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The impact of climate change on the conditions of life in the rural areas of Ukraine

Wpływ zmian klimatu na warunki życia na obszarach wiejskich Ukrainy

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Abstract. Small agricultural holdings (SAHs) in Ukraine provide a significant part of agricultural production and are the main factor ensuring human survival in rural areas. Quite often, SAHs are located in remote areas with complex relief that are susceptible to various adverse climatic influences. The SAH's are also faced with progressive challenges such as land degradation, loss of biodiversity, depletion of water resources, shortage of energy, etc. Due to the celerity and scale of climate change over the past decade, it is not possible to plan economic activity taking only the time series data into account. Preventing climatic risks and taking actions to reduce them is important to the sustainable development of rural areas. This will necessitate the use of innovative economic, technological and political approaches.

Key words: Ukraine • climate change • negative and positive effects • agriculture • living conditions

Streszczenie. Małe gospodarstwa rolne na Ukrainie dostarczają znaczącą część produkcji rolniczej i są głównym czynnikiem zapewniającym przetrwanie mieszkańców obszarów wiejskich. Praca przedstawia wyniki analizy zarówno negatywnych, jak i pozytywnych skutków zmiany klimatu dla rolnictwa i bezpieczeństwa żywnościowego ludności (w tym problemów z dostępnością wody), wpływających na standard życia mieszkańców obszarów wiejskich. Wyniki różnych badań wskazują, że temperatura powierzchni gleby na Ukrainie wzrosła o 1 stopień Celsjusza w ciągu ostatniego stulecia, co wymaga stworzenia odpowiedniej strategii zmian w rolnictwie, gospodarowania zasobami wody i ekosystemami. Celem pracy jest przedstawienie możliwych kierunków zrównoważonego rozwoju małych gospodarstw rolnych na Ukrainie wobec zachodzących zmian klimatycznych.

Słowa kluczowe: Ukraina • zmiany klimatu • efekty negatywne i pozytywne • rolnictwo • warunki życia

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Introduction

The negative effects of climate change have a profound impact on food security, agriculture and the quality of life in rural areas as a whole since they lead to changes in the conduct of agricultural activities by disturbing the structure of land relief, reducing the efficiency of crop production, destroying the infrastructure of rural regions, disturbing the balance of water consumption and, as a result, significantly reducing the living standard of the population.

The study of climate dynamics in the region indicates a change in various components of the climate system: the existence of positive trends in temperature series in different halves, the increase in carbon dioxide concentration in the atmosphere, the presence of the greenhouse effect, etc. According to various estimates on climate change, the mean surface temperature of the earth has risen by 0.6 degrees Celsius over the past millennium. In the case of Ukraine, this figure corresponds to 1 degree Celsius over the last hundred years. How do the various climatic factors affect the sustainable development of the region and especially of its agriculture? This is an important question because the share of the rural population in Ukraine is 31.9%[1]. Researching the situation and climate change forecasts will make the creation of a strategy for the adaptation of agriculture, water resources and ecosystems to the new conditions possible.

The main aim of this paper is to characterise the possible ways of ensuring a sustainable development of SAHs[2] in Ukraine in the face of climate change.

Material and methods

The research uses general scientific methodology. System analysis as well as monographic, abstract, logical and balance methods are employed to investigate the current state of the Ukrainian climatic parameters and their influence on the development of rural areas and agricultural activities. Adopting a regional perspective, the study suggests some ways of preparing rural areas and agriculture to respond to the challenges of climate change, which are based on the leading practices in the field.

Results

Major climatic parameters

Climate information and professional seasonal climate forecasts contribute to the improvement in agricultural productivity and spatial development. Among other things, the structure of crop production and the distribution of small farms can be

[1] http://databank.worldbank.org/ddp/home.do.

[2] In this study, the term "SAH" refers to different types of objects involved in agricultural activities, i.e. farm holdings (private and cooperative) and households.

optimised under the changing climate according to region, and their development can be stimulated with the aim of achieving "strong" sustainability. The climate change involves a change in the habitat of plants and has a significant impact on the processes of plant growth.

The most important parameters of climate are air temperature, precipitation, relative humidity, and carbon dioxide concentration. They form the conditions affecting the productivity of crops (CGO 2006):

- Air and soil temperature determines the dates of sowing, the length of the growing season, germination conditions, the pattern of phenological phases and growth. Extremely high temperatures suspend physiological processes in plants and exhaust water supplies;
- Humidity defines the evaporation rate and sets the moisture and heat transfer for each crop;
- Precipitation influences soil and air moisture and creates conditions for growth. On the other hand, downpours can be a hindrance to agricultural activities and can cause landslides and flooding;
- The concentration of carbon dioxide defines the intensity of photosynthesis and plant respiration that impacts the efficiency of the formation of the biomass. The annual increase in the concentration of carbon dioxide in the atmosphere is fixed continually. The measurements of this parameter are carried out at stations located around the world. However, the rise in temperature as a result of the greenhouse effect is still a matter of discussion;
- The intensity of sunlight also affects the speed and volume of the formation of the biomass.

The climatic variables listed above have also a strong impact on the structure of land. Finally, all this impacts the conduct of agricultural activities of the SAHs, which leads to a change in the living conditions in rural areas.

Ukrainian conditions

The rural population is at a high level in comparison with other European countries. Over the last decade, however, it has been steadily declining (Fig. 1) due to a number of factors, such as a low life expectancy, declining living standards, unemployment, and so on.

The share of employment in agriculture in Ukraine was at its peak 15.8% in 2008 (similarly, Poland had a high share of 14%). The SAHs numbered 15 600 units at the same time[3].

Land makes up the greatest fixed asset and the base for the agricultural production processes. Ukraine has a significant land bank; the share of arable land (of the total land area) is 56% (Fig. 2).

[3] http://databank.worldbank.org/ddp/home.do.

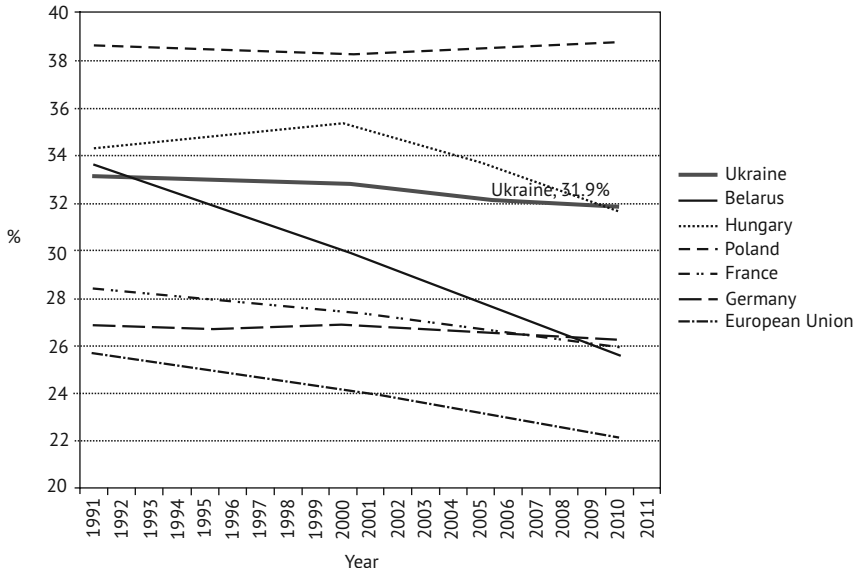

Fig. 1. Share (%) of rural population in the total population of Ukraine as against some other European countries

Source: World Bank, Agriculture and Rural Development (http://databank.worldbank.org/ddp/home.do)

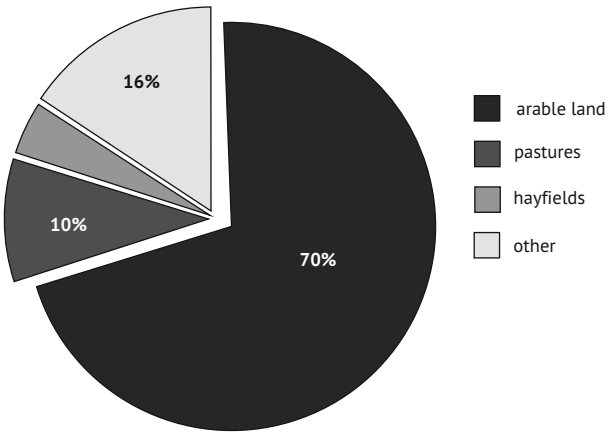

Fig. 2. Structure of agricultural land in Ukraine

Data source: State Land Cadastre of Ukraine (01.01.2011)

Traditionally, crop production has been the basic sector of agriculture in Ukraine. The main crops are wheat, sunflower, corn, canola, barley, rye and sugar beets. Large farmers (large agricultural holdings) are orientated towards exporting products such

as wheat, sunflower, corn and canola (Fig. 3), while SAHs cover the full spectrum of agricultural production, including gardening, horticulture and animal husbandry.

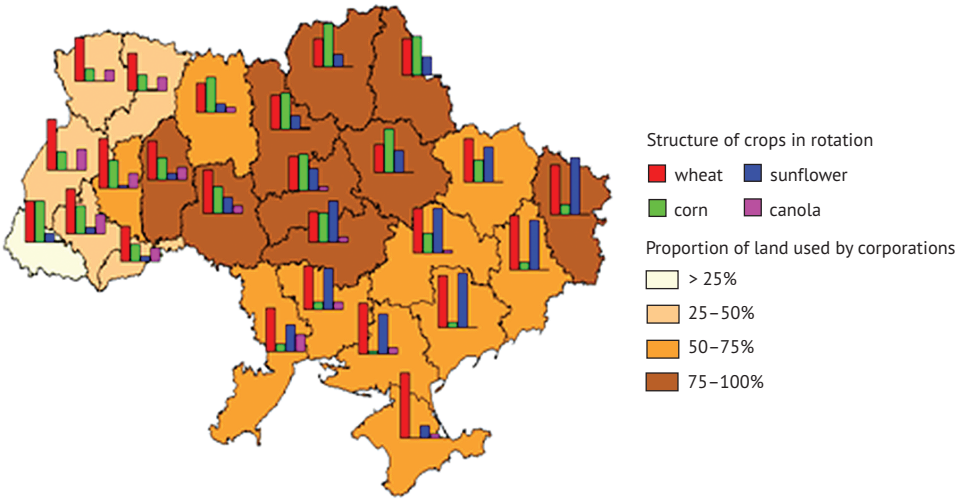

Fig. 3. Structure of sown area used by corporations

Source: Map designed by Olena Bordina

Climate change destroys the usual understanding of the seasonal framework. The Chairman of the Ukrainian Hydro-Meteorological Centre argues: "Previously we had four seasons with a strict short-lived off-season. Now the opposite is true, we have one off-season: March is warmer than April, April is warmer than May, and spring begins in February and runs until June, when the night temperatures still reach frost levels. Winters become 'rotten' (unseasonably warm), and at the same time there is an intrusion of extremely cold arctic air, such as in the year before, which causes anomalous frosts".

About 600 plant species have changed their habitats. The varieties from the Near East and Middle Asia have penetrated into Ukraine, with many of them being bad for us. For example, the ragweed causing an allergic reaction has begun its expansion with the Donetsk region and has already reached the Carpathians. On the other hand, not enough research into the changes in the environment under the influence of exotic species has been conducted so far.

With the support from the World Bank (William et al. 2013), a number of farmers and other local experts have outlined and adopted several solutions to adapt to climate change, including the following:

- Expand the water supply for irrigation by building small-scale storage reservoirs, harvesting rainwater, and making greater use of local water sources, such as creeks and groundwater, for irrigation;
- Apply protective measures, such as moving vegetable production to greenhouses, using mulch or other plant protection on soil, installing plant protection belts, or using hail nets;

– Change agronomic practices, such as planting patterns, crop rotation and intercropping, chemical soil augmentation, and using drought-resistant varieties.

From the point of view of experts (IFAD 2012), at least three key impediments to the effective adaptation to the effects of climate change can also be noted:

1) The lack of timely meteorological information to respond effectively to weather conditions, especially to extreme events such as droughts;
2) Limited access to alternative crop varieties (particularly seeds) and know-how to make the best use of these varieties through enhanced extension;
3) Poor or limited access to irrigation water and to technologies to make the most efficient use of the irrigation infrastructure.

Permaculture

There is a viable alternative for rural areas, allowing their adaptation to climate change, namely permaculture. It offers a way to create a "strong" sustainability, particularly in regions whose development is based on agriculture. The first evidence of the practice of permaculture as a system approach belongs to the Austrian farmer Josef "Sepp" Holzer and relates to the year 1960 (Holzer 2012).

Australian scientists': the bio-geographer Bill Mollison and the ecologist David Holmgren, presented the scientific development of this technique in 1978. By the Mollison definition, permaculture is a system of design, the purpose of which is to organise the space occupied by people on the basis of environmentally sound models. This applies not only to food production and agriculture, but also implies the creation of buildings, infrastructure, and all other components of the world (Mollison and Holmgren 1978).

The principles of permaculture focus on the reasonable design of small-scale intensive systems that are labour-effective, energy-efficient, and based on biological resources.

Holzer's Permaculture acquired great efficiency in practice. According to his techniques, stable and very efficient farms were established around the world, even in the face of the lack of suitability to conduct agricultural activities from the traditional point of view. Holzer's Permaculture is an alternative to the widespread measures such as drainage, creating channels, monoculture farming, and to the excessive exploitation of forests, meadows, land and animals. This is consistent with the nature of agriculture and livestock which can be used in large areas, shaping the landscape and taking into account the needs of future generations (Holzer 2012).

Conclusion

Preventing climatic risks and taking actions to reduce them is important to the sustainable development of rural areas. This will necessitate the use of innovative economic, technological and political approaches. The study discussed the possible

ways of ensuring sustainable development for Ukrainian small agricultural holdings in the face of climate change. The results can be used to justify further research on the optimisation of the activity of such entities under the changing climatic conditions.

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