

## WSZECHSTRONNA OCENA OBIEKTÓW WYKONANYCH TECHNOGENICZNIE DLA TWORZENIA STREF REKREACYJNYCH NA UKRAINIE

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**Streszczenie.** W artykule podkreślono przyczyny problemów środowiskowych na Ukrainie, takich jak środowiskowe, gospodarcze, społeczne, polityczne, przemysłowe. Ustalono, że potencjał ekologiczny ziem Ukrainy jest znacznie uszczuplony i wymaga znacznych kosztów sztucznej odbudowy. Prowadzone badanie efektywnego wykorzystania obiektów wykonanych przez człowieka na Ukrainie pod kątem następujących elementów: badania nad koncepcją ochrony ziemi; określenie istoty ziem zdegradowanych, nieprodukcyjnych i zniszczonych; przeprowadzenie opisu rekultywacji terenów dotkniętych działalnością człowieka; wprowadzenie klasyfikacji terenów naruszonych do rekultywacji; ocena terenów naruszonych pod kątem ich przydatności do rekultywacji; określenie kolejności rekultywacji; identyfikacja cech rekultywacji terenów naruszonych wyrobiskami odkrywkowymi; opracowanie wymagań dotyczących wyboru kierunku rekultywacji terenu; procedura przekazania gruntów zrehabilitowanych właścicielom oraz kontrola jakości rekultywacji. Przeprowadzono podejście do szacowania obiektów spełniających wymagania technogeniczne, którego celem jest tworzenie terenów rekreacyjnych na Ukrainie. Podejście to obejmuje dziewięć kolejnych etapów i pozwala oceniać obiekty stworzone przez człowieka i określa ich efektywność ekonomiczną. Opisano proces od oceny obiektów wytworzonych przez człowieka do przekazania właścicielowi gruntu zrehabilitowanego w celu utworzenia terenów rekreacyjnych na Ukrainie. Proces ten jest określany jako niezwykle kosztowny z ekonomicznego punktu widzenia i w czasie. Udowodniono, że po rekultywacji zniszczonych terenów możliwe jest tworzenie stref rekreacyjnych. Utworzone strefy będą sprzyjać efektywnemu wykorzystaniu zasobów turystycznych i rekreacyjnych; będą stymulować rozwój infrastruktury turystycznej; utworzy się dogodne warunki zaspokojenia potrzeb ludności w zakresie aktywnego wypoczynku i promocji zdrowia; utworzone strefy zapewnią miejscowej ludności miejsca pracy w sferze nieprodukcyjnej.

**Słowa kluczowe:** przedmioty zużyte technogenicznie lub przedmioty wytworzone przez człowieka, ziemie odzyskane, teren rekreacyjny, ocena, efektywność ekonomiczna, zasoby turystyczne, zasoby rekreacyjne, potrzeby ludności.

## COMPREHENSIVE ASSESSMENT OF TECHNOGENIC WASTE OBJECTS FOR THE CREATION OF RECREATIONAL AREAS IN UKRAINE

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**Abstract.** The article highlights the causes of environmental problems in Ukraine, such as environmental, economic, social, political, industrial. It is established that the ecological potential of the lands of Ukraine is significantly depleted and requires significant costs for artificial restoration. A study of the effective use of man-made objects in Ukraine on the following elements: research on the concept of land protection; determination of the nature of degraded, low-productive and disturbed lands; characterization of the reclamation of territories affected by human activity; classification of disturbed land for reclamation; assessment of the affected areas by their suitability for reclamation; determination of the sequence of reclamation; isolation of the features of reclamation of the territories disturbed by open workings; development of requirements for the choice of land reclamation direction; the procedure for the transfer of reclaimed land to the landowner and quality control of reclamation. Takes an approach to the evaluation of technogenic waste objects. The purpose of the approach is to create recreational areas in Ukraine. This approach includes nine successive stages and makes it possible to evaluate man-made objects and determine their economic efficiency. The process from the assessment of man-made objects to the transfer of reclaimed land to the landowner for the creation of recreational areas in Ukraine is described. This process is defined as extremely costly from an economic point of view and in time. It is proved that after the reclamation of the formed land plots it is possible to create recreational zones. The created zones will promote the use of tourist and recreational resources; will stimulate the development of tourist infrastructure; will create unfavorable conditions to meet the needs of the population in active recreation and change of health; to promote local jobs in the non-productive sphere.

**Keywords:** technogenic waste objects, reclaimed lands, recreational zone, assessment, economic efficiency, tourist resources, recreational resources, needs of the population.

## КОМПЛЕКСНЕ ОЦІНЮВАННЯ ТЕХНОГЕННО-ВІДПРАЦЬОВАНИХ ОБ'ЄКТІВ ДЛЯ СТВОРЕННЯ РЕКРЕАЦІЙНИХ ЗОН В УКРАЇНІ

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**Анотація.** У статті висвітлені причини проблем порушення природного стану навколишнього середовища в Україні такі, як екологічні, економічні, соціальні, політичні, промислові. Встановлено, що екологічний потенціал земель України має значне виснаження і потребує суттєвих витрат на штучне відновлення. Проведено дослідження ефективного використання техногенно-відпрацьованих об'єктів в Україні за такими

елементами: дослідження поняття про охорону земель; визначення сутності деградованих, малопродуктивних і порушених земель; проведення характеристики рекультивації територій, порушених діяльністю людини; здійснення класифікації порушених земель для рекультивації; оцінка порушених територій за їхньою придатністю до рекультивації; визначення послідовності здійснення рекультивації; виокремлення особливостей рекультивації територій, порушених відкритими виробітками; розробка вимог до вибору напрямку рекультивації земель; порядок передачі рекультивованих земель землевласнику та контроль якості рекультивації. Здійснено підхід до оцінювання техногенно-відпрацьованих об'єктів, метою якого є створення рекреаційних зон в Україні. Даний підхід включає дев'ять послідовних етапів і дає можливість оцінити техногенно-відпрацьовані об'єкти й визначити їх економічну ефективність. Охарактеризовано процес від оцінювання техногенно-відпрацьованих об'єктів до передачі рекультивованих земель землевласнику для створення рекреаційних зон в Україні. Цей процес визначено як надзвичайно затратний з економічної точки зору і в часовому вимірі. Доведено, що після проведення рекультивації порушених земель можна створювати рекреаційні зони. Створені зони сприятимуть ефективному використанні туристичних і рекреаційних ресурсів; стимулюватимуть розвиток туристичної інфраструктури; створюватимуть сприятливі умови для задоволення потреб населення в активному відпочинку і зміцненні здоров'я; забезпечуватимуть місцеве населення робочими місцями у невиробничій сфері.

**Ключові слова:** техногенно-відпрацьовані об'єкти, рекультивовані землі, рекреаційна зона, оцінювання, економічна ефективність, ресурси туристичні, ресурси рекреаційні, потреби населення.

**Problem set-up and its significance.** In modern conditions rational use of natural resources and protection of the natural environment is an important task for the development of any state. In Ukraine, the problem of environmental degradation has reached enormous proportions as a result of environmental, economic, social and political crises, as well as the intensive development of industry and extensive economic management, the ecological potential of the country's lands has been depleted and requires significant costs for artificial restoration.

**Analysis of the recent research of the problem.** The problems of the effective use of technogenic and waste facilities in Ukraine are devoted the researches of many scientists. They are Demianenko S.O., Liubitseva O.O., Matviichuk L.Y., Tkachenko T.I., Uvarova G. Sh. Theoretical and practical aspects of land reclamation were investigated in particular by Vasylenko T.A. (*Shevchenko, 2016*), Golovanov O.I. (*Vasylenko, 2019*), Yukhnovskyi V. Yu. (*Zemel'nyy kodeks, 2001*) and others.

**Aim of the research.** The purpose of investigation of environmental problems and substantiation of practical measures for efficient use of technogenic waste in Ukraine on the basis of the proposed approach of comprehensive evaluation of technogenic waste objects to create recreational areas.

**Main material statement.** In order to investigate the effective use of technogenic waste objects in Ukraine it is necessary to identify the constituent elements of the problem. Such elements are the following

- research on the concept of land protection;
- determination of the nature of degraded, low-productive and disturbed lands;
- characterization of the reclamation of territories affected by human activity;
- classification of disturbed land for reclamation;
- assessment of the affected areas by their suitability for reclamation;
- determination of the sequence of reclamation;

isolation of the features of reclamation of the territories disturbed by open workings;

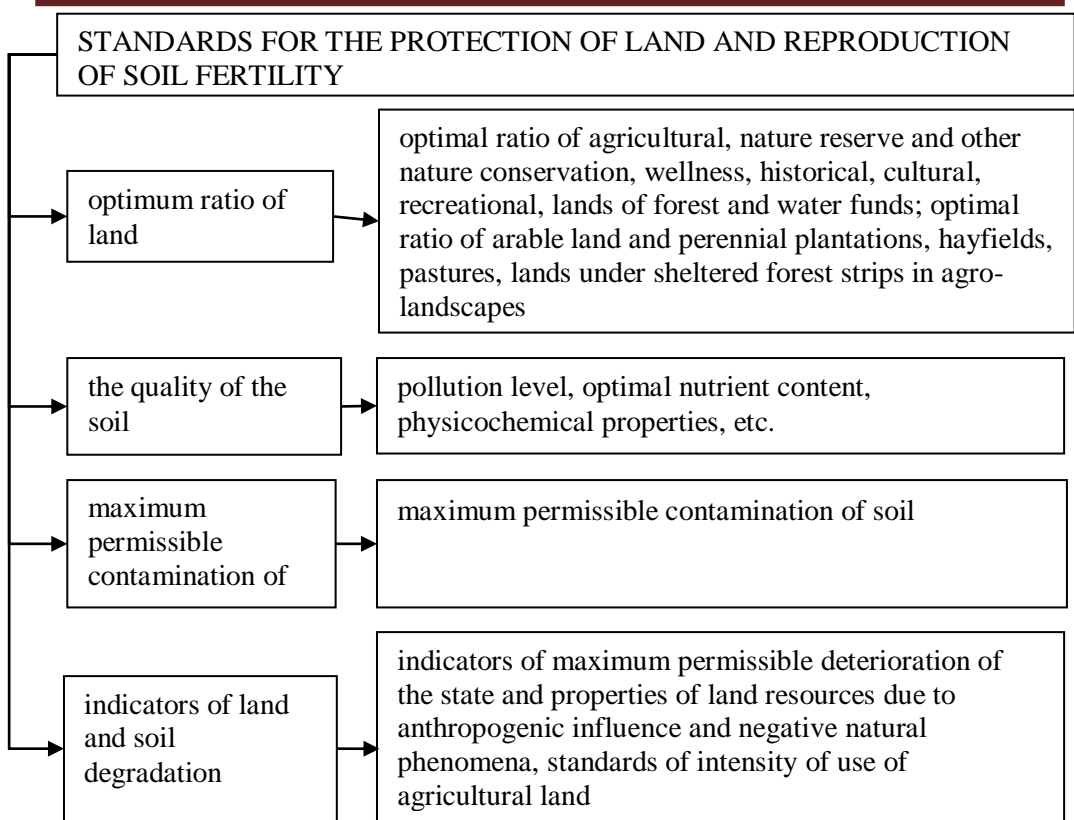
development of requirements for the choice of land reclamation direction;

the procedure for the transfer of reclaimed land to the landowner and quality control of reclamation.

1. On the bases of the above elements will be build an approach to comprehensive assessment of technogenic and waste objects. The logic behind the presentation of the material shows that this question is quite voluminous, covering nine components. We describe each of the elements in more detail. The concept of land protection will be explored. According to Article 162 of the Land Code of Ukraine, ‘land protection is a system of legal, organizational, economic and other measures aimed at rational land use, prevention of unjustified confiscation of agricultural land, protection against harmful anthropogenic impact, reproduction and fertility enhancement, and fertility enhancement. forest fund, provision of a special regime for the use of lands of nature, wellness, recreational and historical and cultural purpose’ (*Aktual'ni problemy 2010*).

Land protection includes justification and ensuring the achievement of rational land use; protection of agricultural lands, forest lands and shrubs from their unjustified seizure for other needs; protection of lands from erosion, villages, flooding, waterlogging, secondary salinization, over-drying, compaction, pollution of production waste, chemical and radioactive substances and from other adverse natural and man-made processes; conservation of natural wetlands; prevention of deterioration of the aesthetic state and ecological role of anthropogenic landscapes; conservation of degraded and low-yield agricultural land.

In the field of land protection and reproduction of soil fertility, certain legal standards are established (Fig.).



**Fig. Standards of the field of land protection and reproduction of soil fertility, grouped by author (*Pro okhoronu zemel'*, 2003)**

2. From Fig. it is clear that the law of Ukraine "On Land Protection" (*Pro okhoronu zemel'*, 2003) defines the legal, economic and social bases of land protection in order to ensure their rational use through its main standards, namely: the optimum ratio of land; the quality of the soil; maximum permissible soil contamination; indicators of land and soil degradation.

3. Determine the nature of degraded, low-productive and disturbed land. Misuse of land resources may result in degradation and contamination of soil and soil (fertile layer) (*Holovanov 2009, 327*). According to this law, soil degradation is a deterioration of beneficial properties and soil fertility due to the influence of natural or anthropogenic factors. In turn, land degradation is the natural or anthropogenic simplification of the landscape, the deterioration of the condition, composition, useful properties and functions of the land and other organically related natural components.

Scientists determine that the main causes of land degradation and reduced productivity are: soil erosion; desertification (a process that leads to the loss of natural vegetation with the subsequent impossibility of restoring it without human involvement); secondary salinization; toxicity (soil contamination); man-made destruction through open-cast mining, construction materials, peat, pipelines, exploration and more.

4. Against this background, reclamation can be regarded as one of the main measures for the effective use of man-made facilities in Ukraine. Thus, the reclamation of disturbed lands is a complex of organizational, technical and biotechnological

measures aimed at restoring soil cover, improving the condition and productivity of disturbed lands. Remediation is subject to land disturbed by man-made destruction.

Let's characterize the reclamation of territories affected by human activity. Open-pit mining leads to a significant deterioration of the environmental situation in both mining and surrounding areas. But most of all the soil is disturbed when extracting minerals in an open way. In this case, large areas of farmland go under the dumps. All lands subject to change in the relief, soil cover, maternal and litter rocks that occur or have already occurred in the course of mining, construction, hydrotechnical, geological prospecting and other works are subject to reclamation. The main task of reclamation is to perform a set of special works and measures, to bring the disturbed lands to a condition suitable for their use in agriculture, forestry, fisheries, for industrial and communal construction, the creation of greenhouses and recreation areas. Disturbed lands shall be brought to a suitable condition during mining and other works, and if not possible, not later than one year after their completion, excluding the period of freezing of the soil.

5. We will classify the disturbed lands for reclamation. The disturbed territories after the complex of restoration works are used for creation of green areas of general and limited use, special purpose; industrial and external transport zones; residential areas and neighborhoods; zones of water regulation devices; fish and agricultural areas; water supply zones; communal-warehouse zones, etc. (HOST 17.5.1.02-85). The classification of disturbed lands according to the direction of further use is given in Table 1.

*Table 1*

**Classification of disturbed lands by remediation areas according to the types of further use**

Group of disturbed lands by remediation directions	Type of reclaimed land
Agricultural lands for reclamation	Arable land, hayfields, pastures, perennial crops
Forest lands for reclamation	Forestry of general purpose and protective nature, nurseries
Water management land and reclamation	Reservoirs for household, industrial, irrigation and fisheries needs
Recreational land reclamation	Recreation and sports areas: parks and forest parks, reservoirs for wellness purposes, hunting grounds, tourist bases and sports facilities
Lands of nature protection and sanitary-hygienic direction of reclamation	Protected areas: anti-erosion afforestation, retarded or flooded areas, areas secured or preserved by technical means, areas of self-growth that are not specifically arranged for use for economic or recreational purposes
Construction land of reclamation	Lands for industrial, civil and other construction, including the placement of waste heaps of production waste (rocks, construction debris, enrichment waste, etc.)

Source: grouped by author by data (HOST 17.5.1.02-85)

6. Estimation of disturbed territories by their suitability for reclamation. The procedure for the restoration of disturbed territories and their urban planning use are designed on the basis of: soil groups by acidity (pH); mining facilities, type of production (open and underground mining, mineral processing, processing of mineral raw materials, waste from thermal power plants and metallurgical enterprises); forms of

violation (recess, quarry, drawdown, dump, embankment, failure); sizes of disturbances (morphometry, amplitude of anthropogenic landforms, area occupied by disturbed areas); engineering and geological parameters of the territory (type, acidity and salinity of soils, mode and sources of supply of groundwater, natural forms of relief); biological properties of soil of the territory; types of settlement of the area with disturbed territories (dispersed, centralized, group); functional needs of cities and other settlements in the settlement system; development of transport and engineering infrastructure of the settlement system, individual cities and settlements; technical and economic means for restoration of territories.

7. Determine the sequence of reclamation. In the process of restoration of disturbed territories there are two stages of reclamation: technical and biological (*HOST 17.5.1.02-85; Lisovi melioratsiyi. 2010; Pro okhoronu zemel', 2003*).

The technical stage of reclamation is a complex of engineering works. It includes removal and storage of a fertile layer of soil and potentially fertile rocks; formation of dumps of mines, quarries, and hydraulic dumps; leveling the surface, laying, terracing and fixing slopes of dumps, boards and quarries, backfilling mine dips, securing their boards; chemical reclamation of toxic soils; covering the leveled surface with a layer of fertile soil or potentially fertile rocks; engineering management of the reclaimed area (drainage network, roads, exits, etc.); leveling the bottom and sides of the quarry when creating reservoirs.

The biological stage of reclamation is a set of measures for the creation of favorable water-air and nutrient regimes of soil for agricultural and forest crops, which is determined by the physicochemical properties of the bedding rocks and the applied fertile soil layer or potentially fertile rock. This complex covers the introduction of crop rotations, saturated with crops for fertilizer, the introduction of high standards of organic and mineral fertilizers, mulching, etc.

8. Distinguish the features of the reclamation of the territories disturbed by open workings. In the development of minerals in the open way, formed concave (negative forms - quarries, flooded and dry interspace) or convex (positive forms - dumps, tailings) type of relief. Careers for the extraction of building materials have a low-power gap and a powerful layer of extractable material. In this regard, only waste from metallurgical enterprises and large thermal power plants can be used for full backfilling of quarries. In the absence of such a possibility, careers are used as reservoirs of various purposes.

In the restoration of open-cast mining areas, vertical planning work is performed to a minimum extent, ensuring mainly the stability of forms and taking measures against erosion and excessive infiltration of precipitation. On this basis, they do: tracing the sides of quarries, dumps with various functional uses; planning-leveling of dumps; preparation of the bottom surface of the quarry under the reservoir bed; falling asleep-forming or falling asleep-leveling quarries; full backfill of the quarry to the adjacent areas.

9. Development of requirements for the choice of land reclamation direction. Areas of reclamation determine the end use of disturbed lands after conducting the relevant mining, engineering, hydrotechnical and other measures, they are selected on the basis of a comprehensive account of the following factors: natural conditions of the field of development of the field (climate, soil types, geological structure, vegetation and vegetation, etc. .); state of disturbed lands up to the time of reclamation (nature of technogenic relief, degree of natural overgrowth, etc.); mineralogical composition, water-physical and physicochemical properties of rocks; agrochemical properties



(nutrient content, acidity, presence of toxic substances, etc.) of rocks and their classification according to suitability for biological reclamation; engineering-geological and hydrological conditions; economic, socio-economic, environmental and sanitary conditions; service life of reclaimed lands (possibility of repeated violations and their periodicity); technology and mechanization of mining and construction works.

In the process of choosing the direction of land reclamation, it should be borne in mind that the reclaimed lands and the areas surrounding them after completion of the works represent an optimally formed and environmentally balanced landscape area.

10. Procedure for the transfer of reclaimed land to the landowner and quality control of reclamation. Acceptance (transfer) of the reclaimed lands is carried out after the written notification of completion of the reclamation works to the local self-government bodies.

The following materials are attached to the notice: copies of permits for the work related to the violation of the soil cover, as well as documents certifying the right to use the land and subsoil; copying from the land use plan with the boundaries of the reclaimed plots; land reclamation project with the conclusion of the state environmental review; data of soil, engineering-geological, hydrogeological and other necessary surveys before carrying out works related to the violation of the soil cover, and after the reclamation of disturbed lands; diagram of location of wells and other observation posts of hydrogeological, engineering-geological monitoring; project documentation (working drawings) for reclamation, anti-erosion, hydrotechnical and other objects, timber-reclamation agrotechnical, other measures envisaged by the reclamation project; materials of inspections of performance of reclamation works, carried out by inspection bodies or specialists of design organizations in the procedure of copyright supervision, as well as information on measures taken to eliminate the detected violations; information on removal, storage, use, transfer of the parent layer, confirmed by the relevant documents; reports on the reclamation of disturbed lands in the form No. 2-tp (reclamation) during the period of works related to the violation of the soil cover in the leased area.

When accepting the reclaimed land plots, the working committee checks: compliance of the performed works with the approved reclamation project; quality of planning works; power and uniformity of application of fertile soil layer; the presence and volume of unused fertile soil, as well as the conditions for its preservation; completeness of fulfillment of requirements of ecological, agro-technical, sanitary-hygienic, building and other norms, standards and rules depending on the type of soil cover violation and further targeted use of reclaimed lands; quality of completed reclamation, anti-erosion and other measures; the presence on the reclaimed site of construction and other wastes; availability of monitoring points for reclaimed land. The object is considered to be accepted after the approval by the Chairman of the Standing Commission of the act of acceptance of the delivery of the reclaimed lands.

**Results of the research.** Based on the current legislation of Ukraine that regulates the obligations of the landowner and the land user in relation to create recreational areas to the efficient use of land in accordance with the intended purpose based on the implementation of a set of measures for the protection of land, we have taken an approach to the assessment of man-made objects in Ukraine. This approach consists of nine consecutive steps and provides an opportunity to comprehensively and qualitatively evaluate such objects and determine their performance (cost and effectiveness).



The research made it possible to build an approach to the category 'cost-effectiveness of technogenic waste' as a correlation between the results and the cost of their recovery.

Thus, the process of assessing technogenic and waste objects in Ukraine to transferring reclaimed land to the landowner is extremely complex and time-consuming, both economically and economically. Therefore, in determining the cost-effectiveness of technogenic and waste facilities. The amount of discounted incremental income and reversed losses should be estimated in the long run. Also, with the reclamation of disturbed lands, it becomes possible to create recreational areas that will promote the efficient use of available tourist and recreational resources; will stimulate the development of tourist infrastructure; create favorable conditions to meet the needs of the population in active recreation and health promotion; will provide the local population with jobs in the non-productive sphere.

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