability considerations into their decisions. (The not-defined or unstable property rights and leasing regulations encourage short run profit-maximisation and thus lead to the overexploitation of resources.) However we should keep it in mind that private property rights cannot be absolute and the owners can use their land in a way which is not against the public interest. It has an increasing demand for regulation. For example, the state can use eco-taxes to avoid land abandonment or over exploitation of forest or water resources.

Nutrition, food safety and health benefit have also become very important issues worldwide. As personal income increases in each country, consumers have increased expectations about what they eat and demand more guaranteed quality and safety. This increases the demand for organic and low input production, but until 2020 it will represent a small share of total production because of the low level of initial income. As the income of people increases, demand for organic products will increase, and lead to an increase in their prices and profitability. The non-production role of agriculture in providing public goods and positive externalities (e.g. environmental benefit, landscape) will be positively accepted and compensated. In the CEECs, with a considerable extent of less favoured areas and abundance of rural amenities stemming from them, some form of LFA support will be introduced.

4. Summary

The scenario analysis showed that the changes in land use depend on the climate scenario applied. Furthermore, differences in the socio-economic condition also had significant impacts on land use. This indicates that, on the one hand, it is not possible to design policies that anticipate certain climate induced land use changes, but that policies should be adjusted continuously to adapt to climate change. On the other hand, land use is sensitive to markets for agricultural inputs and outputs, technology, and policies and these changes may in many cases have more significant impacts on land use than climate change. The vulnerability assessment in combination with the scenario analysis involving stakeholders may help the future formulation of agricultural policies including the CAP, meeting more public concerns and with less transition cost. The inclusion of climate change impact in the design and implementation of European, national and local development initiatives can reduce the vulnerability of the farm sector and rural economy. Results show that Central and Eastern European countries are likely to have considerable more difficulty adapting to climate due to many factors not just the policy.

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