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## Legal provision of prevention and combating land flooding in Ukraine

Maryna A. Deineha\*

Full Doctor in Law, Associate Professor  
National University of Life and Environmental Sciences of Ukraine  
03041, 15 Heroiv Oborony Str., Kyiv, Ukraine

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Due to global warming, overregulation of water bodies, disruption of water runoff, unsatisfactory functioning or complete absence of drainage systems, reduction of forest areas, Ukraine will not avoid the problems related to land flooding. The harmful effects of water are caused by both global factors, such as warming and melting of glaciers, and regional features, namely the system of water exchange between water bodies, changes in precipitation and river flow. Land flooding is a phenomenon that cannot be completely prevented. However, human activity increases its probability and impact. The risk of flooding and the extent of damage caused, as well as the impact on the health and socio-economic situation of those affected, will continue to increase because of climate change. Inadequate river management, construction in freshet-prone areas, and the growing population living in these areas further exacerbate the effects of land flooding. Ukraine has already taken appropriate steps to implement the provisions of international acts in the field of preventing and combating land flooding in national legislation. However, the quality

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\*Corresponding author

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of implementation of national programs in the defined area leaves much to be desired, as most of the measures, unfortunately, are not implemented. Failure to comply with measures in certain amounts creates high risks of land flooding, as a result of which the population and the national economy suffer multimillion-dollar losses

**Keywords:** land flooding, harmful effects of water, threats and risks of flooding, management of water resources according to the basin principle, climate change, global warming

### **Introduction**

Over the past decade, the area of land with constant manifestations of flooding has doubled. According to expert estimates, up to 16 million people suffer from land flooding to one degree or another. Adverse consequences of floods and freshets are manifested in 27% of the territory of Ukraine, where almost a third of the population lives. 541 settlements are flooded, and in 97 the flooded area exceeds 50% of the territory. Socio-economic losses amount to 300 to 500 UAH in rural areas, and up to 10-12 thousand UAH per 1 hectare of flooded territories in cities and towns [1]. At the same time, the population suffers direct losses from loss or damage to housing, farm buildings, crop destruction on homesteads.

The area of flooded agricultural land is about 118 thousand hectares. The total area of agricultural land with constant manifestations of flooding amounts to 12% of the territory of Ukraine. According to expert estimates, the economic losses caused by the harmful effects of water on agricultural lands, which are estimated as losses from a decrease in the production of plant and animal products, costs for the repair of premises, equipment, and inventory, replanting of agricultural crops, etc., amount to about 205 million UAH every year [2]. However,

the greatest losses await society when catastrophic floods and freshets result in fatalities.

The intensity of land flooding in Ukraine, its catastrophic consequences, and the imperfection of statutory regulation require an urgent solution to this issue.

*The purpose of this paper* is to analyse the legal support for preventing and combating land flooding in Ukraine, identify legal issues in the outlined area and outline their solutions.

### **Results and Discussion**

Land flooding occurs under natural and anthropogenic factors due to rising water levels, which leads to a violation of the normal living conditions of the population and land use. Flooding in terms of distribution and development dynamics prevails among exogenous geological processes and causes a decrease in soil strength, activation of landslide phenomena, an increase in groundwater aggressiveness, and contamination of surface and underground water bodies [1].

The main causes of land flooding are climate change; the overregulation of rivers by reservoirs and ponds, which causes the groundwater level to rise and the natural drainage of the territory to decrease; violation of natural runoff in built-up areas;

unsatisfactory functioning or complete absence of corresponding ameliorative systems; irrigation of arable land without adequate drainage; reduction of areas of forest stands, etc. [2].

Separately, one should focus on the global issue of rising sea levels caused by climate change, which poses a threat of flooding primarily to the coastal territories of many countries around the world. Ukraine is no exception. Ukraine has one of the longest coastlines in Europe, and therefore the adverse consequences of rising sea levels will also be reflected on Ukrainian coast.

According to Ukraine's Fifth National Communication on Climate Change [3], the risks and losses from sea level rise by 2100 will differ depending on the rise scenarios. According to various climate change modelling scenarios, the rise in the level of the Black and Azov Seas may range from 22 to 115 cm by 2100. The following scenarios of rising levels of the Black and Azov seas by 2100 are also mentioned: a minor increase to 0.66 m and a large increase to 7.15 m. In a pessimistic scenario, it will be necessary to introduce active measures to protect coastal resources. The processes of coastal erosion, flooding, inundation, and salinization of soils in the Black Sea and Azov regions will intensify; sea level rise will also cause substantial changes in the ecosystems of the estuarine regions of the Danube, Dnieper, and Dniester, will lead to the transformation of the lowland landscapes of the sea coast, and the erosion processes will become more active. Considerable areas of the land fund will be under threat of destruction, and many settlements will be partially or completely flooded [4].

Protection of land from the harmful effects of water and flooding is one of the most pressing issues today. Therewith, the system of such protection should be comprehensive, be a mandatory component of the formation and implementation of the national policy of Ukraine on its way towards sustainable development. Practice shows that it is impossible to solve the issue of flood protection exclusively by engineering measures. Insufficient consideration of natural factors, saving on preventive measures that ensure the sustainability of ecosystems, leads to a considerable increase in the cost of eliminating the consequences of harmful effects of water and land flooding.

According to Article 107 of the Water Code of Ukraine [5], the harmful effects of water are as follows: the consequences of flooding, which led to flooding and inundation of lands and settlements; destruction of banks, protective dams, and other structures; waterlogging, inundation, and salinization of lands caused by the rise in the level of groundwater due to irregular water supply during irrigation, leakage of water from water supply and sewage systems and blocking of groundwater flows when large industrial and other structures are placed; land drainage caused by the withdrawal of groundwater in an amount that exceeds the permissible limit; pollution (salinization) of land in areas of mineral extraction, as well as after the end of exploitation of deposits and their conservation; soil erosion, formation of ravines, landslides, and mudslides.

The Land Code of Ukraine [6] and the Law of Ukraine "On Land Protection" [7] define that land protection is ensured based on the implementation of a set of measures to

preserve the productivity of lands, improvement of their ecological stability and soil fertility. According to Article 36 of the Law of Ukraine "On Land Protection", land protection from flooding is carried out based on the implementation of measures prescribed by national and regional programs, according to land management schemes and feasibility studies for the use and protection of land of administrative-territorial units, work projects of land management [7].

Furthermore, according to Articles 38, 42 of the Law of Ukraine "On Land Protection" during land reclamation, placement, design, construction, reconstruction, and operation of water management facilities, measures aimed at preventing flooding and waterlogging of land, deterioration of soil quality are provided [7]. Thus, during the design of water management and other objects, the possible harmful effect of water should be considered, and during the operation of these objects, measures should be taken to prevent it, namely planting and creating forest stands on coastal protective strips, slopes, arroyo, and ravines; construction of anti-erosion hydrotechnical structures, earthen shafts, spillways, protective dams, reservoirs-regulators; construction of drainage; shore fortification, etc. (Article 107 of the Water Code of Ukraine [5]).

In 2016, the Law of Ukraine "On Amendments to Certain Legislative Acts of Ukraine Regarding the Implementation of Integrated Approaches in the Management of Water Resources Based on the Basin Principle" [8] amended the Water Code of Ukraine [5] with Article 107-1, which defines the mechanism for developing a flood risk management plan to reduce the potential adverse impact of

flooding on human life and the surrounding natural environment. Flood risk management plans are being developed for individual areas within the river basin area that have a high risk of flooding.

In compliance with the requirements of the said Article in 2018, the Resolution of the Cabinet of Ministers of Ukraine approved the procedure for developing a flood risk management plan [9], the Order of the Ministry of Internal Affairs of Ukraine approved the methodology for developing maps of threats and risks of flooding [10], and the Order of the Ministry of Internal Affairs of Ukraine approved the Methodology for preliminary assessment of flood risks [11]. The management plan is developed by the State Emergency Service of Ukraine together with the Ministry of Environmental Protection and Natural Resources of Ukraine, the State Water Resources Agency of Ukraine, other interested central bodies of executive power and is agreed with local executive bodies and local self-government bodies in whose territory there is a high risk of flooding, and is approved by the Cabinet of Ministers of Ukraine. The State Service of Ukraine for Emergencies provides a strategic environmental assessment of the management plan project according to the Protocol on Strategic Environmental Assessment to the Convention on Environmental Impact Assessment in a Transboundary Context, ratified by the Law of Ukraine dated July 1, 2015 [12].

To prevent and eliminate the consequences of land flooding, to restore the role of reclaimed land in the food and resource supply of the state, as well as to introduce a system of integrated water resources management based on the basin principle in

2012. The Verkhovna Rada of Ukraine adopted the Law of Ukraine “On the Approval of the Nationwide Target Program for the Development of Water Management and Ecological Improvement of the Dnipro River Basin for the period until 2021” [13]. In land protection from the harmful effects of water and comprehensive anti-flood protection, the tasks of the Program are defined as: construction, reconstruction and capital repair of hydrotechnical structures, protective anti-flood dams, shore fortification structures, clearing, and regulation of river channels and reservoirs; application of modern flood monitoring and forecasting methods, timely, reliable informing of the population and enterprises about the possibility of an emergency flood situation, as well as its consequences; construction and reconstruction of anti-slide and anti-mudflow structures; implementation of local programs for the revival of small rivers and reservoirs; reducing the intensity of surface runoff.

However, according to the results of the Accounting Chamber [14], the Program [13] is not implemented in the planned volumes and terms. Measures taken during 2013-2020 by its state customers, namely the Ministry of Ecology and Natural Resources of Ukraine (and its legal successors) and the State Water Management Agency of Ukraine, both at the first stage of the implementation of the National Program (2013-2016), and in the second (2017-2020), turned out to be insufficient for its implementation.

Of the performance indicators planned by the Program in terms of “Protection of rural settlements and agricultural lands from the harmful effects of water”, 1 has been completed, 11 have been partially completed,

and 1 has not been completed. In terms of “Complex Anti-flood Protection in the Basins of the Dniester, Prut, and Siret rivers”, out of 31 planned measures, work was financed under 12 measures, of which not a single measure was financed in the planned volumes. This led to the failure to achieve the planned performance indicators (completed – 3, partially completed – 7, not completed – 21). Therewith, according to such indicators as the number of anti-flood tanks built in mountainous and plain parts of rivers; the number of polders and anti-flood storages constructed; the area of land on which coastal protective strips are afforded and limed; the area of land on which anti-slide measures have been implemented; the number of built anti-flood structures; the number of people who need to be resettled from risk zones of land use within the territory of possible flooding; the number of designed storage tanks in the complex with hydroelectric power stations; the number of projects developed, and scientific research conducted, no work was carried out at all. As a result, the risks of failure to provide adequate protection against floods in the basins of the Dniester, Prut, and Siret rivers with anti-flood structures (dams and shore fortifications) are increasing. Since the implementation of the National Program in terms of “Complex flood protection in the basin of the Tysa River in Zakarpattia Oblast”, of the planned performance indicators, 1 indicator has been fully implemented, 6 have been partially implemented, and 12 have not been implemented. As a result, the risks of flooding of rural settlements and agricultural land located in the Tisa River Basin increase.

Failure to comply with the measures prescribed in the Program in certain amounts creates high risks of land flooding, as a result of which the population and the national economy suffer multimillion-dollar losses.

The Cabinet of Ministers of Ukraine approved the Strategy of Irrigation and Drainage in Ukraine for the period until 2030 [15], the purpose of which is to determine the strategic vectors of the national policy on irrigation and drainage, to ensure the sustainable and ecologically balanced development of agriculture in Ukraine. The implementation of the Strategy is aimed at restoring the potential of irrigation and drainage systems to further increase the area of irrigation and water regulation as the basis for achieving the maximum level of agricultural production efficiency and environmental safety. To fulfil the purpose and objectives of the Strategy, the Cabinet of Ministers of Ukraine adopted an order [16] approving the Action Plan for the Implementation of the Irrigation and Drainage Strategy in Ukraine for the period up to 2030. The implementation of the adopted Action Plan should ensure the development of agriculture in Ukraine, increase the yield of agricultural crops, increase the area of land with drainage systems and expand the agricultural potential of Ukraine.

### **Conclusions**

Unfortunately, Ukraine will not avoid problems related to flooding of lands caused by global warming, regulation of water bodies, disruption of water flow, unsatisfactory functioning or complete absence of drainage systems, reduction of the area of forest plantations, etc. The harmful effects of water in Ukraine are caused by both global factors,

such as warming and melting of glaciers, and regional features, specifically the system of water exchange between water bodies, changes in precipitation and river flow.

Land flooding is a phenomenon that cannot be completely prevented. However, human activity increases its probability and impact. The risk of flooding and the extent of damage caused, as well as the impact on the health and socio-economic situation of those affected, will continue to increase as a result of climate change. Inadequate river management, construction in freshet-prone areas, and the growing population living in these areas further exacerbate the effects of land flooding.

Ukraine has already taken appropriate steps to implement the provisions of international acts in the field of land flood prevention and control, namely the provisions of Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks [17]. The main tasks of the Directive are preliminary flood risk assessment, creation of flood hazard maps and flood risk maps, as well as creation of flood risk management plans. Ukraine has developed and adopted the relevant regulatory framework defined by the provisions of the Directive. However, the quality of implementation of national programs in this area leaves much to be desired, which is confirmed by the conclusions of the Accounts Chamber of Ukraine, according to which most of the measures are not implemented. Failure to comply with measures in certain amounts creates high risks of land flooding, as a result of which the population and the national economy suffer multimillion-dollar losses.

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## Правове забезпечення запобігання і боротьби з підтопленням земель в Україні

**Марина Андріївна Дейнега**

Доктор юридичних наук, доцент

Національний університет біоресурсів і природокористування України  
03041, вул. Героїв Оборони, 15, м. Київ, Україна

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### **Анотація**

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Через глобальне потепління, зарегульованість водних об'єктів, порушення водного стоку, незадовільне функціонування або повну відсутність дренажних систем, скорочення площ лісових насаджень наша держава не уникне проблем, пов'язаних із підтопленням земель. Шкідлива дія вод обумовлюється як глобальними чинниками, такими як потепління та танення льодовиків, так і регіональними особливостями, зокрема, системою водообміну між водними об'єктами, змінами у кількості опадів і річкового стоку. Підтоплення земель – це явище, якого не можна повністю запобігти. Однак людська діяльність сприяє збільшенню його вірогідності та впливу. Ризик затоплення та ступінь заподіяної шкоди, а також вплив на здоров'я та соціально-економічну ситуацію тих, хто постраждав, продовжуватиме зростати у майбутньому внаслідок зміни клімату. Невідповідне управління річками, будівництво в районах, що піддаються ризику паводку і зростаюча кількість населення, що приживає у цих районах, ще більше посилюють наслідки підтоплення земель. Україною зроблені вже відповідні кроки щодо впровадження положень міжнародних актів у сфері запобігання і боротьби з підтопленням земель у національне законодавство. Однак якість виконання загальнодержавних програм в окресленій сфері вимагає кращого, оскільки більшість заходів, на жаль, не виконується. Невиконання заходів у визначених обсягах створює високі ризики підтоплення земель, внаслідок чого населення та економіка держави зазнає багатомільйонних збитків

**Ключові слова:** підтоплення земель, шкідлива дія вод, загрози і ризики затоплення, управління водними ресурсами за басейновим принципом, зміна клімату, глобальне потепління

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