

VULNERABILITY OF AGRICULTURE TO CLIMATE CHANGE IN THE NEW MEMBER STATES OF EUROPEAN UNION

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Abstract

During the last decade, as our Planet became more vulnerable, the demand for improved knowledge of environmental process and the impact of human activity on their dynamic increased. The debate over climate change has clearly entered a new phase that is focusing on what must be done related to mitigation and adaptation. It is there for clear how important agricultural land use change is for the global environment in all its varied components. Different factors, including demographic trends, economic growth and affluence, technology, agricultural and rural policies, institutional structure, social attitudes and values and other key driving forces, lead to changes in land use and land cover resulting in a range of impacts on yields, farm income, biodiversity, landscape identity water quality, flooding, greenhouse gas emissions, soil erosion.

As the impacts of climate change become more noticeable, international, national and local awareness of the need to prepare for, and respond to, the impacts of climate change has grown. In the face of increasing uncertainty of climate variability, and socio-economic situation their effectiveness may be reduced significantly. 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 analysis is required. This paper is focusing on the methodology issues of vulnerability analysis in agriculture with special attention on new member states of EU.

Key Words: *climate change, agriculture, vulnerability*

JEL Classification: Q54

1. INTRODUCTION

The concept of sustainable development began to be incorporated into theories and practice on agricultural development in the early 1980s and throughout the 1990s and 2000s, during a period when a number of concerns appeared on the development agenda related to agricultural policy reforms, and rural development, institutional change, specifically those issues related environmental degradation and improvement of environment services. The relevant wording of the issues of sustainability is that this is the ability of agroecological system to preserve its efficiency despite stress and shock effects and to enhance the same without degradation of natural resources (Csete-Láng, 2005). The aim of sustainable development is to create dynamic and harmonized system in sense of economic, ecological, social and institutional. (Szabó-Kovács, 2008, Schröter et.al, 2004) Sustainable development has also been described as fostering adaptive capabilities and creating opportunities. This definition is combining sustainability, as the capacity to create, test, maintain and improve adaptive capability and development, as the process of creating, testing, maintaining and improving opportunities (Holling, 2001).

The principal challenge to the global agriculture is to supply the growing population with food. The report of the World Bank in 2008 stated that in the 21st century agriculture has to face a more 'threatening' challenge than ever before. Its major cause is the growing population, i.e. the number of people living today, which was 6.1 billion in 2000 and is expected to rise to 9.1 billion by 2050. Besides the excessive rate of growth of the population, rising incomes are going to raise significantly the per-capita consumption of foodstuffs, too (Rounsewell, 2004). The middle class of the rapidly urbanized developing world represents hundreds of millions of people whose food demand is different from the traditional food demand of poorer countries. Energy related production might become a major determinant in the demand for agriculture as a sector as farm acreages and water become increasingly scarce resources, the rising demand for agricultural products can only be satisfied by a higher efficiency.

In other respects, agriculture has specific characteristic which means the potential for provision of public goods, such as landscapes, biodiversity, soil functionality, climate stability. However many of these public goods are highly valued by society, the worldwide indicators suggest a situation of growing undersupply. The sustainable supply of ecosystem services also can be used as a measure of human wellbeing. Among many other factors of global change, land use change has been highlighted as the key human induced affect on ecosystem. Given that land is a finite resource, changes in supply of agricultural production and ecosystem services can increasingly related to climate change and variability, but also production technology, market prices, general economic development of the country and the agricultural policy especially the system of subsidy (Szabó, 2008).

Both financial consequences of previous agricultural policy and requirements of sustainable development force to reform agricultural policy in the European Union and USA as well. This process helps to discharge from normative subsidies to another determined and specificity system of subsidies. It based on an agro ecosystem's vulnerability- adaptive capacity assessment. (Fekete-Farkas et al, 2005). The integration of climate risk and vulnerability reduction objective into sustainable development strategy can be only based on the recognition of the fact that social and economic and environmental sphere are closely linked to each others.

Subsidies in agriculture keeping with sustainability have to tend towards considerable vulnerable fields because of their economical, ecological and social sensitivity and low adaptive capacity.

2. METHODOLOGY

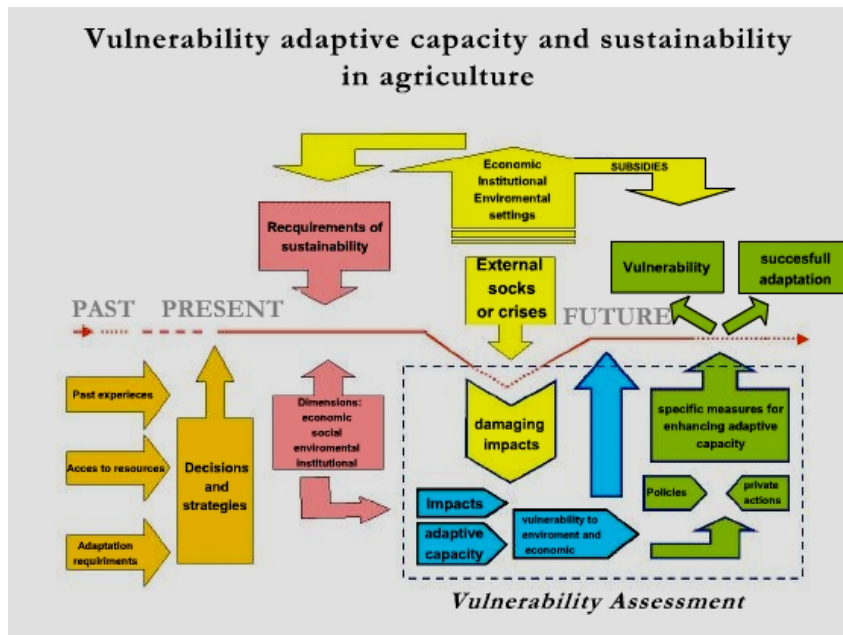
2.1. Conceptual framework

Climate-change and socioeconomic vulnerability assessment has become a frequently employed tool, with the purpose of informing policymakers attempting to adapt to global change conditions. It is going to be illustrated in this paper based on the idea of AIACC (Assessments of Impacts and Adaptations to Climate Change) project (Figure1) and ACCELERATES (Assessing Climate Change Effects on Land Use and Ecosystems from Regional Analysis to The European Scale) project (Figure 2). Methodology of ACCELERATES project - in which the authors was involved as well-shows that the scenarios together with simulation models can successfully be applied to analyze the vulnerability in its complexity.

Many international organizations recommend/suggest definitions to vulnerability and adaptive capacity. According to the UNEP (2001), “Vulnerability is an aggregate measure of human welfare that integrates environmental, social, economic and political exposure to a range of harmful perturbations”. The other definition mentioned above was defined by IPCC (2001) as “The degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including variability extremes” The main difference is that the UNEP conceptual framework shifts the exposure unit toward human and social systems in contrast to the IPCC framework that also includes natural systems. Vulnerability is a function of the character that system unable to cope with damaging impact so becomes to vulnerable. If agroecosystem holds ability to adaptation it could moderate or prevent harmful perturbations (Rounsewell, 2004).

The most recent conceptual developments integrate the different aspects of vulnerability (Schröter et al. 2004). Global change vulnerability is the likelihood that a specific coupled human-environment system will with harm from exposure to stresses associated with alterations of societies and the environment, accounting for the process of adaptation.

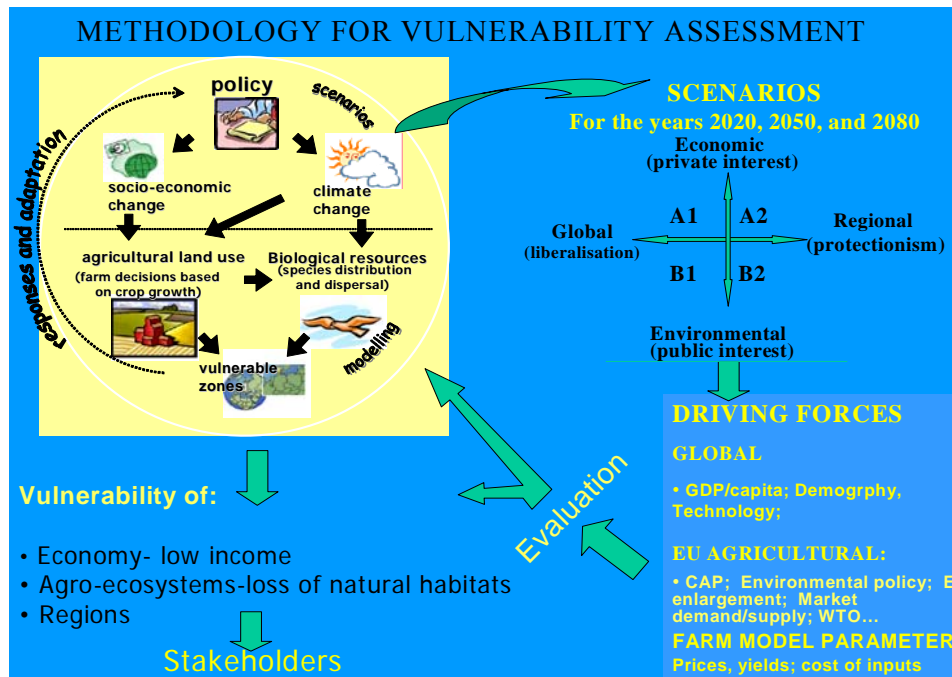
Figure 1 Methodology of Vulnerability analysis based on AIACC project



Source: author’s draft based on AIACC project

Adaptive capacity is an attribute that moderate damaging/negative impacts and helps with expansion of system’s coping range with the new or modified adaptation (IPCC, 2001). But adaptation should be focused not just on moderating harm from effects of change in climate but also exploitation of opportunities as the Fourth Assessment Report of the IPCC defines: “any adjustment in natural or human system in response to actual or expected climate stimuli or their effects, which moderates harm or exploits beneficial opportunities” (IPCC, 2007).

Figure 2 Methodology of Vulnerability analysis of ACCELERATES project



Source: Fekete-Farkas et al., 2005

IPCC recognizes/defines two types of adaptation:

Autonomous adaptation refers to farmer's/individuals' decision making, moderate external impacts (through reorganization of activities, investments, resource allocation, changes crops or uses different harvest and planting/sowing dates.) Adaptation that does not constitute a conscious response to climatic stimuli, but rather is triggered by ecological changes in natural systems and by market or welfare changes in human systems. Planned (or societal) adaptation refers the intervention of society through policy, often multisectoral in nature, aimed at altering the adaptive capacity of the agricultural system or facilitating specific adaptations.

Farmer/individual, region, agroecosystem, farming that unable to autonomous adaptation is vulnerable. Vulnerability and adaptivity in agriculture could threaten ecological, economic and social systems too. Reducing agroecosystem's vulnerability requires the assessment and determination of the main problem sources and examination of impacts on adaptive capacity (Iglesias, 2003, Ruonsevell, 2004).

Defining an integrated analysis system is the first step of the process to determine each participant's vulnerability. Acquired information helps to build up a protective system.

Measuring methods of vulnerability and adaptive capacity determinate indicators, and examine their connections. One part of indicators is quantitative and measurable, other part is qualitative and requires description and explanation. On the other view, one part of indicators could estimate

exactly correctly, other part is not really and their determination is so uncertain (for example: in connection climate change).

2.2. Indicators

Scientific literatures systematize numerous determinative indicators. The following indicator systems were developed, which seems to be acceptable to situation of new member states of EU from Central and Eastern Countries:

- Share of agriculture in GDP and in total employment
- Alternative income sources
- Share of agricultural land area
- Seasonal time, precipitate and soil conditions
- Rate of intensification
- Level of subsidies
- Farm structure
- Land and financial market situation
- Exactly or not exactly defined property rights
- Level of agricultural productivity
- Suitable regulations and market institutions
- Age and qualification of farmers
- Diversity of produced plants
- Rate of fertilizer use
- Frequencies of climate extremes, flood and drought

This system emphasizing sustainability, classifies indicators to three main attributes.

- Access to resources: that are critical to preparing for and recovering from damaging impacts, and are identified together with stakeholders Share of agriculture in GDP and in total employment
- Flexibility: reflects to the capacity of a system to return to an equilibrium state after being affected and depends on access to resources.
- Stability: This refers to the frequency of shocks and degree of uncertainty, affecting the decision- making.

The combination of stable access to resources and flexibility contribute to a system's stability that refers to the system's property of being able to sustain itself. Collecting data of these indicators take advantage to draw conclusions about sensibility and adaptivity in the present and future times too. After the summarize results, with the help of determinates indicators group analyzing the level of vulnerability. This assessment helps to qualify economic systems and decide governmental direction and measurements in the future.

2.3. Qualification of Economic Systems

Our classification ranks economic (farm) systems among four main types in relation to the level of adaptive capacity and vulnerability. Table 1 below summarizes data in a two times two matrix system.

In first case economic system exposed high level external impact besides low level own autonomous adaptive capacity that results a vulnerable system that unable to sustain itself. In second case economic system exposed high level external impact besides high level own autonomous adaptive capacity noticed a system that capable to developed fast but exposed high level risk therefore becomes sensitive (Fekete-Farkas et al, 2006). In third case economic system exposed low level external impact besides low level own autonomous adaptive capacity results being backward and slow development opportunity besides low level risk. In last case economic

system exposed low level external impact besides high level own autonomous adaptive capacity that becomes able to develop and sustain itself in long time.

Table 1 Classification of economic system

External impact (Exposure)	Autonomous adaptive capacity	
	Low	High
High	(1) „Vulnerability”: Unable to survive	(2) „Sensitivity”: fast development, high risk
Low	(3) „Backward system”: slow development, low risk	(4) Sustainable development

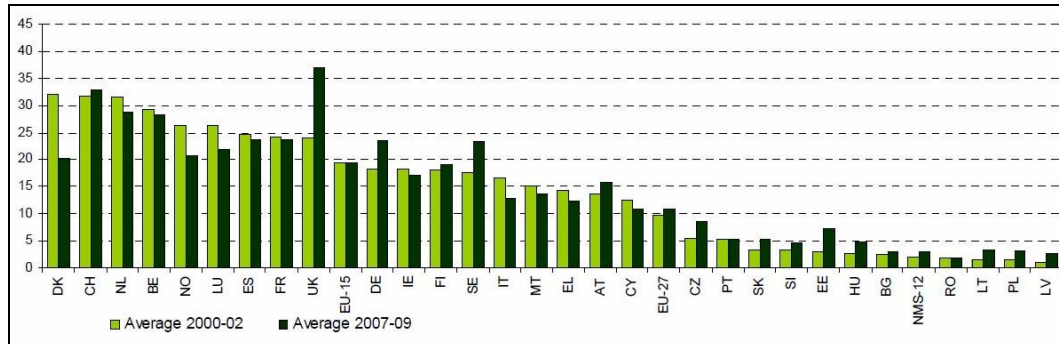
3. RESULTS

This part of the paper shows some of the significant issues of vulnerability in the new member states of EU. Land use in Europe is very diverse depending on climate zones, geography and culture. Within climate zones, land use differs with soil fertility and even with historical background and culture between EU member states. The impacts of climate change also will vary between the regions. This implies that the agricultural policy should design to deal with these regional differences and also should manage the problems of interest conflicts of different groups of a society. Agriculture is a special type of activity in the sense that it guarantees qualitative and quantitative food security and being multifunctional in nature, occupying a large area, and having importance in employment especially in new member states (NMS or EU-12,) it contributes to economic, social and ecological equilibrium (Fekete-Farkas et al. 2005).

The farmers in the new member states of EU are living in the time of change. Agricultural policy in Central and Eastern European Countries was largely dominated by the centrally planned economy and the socialist political model with a strong emphasis on production increase from the beginning of 1950s. This was based on the principle of common use of land and during this time all effective land rights were in hand of the state or cooperatives, which operated on more thousand hectares. Only Poland is unique in the region. Polish collectivization failed completely, and as a consequence of it the agricultural sector became a margin and it was kept from development. Radical political and economical changes which occurred in the Central and Eastern European Countries at the beginning of the 90s led to a sharp economic decline and originated the formation of new agricultural policy and a new agricultural structure built on private ownership. In the CEECs countries the physical distribution of land parcel was common; consequently, this process has contributed to the current situation of fragmentation of land ownership. Land fragmentation is a common phenomenon in the new member states of EU and it is a barrier of sustainable development of agriculture, farm efficiency and resource allocation and thus land transaction can be more complicated and more expensive, too. These historical facts make the new member states more vulnerable in socioeconomic sense. The EU membership in 2004 (Bulgaria and Romania in 2007) can be said as an important milestone in the history of these countries. However farmers have benefit from relative stable price of single market plus from direct payments and rural development measures the access to the European Union has not brought the expected results in the agricultural sector. It is important to note here that the agricultural sectors of the new member states are in delay to catch up the subsidy level of EU-15, according to the Copenhagen treaty, the early value of community support was 25% of the former EU average, then

it is increasing year by year in a preliminary defined way, reaching the maximum value by 2013. The technical, technological efficiency in these counties agriculture has remained low, maintaining the low internal (own) income production of farms Figure 3. The differences between NMS and EU-15 confirm that the large agricultural production potential of the new member states is far from being used its full extent.

Figure 3 Total factor incomes per annual work unit (EUR1000)



Source: Eurostat

During the transition period the structure of production has moved toward a more extensive direction, namely crop production. The livestock production has decreased significantly. This indicates a significant change towards a less intensive agriculture, which has advantages in environmental sense. In most cases the reduction in the use of fertilizers and pesticides was a result of economic necessity rather than environmental awareness. The lack of running capital on new private holdings and remaining collective farms made it difficult to buy in more than the minimum of farm inputs. It means that the use of fertilizers expected to increase in the next future. More vulnerable region is where the performance of farming depends only on the good natural endowment. The result of ACCELERATES project shows that effect of socio-economic factors overweight the climate change effects. The results of our vulnerability analysis make it evident that general economic development is more important for structural change in the rural land use than the economic situation in the agricultural sector itself. Despite the steep falls recorded in number of people employed in agriculture, the labor input in these countries in 2009 accounted 51.7% of EU-27 agricultural labor input. The decreasing trend in agricultural labor input, combining with lower educational level, increases the risk of rural unemployment. His also implies that the future agricultural reform should design to deal with these regional differences and should manage the problems of interest conflicts of different groups of a society.

4. CONCLUSIONS AND RECOMMENDATIONS

All scenarios suggest that the new member states are likely to have more difficulties in the adaptation to the climate due to many factors deriving their history and transition process from central planed economy to market economy. Implementing sustainable development means dealing with deeply rooted social, economic and environmental conflicts, and development developing planning should be combined by vulnerability analysis.

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