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Adaptation to Climate Change in Agriculture of Ukraine: Separate Aspects of Legal Support

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Abstract

The article is devoted to the analysis of separate aspects of legal support of adaptation of agriculture of Ukraine to climate change. The relevance of the study is conditioned upon the fact that global climate change is one of the most acute problems facing humanity today. The aim of the article is to analyse the current state of legal regulation of issues related to the impact of climate change on agriculture at the international, European and national levels, and to develop practical recommendations for implementing measures to adapt to climate change in agriculture. The methodological basis of the study was the dialectical method of scientific knowledge, general scientific (formal-logical, methods of analysis and synthesis) and special-legal method (formal-legal). The article analyses international, European and national legislation governing climate change and its impact on agricultural production. The study found that the most vulnerable to climate change industries is agriculture, which is currently negatively affected by climate trends, which in modern conditions can not be avoided. In this regard, the problem of climate change requires the prioritisation of adaptation measures to minimise losses in agricultural production. At the same time, adaptation involves the creation of new institutions, the introduction of new policies, the inflow of new funds, and, most importantly — new forms of thinking. The need to accelerate the implementation of measures to adapt to climate change in the development of national agricultural policy in parallel with the policy to prevent climate change. Practical recommendations are offered to the state executive bodies on the implementation of tasks related to the adaptation of agriculture to climate change. Emphasis was placed on the need to develop measures aimed at implementing "climate-smart" agriculture in accordance with the Climate Smart Agriculture (CSA) system, and preparing zonal recommendations for adapting agricultural production to climate change and combating desertification and drought. The necessity of creation of the system of scientific and methodical support of adaptation of separate subsectors of agriculture and the mechanism of support of realisation of adaptation strategies for separate groups of agricultural commodity producers is defined

Keywords: climate change, adaptation measures, agricultural production, "climate-smart" agriculture, agricultural legislation, legislation in the field of climate change prevention

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Introduction

Global climate change has become one of the most pressing issues facing human attention. The key international documents regulating climate change are, first of all, the UN Framework Convention on Climate Change 1992 [1], the Kyoto Protocol to the UN Framework Convention 1997 [2] and the Paris Agreement 2015 [3]. In 1988, the Intergovernmental Panel on Climate Change (IPCC) was established to assess the risk of climate change, and its main focus is on preparing regular Climate Change Assessment Reports. According to the forecasts of the Intergovernmental Panel on Climate Change presented in the Fifth Assessment Report [4], the consequences of further climate change will be catastrophic and will affect all continents. Europe is likely to have an increase in average and maximum temperatures, including an uneven distribution of precipitation.

Climate change has been observed in Ukraine for more than a decade. Like many other countries, Ukraine faces and will continue to face a variety of challenges related to these changes. Thus, for the last twenty years, each subsequent year in Ukraine has been warmer than average, and 2020 has become the hottest year in Europe and Ukraine. The air warmed up by 2.8°C higher than the average for 1961-1990 (Fig. 1).

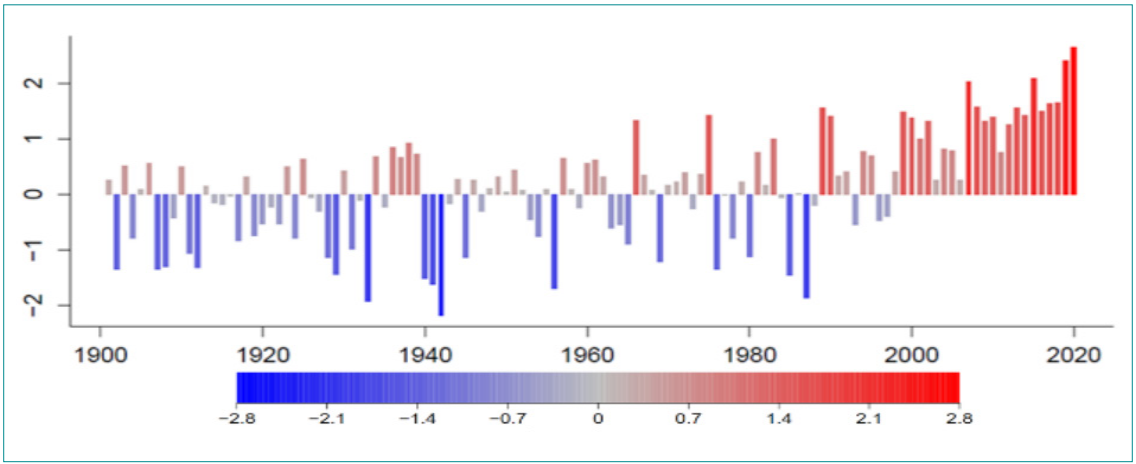

Figure 1. *Change in annual temperature in Ukraine since 1901 Years warmer than the average in the base period of 1961-1990 are marked with red bars, and colder years are marked with blue bars. The larger the column, the greater the difference from the long-run average*

Source*: values are calculated based on Berkeley's Earth temperature data set [5]*

The consequences of climate change are becoming so significant and dangerous that climate change is no longer perceived only as an environmental problem, but also as an economic and social one. Therefore, at the World Economic Forum in Davos in 2016 [6], climate change was recognised as a global environmental threat that has more devastating consequences than weapons of mass destruction, and emphasised their unprecedented impact on slowing economic development, weakening social cohesion and security.

Since 2010, Ukraine, more than ever, has experienced a number of consequences related to climate change. These are severe droughts, major floods and devastating fires, and as a result, all key socio-economic sectors have been affected by extreme weather events. According to scientists, climate change has the greatest impact on the productivity of those industries that are directly dependent on natural resources, the state and functions of ecosystems, water and weather conditions. This is, first of all, agriculture. Agriculture is also identified by the Intergovernmental Panel on Climate Change as one of the most vulnerable sectors of the economy to climate change [7]. Research data emphasise that without the necessary adaptation measures, climate change can reduce agricultural growth by 30% by 2050 [8].

The strength and severity of the consequences will depend mainly on the natural and socio-economic conditions of each region, vulnerability to climate change, the ability of each country to adapt and respond to the effects of climate change. Thus, it is now vital for the entire world community to adopt and implement effective strategies to counter further rapid climate change and adapt to future climate change, considering the already accumulated knowledge and experience in this field.

Given that climate change will affect all industries, all countries of the world, and in particular each sector will be guided by its own interests and opportunities, which may sometimes contradict each other (a classic example is the opposition "agricultural progress — environmental protection"). It is therefore crucial that national governments take the lead in addressing this issue and setting a coordinated approach. This is the focus of all official acts of the European Union on Adaptation (EUs White Paper on Adaptation) [9, p. 5].

The problem of climate change has acquired global significance and requires the prioritisation of adaptation measures, both by the Government of Ukraine and citizens. However, the complexity of this problem in terms of unpredictability of the consequences of further rapid climate change, the uneven regional distribution of the effects of climate change significantly complicate not only scientific analysis but also consensus in effective policy making at regional and global levels. Adaptation to climate change requires the creation of new institutions, the introduction of new policies, the introduction of new tools, and most importantly — new forms of thinking about solving this problem. This process is not easy, and on the one hand, will cause many difficulties, but, on the other hand, investing in solving adaptation problems will lead to long-term benefits.

The impact of climate change on the development of agricultural production has been studied by many foreign and Ukrainian scientists who have formed their approaches to this issue. For example, foreign experts in the field of agronomy J.E. Olesen and M. Bindi analysed the effects of climate change on the productivity of EU agriculture. In their study, researchers drew attention to the positive and negative effects of climate change on agricultural production, emphasising the need to support the adaptation of European agriculture to climate change by encouraging the flexibility of land use and farming systems [10]. The impact of climate change on the water supply of agriculture in the EU and Ukraine has been studied by foreign and Ukrainian scientists I. Didovets, V. Krysanova, S. Snizhko and others. Scientists have concluded that it is important to develop adaptation strategies at the regional and national levels based on modern scientific knowledge for various industries, and especially for agricultural production [11]. The effects of global climate change on agriculture and the environment have been the subject of research and foreign scientists D. Li, J. Yuan, R.E. Kopp. Scientists have analysed the impact of extreme heat and precipitation on agricultural production and proposed a system of adaptation measures [12]. Undoubtedly, these studies have made a significant contribution to the development of a mechanism to combat and prevent the effects of climate change on agriculture, but some aspects of the problem remain relevant. That is why the presented study focuses on the characteristics of the system of legal support for climate change and the development of legal measures to adapt agriculture to the effects of climate change.

The aim of the article is to analyse the key international documents regulating climate change and its impact on agriculture, EU documents related to the policy of adaptation of agriculture to climate change, including the normative legal acts of the Ukrainian legislation adopted in fulfillment of international obligations on counteraction to further climate change and adaptation of agriculture to its inevitable consequences.

Materials and Methods

During the research, a set of methods and techniques of scientific knowledge was used, which allowed carrying out a comprehensive and objective analysis of the subject of research — philosophical and philosophical, general and special scientific methods. The application of the dialectical method allowed studying the trends of climate change and its impact on political, economic, social and environmental factors of society. The formal-logical method contributed to the characterisation of the content of system-forming concepts and constructions of the subject of study, such as "climate change", "adaptation measures", "agriculture", "agricultural production", "climate-smart" agriculture, etc. The method of analysis was used in the study of scientific achievements of scientists on the research topic, and in the study of international, European and national legislation governing climate change. Using the method of synthesis, the place of normative legal acts regulating relations in the field of combating and preventing the consequences of climate change in agriculture in the legislation of Ukraine has been established**.** The formal-legal method contributed to the clarification of the content of legal norms of the relevant legislation and the development of proposals for its improvement.

Characterisation of negative and positive factors of climate change affecting agriculture in Ukraine was the initial stage of the study. It was found that increasing the number and intensity of droughts in combination with other negative factors of anthropogenic impact can lead to the expansion of the zone of risky agriculture and desertification in Ukraine. Cases of extreme rainfall, which increase the frequency of rain floods, pose a serious threat to Ukraine's agriculture and can cause significant damage to agricultural production. As a result of climate change, there have also been changes in the structure of agriculture, sown areas and crop yield levels. The second stage of the study analysed international and European legislation in the field of combating and preventing the effects of climate change on agriculture and food security in Ukraine, including implemented adaptation actions in this part. Particular attention is paid to the characteristics of the European Green Course — a system of sustainable practices of the agricultural sector, such as organic production, precision farming, agri-environment, agroforestry, compliance with animal welfare standards and more. At the final stage of the study, attention was paid to the analysis of the current state of legal support for the adaptation of agriculture to climate change in Ukraine. The content of the main normative legal acts in this part was revealed, legal gaps and conflicts were identified. The directions of improvement of legal measures on adaptation to climate change within the framework of development of the national agrarian policy in parallel with the policy on prevention of climate change are offered.

The study analysed international and European

documents regulating climate change and the system of adaptation measures in the field of agriculture, in particular: the UN Framework Convention on Climate Change 1992 [1], the Kyoto Protocol to the UN Framework Convention 1997 [2], The Paris Agreement of 2015 [3], the Coronivian Programme of Joint Work on Agriculture 2017 [13], the Food and Agriculture Climate Change Strategy of the United Nations Food and Agriculture Organisation 2017 [14], the EU Strategy for Adaptation to Climate Change 2021. [15], and regulations of national legislation in this area, used the results of assessment reports on climate change prepared by the Intergovernmental Panel on Climate Change, materials of information and analytical documents on the specific features of agricultural production in climate change.

Results and Discussion

Agriculture is one of the main economic activities in Ukraine, but recently, unfortunately, climate change has significantly affected this sector, both negatively and in some cases positively. It is worth emphasising that the negative aspects mostly prevail.

Global climate change poses many threats to agriculture, including declining productivity, loss of stability of production and income of agricultural producers. Changes in weather conditions (increase in air temperature, unequal distribution of precipitation, which in the warm period are draining, inefficient accumulation of moisture in the soil) causes an increase in the number and intensity of droughts. In combination with other negative factors of anthropogenic impact, this can lead to further expansion of the zone of risky agriculture and desertification [16, p. 14].

The recurrence of droughts in different agro-climatic zones of Ukraine is 20-40%. Over the last 20 years, droughts have occurred almost twice as often [17]. Thus, in 2003 and 2007, the drought in Ukraine caused losses in grain production, which are estimated at 3 billion euros [18]. During the 2010s, agricultural production in Ukraine conditioned upon low rainfall and severe droughts has repeatedly suffered significant crop losses [19]. In the period from September 2019, higher than average temperatures and long-term deficit of precipitation in the south-west and in the center of Ukraine, caused a drought with a corresponding decrease in yield [20; 21]. Such crop losses will continue, with serious negative consequences for global food security.

There is a dangerous tendency to increase the recurrence of droughts in the area of sufficient humidification of the atmosphere, covering Polissya and the northern regions of the Forest-Steppe [22] (Fig. 2).

Figure 2. *In 2020, the so-called "Semeniv Desert" was formed on agricultural lands in the Semeniv and Nizhyn districts of the Chernihiv region*

Source*: [23]*

At the current rate of development of droughts in 10-15 years, part of the territory of Ukraine (about 3 million hectares of arable land) may become unsuitable for agricultural production [16, p. 16], in particular, this applies to part of the territory of Zaporizhia, Kherson, Mykolaiv and Odessa regions.

At the same time, contrary to the estimates of climatologists who predicted a decrease in precipitation, over the past 20 years the average annual rainfall has not decreased [24], and over the past 5 years there was a very uneven distribution over time and across Ukraine [25, p. 18]. In addition, the nature of precipitation is changing, namely the number of inefficient heavy rains, which for the most part after long periods of drought do more harm than good. Extreme rains can increase the frequency of rain floods. Annual flood losses in Europe are expected to increase fivefold by the 2050s and seventeenfold by the 2080s. This requires the development of flood resistance by states [26]. Ukraine is currently facing such a problem. In Ukraine today, river floods pose

a serious threat throughout the country, as they can cause significant damage and endanger people's lives.

The forecasts contained in the Fifth Assessment Report of the Intergovernmental Panel on Climate Change indicate the negative impact of climate change on crop yields. Thus, in regions with tropical and temperate climates, an increase in temperature by 2°C without adaptation to it will negatively affect the yield of wheat, corn, soybeans, rice. Although it should be noted that in some regions it will have positive consequences. In general, the increase in global temperature by 4°C will be a risk factor for global food security [16, p. 13].

As a result of intense warming in recent decades, there have also been changes in the structure of agricultural production in Ukraine, sown areas and their yield levels. Analytical data show that the steppe zone, where 46% of grain crops are concentrated, now gives only 35% of total grain production against 45% in 1990. The average grain yield in this area over the past five years, despite its growth of 21% across the country, decreased from 35.8 c/ha in 1990 to 32.2 c/ha in 2017-2019. In Polissia and in the Forest-Steppe there was an increase in yield from 30-37 c/ha to 48-53 c/ha. Conditioned upon this, 65% of grain is produced in these areas, although the share of crops in this group of crops is only 53% [27].

In addition to a significant territorial redistribution of crop structure, there is a change in the dynamics and growth rates of their yields. Thus, the average yield of cereals and legumes in the Forest-Steppe and Polissia increased by 46-61%, and in the Steppe decreased by 10% [28]. A similar situation is observed with regard to changes in the level of yields of other major crops. The general increase in the yield of grain and legumes in Ukraine was due to the wetter areas of the Forest-Steppe and especially Polissia.

Analysing climate change in Ukraine, it should be noted that this process in general leads to loss of fertility and potentially critical decline in yield, shift of sown areas from south to north conditioned upon rising temperatures. Significant warming in winter, slight freezing of the soil and the early onset of spring processes contribute to an increase in the number and area of pests and diseases of crops. According to experts, in the period 2011-2016, they increased by almost 25% compared to previous years and continue to increase exponentially [25, p. 25]. Probable and further migration of pests, not typical for the territory of Ukraine, increase in their number and number of generations.

At the same time, the increase in the average annual temperature may have a limited positive impact on agricultural production in Ukraine. These are improving conditions and shortening harvest times; the possibility of effective introduction of late-maturing varieties of agricultural crops that require more thermal resources; improving wintering conditions for crops and perennial grasses; improving the efficiency of fertilizer application, etc.

In addition to the possibility of zoning and growing crops typical of more southern regions [10], climate change can increase grain yields and productivity in the range of 10-20% for early spring crops by 2050 and up to 20-46% of winter crops in the period from 2030 to 2040 [29]. Thus, a study of the impact of climate change on the cultivation of major crops shows that in the next 10-20 years, favourable conditions for growing winter wheat as a result of shifting sowing dates by 20-40 days and more efficient use of autumn growing conditions, which will lead to increase overall productivity by 20-40%; in the northern regions sunflower and corn will be sown, and grain of productive medium-ripe and late varieties [16, p. 17].

At the same time, agriculture in the steppe and forest-steppe zones will require additional irrigation, which, in turn, will lead to a reduction of already scarce water resources [11] and increase spending on agriculture.

But these benefits can be offset if important warming thresholds are exceeded. In warmer climates, extreme heat is increasing, and this, combined with an increase in the frequency and intensity of droughts, will have general negative consequences.

The impact of climate change on agriculture is obvious. However, agriculture, which is often affected by climate change, is also a source of such change. First, agricultural production leads to significant greenhouse gas emissions, as livestock and crop production are directly linked to these emissions, as evidenced by emissions reports from governments to the Secretariat of the UN Framework Convention on Climate Change. Thus, agriculture is the source of about 15% of global greenhouse gas emissions [12]. Second, greenhouse gases change climate and thus affect agricultural production.

In 2019, the percentage of agricultural production in Ukraine in total emissions was 12.1. The main sources of emissions in the agro-industrial complex are intestinal fermentation and agricultural soils — respectively 22.1% and 71.0% of total emissions in 2019 [25, p. 12]. Over the last decade, Ukraine has tended to increase its greenhouse gas emissions from agriculture.

The consequences of climate change, such as rising temperatures, droughts and other adverse weather events, cannot be avoided in modern conditions, the more they can become more frequent and intense over time. Considering the effects of climate change on agriculture and food security in Ukraine requires adaptation at various levels, taking into account international experience, national and sectoral characteristics. Appropriate adaptation measures are needed to reap the benefits of climate change and offset potential losses.

According to the UN Framework Convention on Climate Change, problems related to the impact of climate change on agricultural production are also being addressed in the framework of the Coronivian Programme of Joint Work on Agriculture [13], adopted in

2017 at the 23rd Conference of the Parties Bonn [30] and in the Food and Agriculture Organization (FAO) Climate Change Strategy 2017 [14], which deals with increasing the capacity of member states in the field of climate change, deepening the integration of agriculture into the international order day in the field of climate change and increase the effectiveness of coordination measures. Currently, in many countries, the Climate Smart Agriculture Programme (CSA), developed by the United Nations Food and Agriculture Organisation, is also actively used — that is, "climate-smart" agriculture. The programme provides for the creation of conditions to increase the productivity of agricultural production and profits of agricultural producers, the creation of climate-resilient food production systems, finding ways to minimise greenhouse gas emissions and carbon dioxide emissions. The main goal of the CSA is to ensure food security, adapt agriculture to climate change and reduce its negative impact on the environment. Its implementation requires the use of special techniques of mechanical tillage and waste management, soil restoration and land reclamation on pastures, improving the organisation of collection, storage and use of manure, energy conservation and decarburisation, cultivation of drought and disease resistant, and high-yield crops [16, p. 69]. CSA works most in the direction of organic production.

Measures to adapt agriculture to climate change at EU level have previously been identified in the EU's Adaptation Strategy 2013 [15], which was approved to increase climate awareness, including the common agricultural policy. The strategy includes eight actions aimed at promoting adaptation measures at the national and local levels, supporting the exchange of knowledge to provide more informed solutions and promoting adaptation in key vulnerable sectors, including agriculture. In 2021, the European Commission has adopted a new EU Strategy for Adaptation to Climate Change [31], which considers the main positions of the previous Strategy and focused its efforts on shifting the focus from understanding the problem to its solution and the transition from planning to implementation.

The European Green Course (hereinafter — EGC) adopted by the European Commission in December 2019 became a very important document in the field of adaptation to climate change [32]. The importance of this document was noted by the President of the European Commission Ursula von der Leyen, emphasising that "the European Green Course is our new growth strategy, a development strategy that gives more than it takes away" [32]. Politically, the EPC is "a response to the challenges of global climate change, pollution, biodiversity loss and, consequently, the EU's position as a global leader" [32]. The main goal of the EPC is a sustainable green transition of Europe to a climate-neutral continent by 2050. The EPC is a set of measures that determines the EU policy for the coming years in such areas as climate, energy, biodiversity, industry, agriculture, finance, trade and more.

Green agriculture is defined as one of the structural elements of the EGC. Its main task should be to ensure food security, transition to sustainable production, consumption and healthy eating, reduction of food waste. Practically to achieve this goal and achieve the goals of sustainable development, the European Commission announced a new strategy "From farm to fork" [33], which aims to introduce a system of healthy and environmentally friendly food (Fig. 3).

Figure 3. *Farm to Fork Strategy [33]*

According to this goal, the agricultural sector should have a neutral or positive impact on the environment and be aimed at the use of sustainable practices such as organic production, precision farming, agri-environment, agroforestry, compliance with animal welfare standards, etc. The urgency of this transformation is dictated by estimates of the Intergovernmental Panel on Climate Change, which show that in the EU alone, greenhouse gas emissions from agricultural activities account for almost 11% and almost 70% for livestock [34]. Moreover, agricultural-related industries, through the use of pesticides and fertilizers, contribute to significant pollution of soils and water resources.

What are Ukraine's steps to maintain such a European course? Thus, Ukraine ratified the main international documents governing climate change — the UN Framework Convention on Climate Change in 1996 [1], in 2004 — the Kyoto Protocol [2], in 2016 — the Paris Agreement [3]. In pursuance of Ukraine's international

obligations, the Cabinet of Ministers of Ukraine issued an order "On Approval of the Concept of Implementing State Policy in the Field of Climate Change until 2030" of December 7, 2016 No. 932-r [35], "On Approval of the Action Plan Concepts of implementation of state policy in the field of climate change for the period up to 2030 "dated December 6, 2017 No. 878-r [36], Low Carbon Development Strategy of Ukraine until 2050 [37] (approved by the Interdepartmental Commission for Implementation of the UN Framework Convention on Climate change, Protocol of 16 February 2018 No. 1).

The Cabinet of Ministers of Ukraine has determined the country's intentions to join the EGC. Such statements of the Government are of great importance given the importance of forming a state agricultural policy in Ukraine, which would consider the environmental and climatic challenges of today.

At the same time, the low efficiency of agricultural land use with the world's largest plowing rate (54% of Ukraine's territory) [38] and the constant increase in the percentage of eroded land, in particular due to plowing, makes Ukraine a priority to create an appropriate legal framework to address deep problems in this area.

Thus, the previous version of the Strategy of State Environmental Policy of Ukraine for the period up to 2020 declared "reduction of arable land by removing from use or conservation of degraded, low-productivity and man-made contaminated agricultural land," and so on. The current Strategy of State Environmental Policy until 2030, as well as a number of other documents, among other priorities include the rational use of agricultural land and reducing the man-made burden of agriculture on the environment, promoting organic farming, ensuring rational use of natural resources and more. But I would like to rightly note that the identified areas do not contain clear guidelines for the implementation of these measures.

In addition, the Government of Ukraine should pay attention to improving the legislation that will facilitate the transition to sustainable agricultural practices. In 2018, the Verkhovna Rada of Ukraine adopted the Law of Ukraine "On Basic Principles and Requirements for Organic Production, Circulation and Labeling of Organic Products" of July 10, 2018 No. 2496-VIII [39]. However, despite the fact that organic production has been developing in Ukraine since the early 2000s, the area of organic land in 2020 was only 462 thousand hectares (1.1% of the total agricultural area of Ukraine) [40] [Table 1).

Table 1. *Total area of organic agricultural land in Ukraine (2002-2020)*

Year	Area, ha	Year	Area, ha
2002	*164449*	*2012*	*272850*
2003	*239542*	*2013*	*393400*
2004	*240000*	*2014*	*400764*
2005	*241980*	*2015*	*410550*
2006	*242034*	*2016*	*411200*
2007	*249872*	*2017*	*420000*
2008	*269984*	*2018*	*429100*
2009	*270193*	*2019*	*467980*
2010	*270226*	*2020*	*462225*
2011	*270320*		

Source*: [41]*

At the same time, according to studies conducted within the project "Assessment of technological needs in Ukraine" [42], under organic production in Ukraine can be occupied up to 4 million hectares [43, p. 41]. On March 3, 2021, the Cabinet of Ministers of Ukraine approved the Resolution "On Approval of the National Economic Strategy until 2030" No. 179 [44], which plans to achieve an area of land with organic status of at least 3% of the total agricultural land area of Ukraine approximately 1.3 million hectares.

Ukraine is also an outsider on the implementation of a number of provisions related to the impact of the agricultural sector on the environment, namely: regulation of groundwater and surface water pollution by nitrates of agricultural production, adoption of a code of best agricultural practices, harmonisation of fertilizers and pesticides. Thus, recent studies show that total greenhouse gas emissions in the agricultural sector in 2020 increased by 7.7% compared to the previous year [45]. This is justified by the increase in arable land and the growth of mineral and organic fertilizers.

The adoption of the Law of Ukraine "On Environmental Impact Assessment" of May 23, 2017 No. 2059-VIII [46], which established the legal and organisational framework for environmental impact assessment, deserves high praise for sustainable agricultural development and prevention of possible consequences of agricultural activities on the environment, aimed at preventing environmental damage, environmental safety, environmental protection, rational use and reproduction

of natural resources, in the decision-making process of economic activities that may have a significant impact on the environment, including in agriculture.

It is worth paying attention to paragraph 12 of the order of the Cabinet of Ministers of Ukraine "On Approval of the Action Plan for the Implementation of the Concept of State Policy in the Field of Climate Change Until 2030" of December 6, 2017 No. 878-r [36], according to which The Ministry of Agrarian Policy of Ukraine was obliged to prepare recommendations on the adaptation of agriculture to climate change for the period up to 2030. In 2019, the Ministry of Agrarian Policy of Ukraine presented the draft Strategy for Adaptation to Climate Change in Agriculture, Forestry and Fisheries of Ukraine and the period up to 2030. The purpose of the Strategy was to ensure Ukraine's participation in achieving one of the main goals of UN Sustainable Development — to take urgent measures to combat climate change and its consequences, and to adapt to them and early warning. At the end of 2021, the Cabinet of Ministers of Ukraine approved the Strategy for Environmental Safety and Adaptation to Climate Change until 2030 [47] and the Operational Plan for its implementation in 2022-2024 [48] (order of October 20, 2021 No. 1363-r) in a new version, where agriculture is identified as one of the socio-economic sectors that is most vulnerable to the effects of climate change. The Strategy identifies issues that need to be addressed as soon as possible, such as land degradation and desertification, restoration of anthropogenically altered ecosystems, improving the structure of agricultural lands and economic activities to form a balanced relationship between agricultural lands and ensure environmental safety and environmental security. It was also noted that "negative consequences of climate change in Ukraine, in particular conditioned upon increasing frequency and intensity of extreme weather events, can be considered reduced soil fertility, reduced crop productivity, the need to breed and introduce new varieties more resistant to drought and heat, expansion irrigation". The document emphasises that "conditioned upon changes in the nature of precipitation, soils are not able to absorb water in full, moisture in the soil is not retained, the fertile layer of soil is washed away" [47].

Research and practice confirm that in the context of climate change, the level and conditions of humidity in the country is a leading factor that limits the level of productivity and use of the natural potential of agriculture. 5.5 million hectares of reclaimed land are registered in Ukraine, of which 2.2 million hectares are irrigated and 3.3 million hectares are drained. But the real area of irrigated land is 400-500 thousand hectares. The irrigation and drainage system is poorly developed: Ukraine uses about 20% of its irrigation and about 10% of its drainage potential. Conditioned upon this, every sixth hectare of agricultural land degrades [49]. It is unfortunate, but it should be noted that the reasons for this were imperfect legislation, underdeveloped system of water resources management and land reclamation, outdated technical condition of engineering infrastructure.

To reduce the negative processes of climate change in agriculture, on August 14, 2019, the Government of Ukraine approved the Strategy of Irrigation and Drainage of Ukraine for the period up to 2030 [50], which identified strategic directions of state policy in the field of irrigation and drainage, ensuring sustainable environmentally balanced development of agriculture in Ukraine. The strategy outlines the ways to achieve this goal: change the nature of public administration of the irrigation system through the introduction of an integrated water resources management mechanism based on the basin principle; preservation and restoration of soil fertility, protection of settlements from the harmful effects of water, achievement and maintenance of river basins; restoration and increase of areas of irrigated lands, drainage systems, etc. The implementation of the Strategy is aimed at restoring the capacity of irrigated and drainage systems to further increase the area of irrigation and water regulation on agricultural land as a basis for achieving the maximum level of efficiency and environmental safety of agriculture. To implement the goals and objectives of the Strategy [50], on October 21, 2020, the Cabinet of Ministers of Ukraine adopted the Order No. 1567-r, which approved the Action Plan for the implementation of the Strategy of reclamation and drainage in Ukraine until 2030 [51]. Implementation of the adopted Action Plan will increase crop yields, the area of irrigated land, drainage systems and expand Ukraine's agricultural potential.

To introduce the mechanism of integrated water resources management according to the basin principle and considering the need to separate the functions of water resources management from the function of water infrastructure management, on May 24, 2021, the Cabinet of Ministers of Ukraine adopted Resolution No. 539 "Some Issues of Distribution of Certain Powers of Central Executive Bodies in the Field of Land Reclamation". The resolution restricts the functions of the State Agency of Water Resources of Ukraine for hydraulic reclamation of land; the task of the State Agency of Water Resources of Ukraine on the development of land reclamation and management of the operation of irrigation and drainage systems was terminated; the functions of the State Fisheries Agency of Ukraine, which was renamed the State Agency for Land Reclamation and Fisheries of Ukraine, were expanded; the Ministry of Agrarian Policy of Ukraine, etc., has been given the authority to formulate policy in the field of hydraulic reclamation of lands.

An important contribution to reforming the public administration system for irrigation and drainage in accordance with the order of the Cabinet of Ministers of Ukraine of December 29, 2021 No. 1793-r [52] in Ukraine was the establishment of the Institute of Climate Oriented Agriculture NAAS of Ukraine by reorganising the Institute of Irrigated Agriculture, Rice Institute and the Southern State Agricultural Research Station of the

Institute of Water Problems and Reclamation of NAAS of Ukraine. The Institute of Climate-Oriented Agriculture of NAAS of Ukraine will be endowed with the functions of the Main Scientific Institution for forming the main directions of state policy in the field of climate-oriented agriculture, developing tillage systems using climate-oriented technologies, studying crop productivity to ensure sustainability resources, restoring and increasing soil fertility, reducing anthropogenic pressure on the environment and preventing the negative effects of climate change on agricultural production.

Conclusions

The consequences of climate change for agriculture, such as rising temperatures, droughts and extreme weather events, cannot be avoided in modern conditions, and over time they may become more frequent and intense. Therefore, it is necessary to accelerate the implementation of measures to adapt to climate change in the development of national agricultural policy in parallel with policies to prevent climate change. In this regard, the Ministry of Agrarian Policy and Food of Ukraine needs to ensure the proper implementation of the tasks set by the Strategy of Environmental Security and Adaptation to Climate Change for the period up to 2030 and the Operational Plan for its implementation in 2022-2024 in terms of rural adaptation to climate change; together with the institutions of the National Academy of Agrarian Sciences of Ukraine to develop measures aimed at implementing "climate-smart" agriculture, which corresponds to the Climate Smart Agriculture (CSA) system developed by the Food and Agriculture Organisation of the United Nations; develop zonal recommendations for the adaptation of agricultural production to climate change and the fight against desertification and the manifestation of droughts; provide scientific and methodological support for the adaptation of certain subsectors of agriculture; create mechanisms to support the implementation of adaptation strategies for certain groups of agricultural producers.

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Адаптація до зміни клімату сільського господарства України: окремі аспекти правового забезпечення

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Анотація

Стаття присвячена аналізу окремих аспектів правового забезпечення адаптації сільського господарства України до змін клімату. Актуальність дослідження зумовлено тим, що глобальні кліматичні зміни є однією з найгостріших проблем сьогодення, що стоїть перед людством. Метою статті є аналіз сучасного стану правового регулювання питань, пов'язаних з впливом зміни клімату на сільське господарство, на міжнародному, європейському і національному рівнях, а також вироблення практичних рекомендацій щодо впровадження заходів з адаптації до кліматичних змін сільськогосподарського виробництва. Методологічну основу дослідження склали діалектичний метод наукового пізнання, загальнонаукові (формально-логічний, методи аналізу та синтезу) та спеціально-юридичний метод (формально-юридичний). У статті проаналізовано міжнародне, європейське і національне законодавство, що регламентує питання зміни клімату та його впливу на сільськогосподарське виробництво. За результатами дослідження встановлено, що найбільш уразливою до зміни клімату галузей є сільське господарство, що нині зазнає негативний вплив від кліматичних тенденцій, якого у сучасних умовах неможливо уникнути. У зв'язку з цим, проблема зміни клімату вимагає пріоритизації заходів з адаптації щодо мінімізації збитків у сільськогосподарському виробництві. Водночас адаптація передбачає створення нових інститутів, впровадження нової політики, надходження нових коштів, і, найголовніше — нових форм мислення. Визначено необхідність прискорення імплементації заходів з адаптації до кліматичних змін в рамках розробки національної аграрної політики паралельно з політикою із запобігання зміні клімату. Запропоновані практичні рекомендації органам державної виконавчої влади щодо реалізації завдань у частині адаптації сільського господарства до зміни клімату. Акцентовано увагу на необхідності розроблення заходів, спрямованих на впровадження «кліматично-розумного» сільського господарства, що відповідає системі агрогосподарювання Climate Smart Agriculture (CSA), а також підготовки зональних рекомендації щодо адаптації сільськогосподарського виробництва до зміни клімату та боротьби з опустелюванням і проявом посушливих явищ. Визначено необхідність створення системи науково-методичної підтримки адаптації окремих підгалузей сільського господарства і механізму підтримки реалізації адаптаційних стратегій для окремих груп сільськогосподарських товаровиробників

Ключові слова: кліматичні зміни, адаптаційні заходи, сільськогосподарське виробництво, «кліматично-розумне» сільського господарства, аграрне законодавство, законодавство у сфері запобігання зміні клімату