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USE OF THE DRAINED LAND POTENTIAL IN UKRAINE

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Abstract

The distribution of the drained lands of Ukraine over the land used areas is investigated, among which the highest economic value is agricultural land. It was found that there are a number of local factors that impede the effective sustainable use of drained land. Among the main factors in the short-term are a short list of crops and non-specialized short crop rotations, and in the long-term - inappropriate use of drained land. The result of such decisions was the reduction of yield potential on drained lands for almost all major crops. In order to eliminate the socio-economic and environmental obstacles to the effective use of drained land for crop production, the following areas of land use in Ukraine have been substantiated: a) cultivation of agricultural crops, traditional for the area where drainage amelioration is conducted, in premise the flax; b) increasing the share of renewable energy sources in the energy balance at both regional and national levels in terms of biomass, bio fuels and waste.

Key words*: agricultural land, climate change, drained land, energy resources, sustainable development.*

INTRODUCTION

The Land Fund of Ukraine is one of the biggest in Europe; combined with favourable climatic conditions it provides a potentially high level of agricultural production. However, facing the global humankind problems, namely: climate change, land degradation, reduction of areas suitable for growing crops, while increasing the world's population, the task of the world community is to maximize the rational and effective use of its agricultural lands resource potential.

According to the Food and Agriculture Organization of the United Nations (FAO), agricultural production needs to be increased by at least 1.5 times in the coming decades to meet the food needs of the world's population. At the same time, FAO notes that irrational methods of using or agricultural soil cultivation can cause the release of soil carbon into the atmosphere in the form of carbon dioxide, which in turn can be a factor in climate change. For example, it has been found that changes in land use and organic soil drainage with purpose of land cultivation is the cause for about 10% of all greenhouse gas emissions (FAO, 2015).

On December 12, 2015, at the 21st session of the UN Climate Summit (COP21), it was agreed on a new climate framework document - the Paris Agreement, to the UN Framework Convention on Climate Change (UNFCCC). The agreement noted the need to stimulate the development of renewable energy sources (UNFCCC, 2015).

Ukraine, in line with its commitments under the Energy Community and in line with the Energy Strategy of Ukraine by 2035, should increase the share of renewable energy sources, including biomass, bio fuels and waste up to 11% (today, the share of such sources in the energy balance is about 2%). Agriculture has significant biomass potential as one of the most promising renewable energy sources.

MATERIALS AND METHODS

The research material is based domestic and foreign on scientific publications related to solving global problems of sustainable development, namely climate change, land degradation, reduction of areas suitable for cultivation of crops and tasks for maximum

rationalization and efficient use of the potential of land resources.

The statistical data bases of the study are the official materials and reports of FAO, the State Statistics Service of Ukraine and the State Service of Ukraine for Geodesy, Cartography and Cadastre.

RESULTS AND DISCUSSIONS

Agricultural land occupies 68.8% (41,511.7 thousand hectares) of the total area of Ukraine. The total area of drained land in Ukraine is 3.3 million hectares, or 5.5% of the total area of the country, where the main area of drained land is located in Polissya and in the western regions of Ukraine. Table 1 summarizes the distribution of Ukraine's drained land, where farmland is of the greatest economic value, of which the area of drained agricultural land was about 3 million hectares (2,954.8 thousand hectares) or 7.1% of the total area of agricultural land and 89.4% of all drained land.

Table 1. Distribution of the drained lands of Ukraine as on 01.01.2015

Kind of land	Area of drained land		
	thousand hectares	% to the total area of drained land	% to the total area of land in Ukraine
Agricultural soils, including:	2,994.5	90.6	*7.0*
Agricultural land, including:	*2,954.8*	*89.4*	*7.1*
tilled area	*1,851.1*	*56.0*	*5.7*
long-fallow land	*18.7*	*0.6*	*4.6*
perennial plantings	*9.8*	*0.3*	*1.1*
hay lands	*562.6*	*17.0*	*23.3*
Pastures	*512.6*	*15.5*	*9.3*
Lands under ameliorative improvement and fertility restoration	*0.7*	*0.0*	*1.3*
Other lands	*39.0*	*1.2*	*3.4*
Forests and other wooded areas	192.7	5.8	4.3
Building land	9.7	0.3	0.4
Other lands	110.0	3.3	10.6
Total area of drained land	**3,306.9**	**100.0**	**5.5**

Source: According to the data of the 6-зем form of the State Service of Ukraine for Geodesy, Cartography and Cadastre.

An analysis of the dynamics of agricultural production in the world shows that the greatest success has been achieved in those countries where large-scale national programs for the creation of irrigation and drainage systems have been implemented. According to Delian E., Chira A., Badea M. L., and Chira L. (2019) the future of conservation agriculture will be different, in different parts of Europe because of geographic, climatic, ecological, cultural, local traditions and policy impact, as well as the EU agenda (Delian, Chira, Badea & Chira, 2019).

Today, however, there are a number of factors in Ukraine that hold back the ecological, economic and social efficiency of agricultural use of drained land. Researchers note such causation, in particular:

- transition period of the country's economy;
- parcelled and fragmentation of land, in turn, the destruction of integral land melioration complexes and a decrease in the level of efficiency of functioning of domestic economic networks of hydrotechnical constructions;
- weakening of human resources in the area of land improvement, especially at the level of agricultural producers and land users, and
- insufficient funds from commodity producers for agrotechnical provision of crop production and proper maintenance of melioration systems.

The factors that impede the ecological, economic and social efficiency of agricultural use of drained lands can be seen in the fragment of the land use plan in the territory of the Zabolotskaya village council of the Volodymyretsky district of Rivne region of Ukraine (Figures 1 and 2), where part of the Zabolotivskaya drainage system was constructed in 1963-1967. From the Figure 2 you can see that the majority (almost 80%) of the drained land is owned by the citizens-land parcels owners and the peasant farms which are cultivated independently.

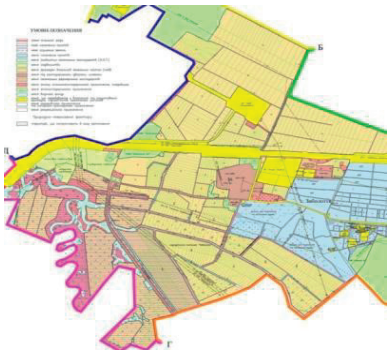

Figure 1. Fragment of the land use plan in the territory of Zabolotskaya village council of Vladimir district of Rivne region, Ukraine (Archive of Zabolotsk village council of Vladimir district of Rivne region)

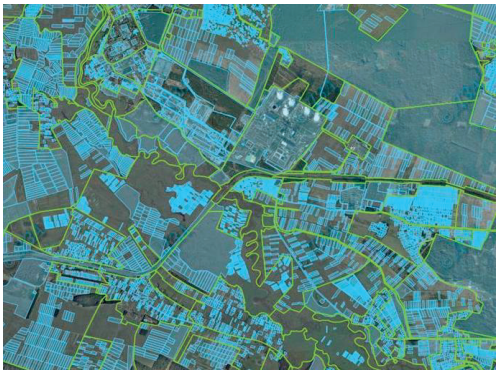

Figure 2. Extract from the Public cadastral map of the territory of the Zabolotsk village council of the Vladimir district of Rivne region (A fragment taken from the Public cadastral map of the State Service of Ukraine for Geodesy, Cartography and Cadastre)

It is well-known that the most important feature of the quality of agricultural land is the fertility of soils, and the main task of land amelioration systems is to ensure maximum yields, while maintaining high soil fertility.

However, in the process of land reform in Ukraine, most of the drained land was converted into individual use by citizens. As a result, the efficiency of the use of these lands has decreased, as the organization of small land areas causes a decrease in crop production and the transition to non-specialized short-rotation crop rotations, and subsequently - to land misuse. In addition, the current market conditions lead to the cultivation of foremost, energy crops, which often lead to neglect of crop rotations, especially in case of growing sunflower.

According to the official statistics of the State Statistics Service of Ukraine, the yield on the drained lands of almost all major crops is not much higher than the yield of crops in Ukraine in general, and in some cases - generally lower (Table 2).

Thus, the functioning of agricultural enterprises with small land areas lead to a mass disturbance of crop rotation, which is one of the reasons for the decrease in soil fertility, as well as the cultivation of monocultures, saturation of crop rotation with energy-intensive crops, which lead to depletion of soil and deterioration of its physical properties and other negative consequences.

Accordingly, we propose to consider priority areas for the use of drained lands in Ukraine.

The proposed directions are considered in the context of Ukraine's compliance with international obligations under the provisions of the Paris Agreement within the UNFCCC on the regulation of measures to reduce carbon dioxide emissions from 2020, as well as increasing the share of renewable energy in the energy balance up 11% by 2035.

Table 2. Yields of basic crops in agricultural enterprises by years, centner per hectare

Main crops	Years					
	2004	2006	2008	2010	2012	2014
On drained lands						
Cereals and legumes, including:	24.1	19.5	24.0	27.4	43.0	56.2
wheat	28.9	21.8	24.5	25.2	36.4	46.4
rye	19.0	11.6	12.5	12.5	18.1	20.7
barley	23.4	19.0	20.9	20.5	31.9	44.8
Sugar beet (factory)	254.7	300.8	384.2	299.2	411.5	470.7
Sunflower	8.7	11.6	15.6	14.6	17.6	22.2
in Ukraine						
Cereals and legumes, including:	28.3	24.1	34.6	26.9	31.2	43.7
wheat	31.7	25.3	36.7	26.8	28.0	40.1
rye	22.2	16.2	22.9	16.7	22.7	25.8
barley	24.6	21.7	30.3	19.7	21.1	30.1
Sugar beet (factory)	238.3	284.7	356.2	279.5	410.8	476.5
Sunflower	8.9	13.6	15.3	15.0	16.5	19.4

Source: According to the State Statistics Service of Ukraine.

Directions for the use of drained lands in Ukraine:

1. Growing and processing traditional crops for the drainage zone.
2. Improving energy efficiency at both regional and national levels in terms of increasing the share of renewable energy in the energy balance.

Given the large areas of drained land, Ukraine has the potential to expand the production of traditional best crops, in particular flax, because the climatic conditions are favourable for this.

The creation of flax plantations on drained lands is fully consistent with the development trends of the domestic economy and the growth of global demand for flax production.

Flax is one of the common multifunctional industrial crops, the popularity of which has increased significantly in recent years around the world.

This is evidenced by the significant increase in acreage under flax in many countries of the world and the constant expansion of the range

and increase in production of various kinds of environmentally friendly household and technical goods.

According to FAO estimates, in 2013, the total area of flax plantations in the world was 2.3 million hectares (Table 3) (SaskFlax, 2015).

Table 3. Characteristics of World Flax Production (fragment) (SaskFlax, 2015)

Country	Crop area, ha		Yield, t/ha		Volume of production, t	
	2013	average over 2009-2013	2013	average over 2009-2013	2013	average over 2009-2013
Canada	412,000	404,360	1.73	1.42	712,000	584,480
Russia	410,000	238,940	0.79	1.29	325,756	289,370
Kazakhstan	384,300	269,440	0.77	0.66	295,020	173,648
India	338,000	371,542	0.43	0.42	147,000	153,780
China	330,000	332,686	1.00	1.03	330,000	341,918
Ethiopia	105,722	112,927	0.99	0.97	104,948	111,165
USA	56,960	111,836	1.50	1.29	85,242	144,214
Ukraine	38,000	50,560	0.66	0.79	25,000	40,240
UK	34,000	34,000	1.50	1.71	51,000	58,000
Belarus	29,024	41,906	0.24	0.24	7,005	9,849
Total	2,270.353	2,150.745	0.99	0.97	2,238.938	2,087.600

As can be seen from the analysis of the table data, in terms of flax sowing areas, Ukraine lags significantly behind many economically developed countries of Europe. 80% of global flax fibre production comes from Europe (Figure 3).

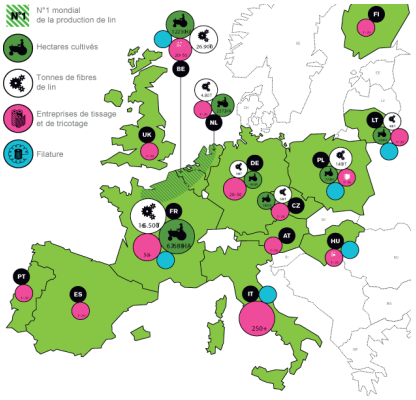

Figure 3. EU flax growing (CELC, 2015)

EU producers consider waste less at all stages of flax fibre production to be the main incentive in growing flax. Flax growing as an actively developing EU agro-industry contributes to economic and social development in rural areas, preventing labour migration. Flax growing and processing requires considerable amount labour and skilled labourers, thus providing a high level of employment in rural areas (five times higher than for growing cereals) (CELC, 2015).

Since 2000, the EU Council has decided to provide the financial support to flax growers through the support system for producers of certain agricultural crops.

The unique biochemical composition of flax seeds makes it a valuable raw material for the creation of functional foods and dietary supplements. In addition, in our opinion, flax cultivation is particularly relevant in the context of increasing the share of renewable energy sources in the energy balance in Ukraine.

The Energy Strategy of Ukraine for the Period up to 2035 "Security, Energy Efficiency, Competitiveness" defines the forecast structure of the total primary energy supply (TPES) (Table 4) (Cabinet of Ministers of Ukraine, 2017).

Table 4. Estimated structure of total primary energy supply (TPES) (million tons of oil equivalent) (fragment) (Cabinet of Ministers of Ukraine, 2017)

Source of primary energy supply	2010	2015	Forecast			
			2020	2025	2030	2035
Biomass, biofuels and waste	1.5	2.1	4.0	6.0	8.0	11.0
Solar and wind energy	0	0.1	1.0	2.0	5.0	10.0
Hydro energy	1.1	0.5	1.0	1.0	1.0	1.0
Thermal energy	-	0.5	0.5	1.0	1.5	2.0
Share of renewable resources	-	4.0	8.0	12.0	17.0	25.0

There is sufficient biomass available for energy production in Ukraine to meet this target - more than 27 million t/year is estimated: the primary components of the potential are primary agricultural waste (straw, corn and sunflower) and energy crops, cultivation of them on an industrial scale has been actively developing in the country in recent years (Geletukha, Zheliezna, Kramar & Kucheruk, 2015).

At present, only about 10% of the total biomass potential is used for energy needs in Ukraine - 2.7 million t/year. It is mainly wood biomass in the form of firewood, wood chips, pellets / briquettes (generally 86% of the total annual use of biomass), and sunflower hulls (8%). The least actively used is the plants waste - 94 thousand tonnes of straw per year, which is less than 1% of the economic potential of straw in Ukraine (Geletukha, Zheliezna, Kramar & Kucheruk, 2015).

Given the above, it can be argued that the demand for bio fuels will grow. This, in turn, indicates a high potential for growing agricultural crops on drained land with the aim, in addition to ensuring food security, also meeting the demand for bio fuels from agricultural waste and growing on plantations the energy crops, in particular, growing flax.

Mechanisms for stimulating the development of the renewable energy sector, the use of renewable energy sources and alternative fuels in Ukraine include such instruments (Cabinet of Ministers of Ukraine, 2014):

- reduction of land tax for renewable energy companies;
- tax reduction for farmers, households, etc. who are engaged in growing flax;
- tax exemption:
  - profits from the core business of energy companies producing electricity from renewable sources;
  - profits of bio fuel producers from the sale of bio fuels;
  - profits of enterprises obtained from activities for the simultaneous production of electric and thermal energy and / or production of thermal energy using biological fuels;
  - profits of manufacturers of machinery and equipment for the manufacture and reconstruction of machinery and vehicles consuming biological fuels.
- exemption from value added tax on operations involving the import into the customs territory of Ukraine of equipment that operates on renewable energy sources, equipment and materials for the production of alternative fuels or for the production of energy from renewable energy sources, as well as exemption from import duties on mentioned equipment and materials;
- the Law of Ukraine “On the Electric Energy Market” dated 04.13.2017 No. 2019-VIII provides for the stimulation of the production of electric energy from alternative energy sources by establishing a “green” tariff for electric energy produced from alternative energy sources, as well as a differentiated premium to the “green” tariff for the use of Ukrainian-made equipment at a level of 30% or more, but less than 50%, or 50% or more.

CONCLUSIONS

Ukraine has significant potential for increasing flax production on drained lands, in addition to the fact that flax production on drained lands creates a range of benefits. In particular, drained lands will be involved in circulation, in particular parcels that are not used today and abandoned, or are occupied with other crops that have worse agri-biological and technical and economic characteristics.

Recommendations on the minimum sown area of flax for one farm is at least 50 ha, which is economically feasible and allows more efficient use of harvesting and other special equipment (Goloborodko, Loginov & Sitnik, 2006), determines the creation of small farms, households specializing in the cultivation of this particular crop.

The high profitability of flax production increases the investment attractiveness of the rural region. The development of flax growing on the drained lands will also stimulate the employment rate of the rural population.

Summarizing, it should be noted that in the context of the formation of financial and investment prerequisites for increasing the level of socio-economic development of the drainage melioration zone, the question arises of choosing the optimal managerial decision on the use of each individual land plot. We believe

that such a tool as comparing the costs and benefits of land use alternatives will make it possible to adopt and implement the best management decisions available:

- to restore the traditional specialization of the administrative areas of the drainage zone;
- to grow bio energy crops to enhance Ukraine's energy efficiency potential;
- to conduct or institutionalize the re-naturalization of drained lands.

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