COLLECTIVE MONOGRAPH

EDUCATION AND SCIENCE IN UKRAINE IN CONDITIONS OF WAR AND POST-WAR PERIOD

Compiled by
VIKTOR SHPAK

Chairman of the Editorial Board
STANISLAV TABACHNIKOV

GS Publishing Services
Sherman Oaks
2025

The collective monograph based on the materials of the III International Scientific and Practical Online Conference "Education and science in Ukraine in conditions of war and post-war period" (November 6-7, 2025).

Authors: Bohdan Andrushkiv, Yuliia Chala, Alla Cherep, Oleh Chertkov, Petro Demyanchuk, Valentyna Groza, Eduard Ivashkevych, Ernest Ivashkevych, Uliana Karpiuk, Yevhen Kharchenko, Liudmyla Kovalenko, Nadiia Kovalska, Ihor Kryvoruchko, Serhii Leychenko, Olha Lozova, Serhii Miroshnichenko, Valentyna Moiseienko, Karina Molozhon, Nataliia Mykhalchuk, Larysa Nalyvayko, Denys Navrotsky, Oleksandr Nazarkin, Iryna Nizhenkovska, Andrii Nykula, Ihor Omelchuk, Olena Osukhovska, Svitlana Padun, Ihor Pilkevych, Oleh Podoliak, Serhii Puzik, Dan Rasputnyi, Anastasiia Romanchuk, Serhii Romanov, Svitlana Shevchuk, Maryna Sittsevá, Kostiantyn Stepanchenko, Myroslav Syvyi, Stanislav,Tabachnikov, Tetiana Tovalovych, Lilia Tsyganenko, Olena Velchynska, Petro Zakharchenko, Serhii Zozulia.

Publisher «GS Publishing Services»
15137 Magnolia Blvd, # D,
Sherman Oaks, CA 91403, USA.

ISBN: 979-8-9917519-6-4
DOI: 10.51587/9798-9917-51964-2025-25

Scientific editors-reviewers:
S. Bobrovnyk, Yu. Bondar, A. Cherep, P. Glukhovskiy, P. Hovorov,
Yu. Kuznetsov, V. Lazurenko, V. Moiseienko, L. Omelianchyk, Zh. Virna.

The monograph is recommended for publication by the Academic Council
of the Institute of Adult Education, Presidium of the National Academy
of Sciences of Higher Education of Ukraine.

Education and science in Ukraine in conditions of war and post-war period : collective monograph / Compiled by V. Shpak; Chairman of the Editorial Board S. Tabachnikov. Sherman Oaks, California : GS Publishing Services, 2025. 209 p.

Available at: DOI: 10.51587/9798-9917-51964-2025-25

CONTENT

EARTH SCIENCES

HISTORICAL SCIENCES

LINGUISTICS

MEDICINE

Myroslav SYVYI,
Doctor of Geographical Sciences, Professor,
Volodymyr Hnatiuk Ternopil National Pedagogical University
ORCID ID: 0000-0002-3150-4848

Petro DEMYANCHUK,
Candidate of Geographical Sciences, Associate Professor,
Volodymyr Hnatiuk Ternopil National Pedagogical University
ORCID ID: 0000-0003-4860-7808
Ukraine

PEAT RESOURCES OF KHMELNYTSKYI OBLAST: CURRENT STATUS OF DEVELOPMENT, POSSIBILITIES OF USE

Podillia belongs to the Forest-Steppe Peat-Swamp Region. At the same time, Ternopil and Khmelnytskyi oblast are included in the Podilsky Forest-Steppe District, and Vinnytsia – Right-Bank Forest-Steppe. In general, the Forest-Steppe Region is characterized by significant elevation and fragmentation of the territory, a small amount of precipitation, which does not contribute to widespread waterlogging and peat formation. The corresponding indicators for the Podilsky District are 0,8 and 0,7 %, for the Right-Bank District – 0,5 and 0,3 %. The region is characterized by eutrophic, floodplain, terraced, valley, and old-river swamps associated with river valleys. The type of peat deposits is lowland (lowland). Peats are mainly medium- and high-ash.

There are 372 peat deposits known in Podillia. These are mostly small deposits in terms of reserves and small in terms of area, however, a number of deposits with reserves exceeding a million tons are distinguished. A clear pattern is observed – all deposits are concentrated in the northern and central areas of Ternopil and Khmelnytskyi oblast and exclusively in the northern areas of Vinnytsia; the southern regions, which are characterized by much more intensive fragmentation of the territory, deep cuts of river valleys, are practically devoid of peat deposits.

In Khmelnytskyi oblast, 171 peat deposits have been discovered, with total geological reserves exceeding 75 million tons. The state balance sheet takes into account only 44 deposits, of which 16 are considered reserve with reserves in

categories A+B+C_1 – about 14 million tons. Another 10 deposits are promising for conducting exploration work with approved reserves of 5,2 million tons[1]. All deposits are located in the Shepetivka and Khmelnytskyi districts of the oblast, most often in the valleys of the Zbruch, Southern Bug, Buzhok, Khomora, Ikva, Horyn, Sluch, Riv, Rivets, etc. There are no large and medium-sized deposits in the oblast. The reserves of the largest deposits do not exceed 3,1 million tons (Bezymyanske in the Chornyi Ostriv Territorial Community (TC) – 3,1 million tons, Kutyanka-Viliya in the Berezdiv TC – 4,3 million tons (872 thousand tons of which are within Khmelnytskyi oblast, the rest are in Rivne), Vovchok I-II in the Derazhnya TC – 1,8 million tons, Ploskivske in the Hvardiiske TC – 1,3 million tons, Vovkivske in the Teofipol TC – 1,0 million tons, Rudavske in the Letychiv TC – 1,0 million tons, Antoninske in the TC of the same name – 1,1 million tons, etc.).

It is worth noting that according to the accepted classification of peat deposits, small deposits are considered to be deposits with an area of up to 100 hectares and with reserves of up to 10 million tons, medium deposits are considered to be 100–1000 hectares and, accordingly, 10–100 million tons, etc.

Some of the deposits in the oblast are drained (7 deposits) and ash-covered (9 deposits), as well as small-bedded (3), with reserves not exceeding 0,6 million tons (Mukhovetske, Luh and Maly Chernyatyn). The largest number of peat deposits is known in Khmelnytskyi district (30): Volochysk TC (3), Krasyliv (3), Chornyi Ostriv (3), Letychiv, Rozsosha, Teofipol TC (2 deposits each), etc. (Fig. 1). In Shepetivka district, 17 peat deposits have been explored: in Berezdiv TC – 3, Bilogirka TC – 4, etc. By the total size of explored reserves (categories A+B+C_1+C_2), Chornyi Ostriv (4,0 million tons), Derazhnia (2,8 million tons), Bilohiria (2.4 million tons), Berezdiv (1,7 million tons) and some other communities stand out. In other TCs, explored peat reserves range from 0,053 to 1.3 million tons, i. e. they are very insignificant. Many communities are characterized by significant indicators of saturation with peat reserves territories of the districts – in Berezdiv, Bilogiria, Yampil, Gvardiiske, Chornyi Ostriv, Derazhnya, Antoniny TC they range from 3 to 14 thousand t/km^2 (Fig. 1), in other communities they do not exceed 2 thousand t/km^2. In the southern communities of the oblast (Kamianets-Podilskyi district) there are no peat deposits with explored reserves.

1 Стан мінерально-сировинної бази (Хмельницька область). К.: Геоінформ України, 2022. 33 с.

Source: Author's research

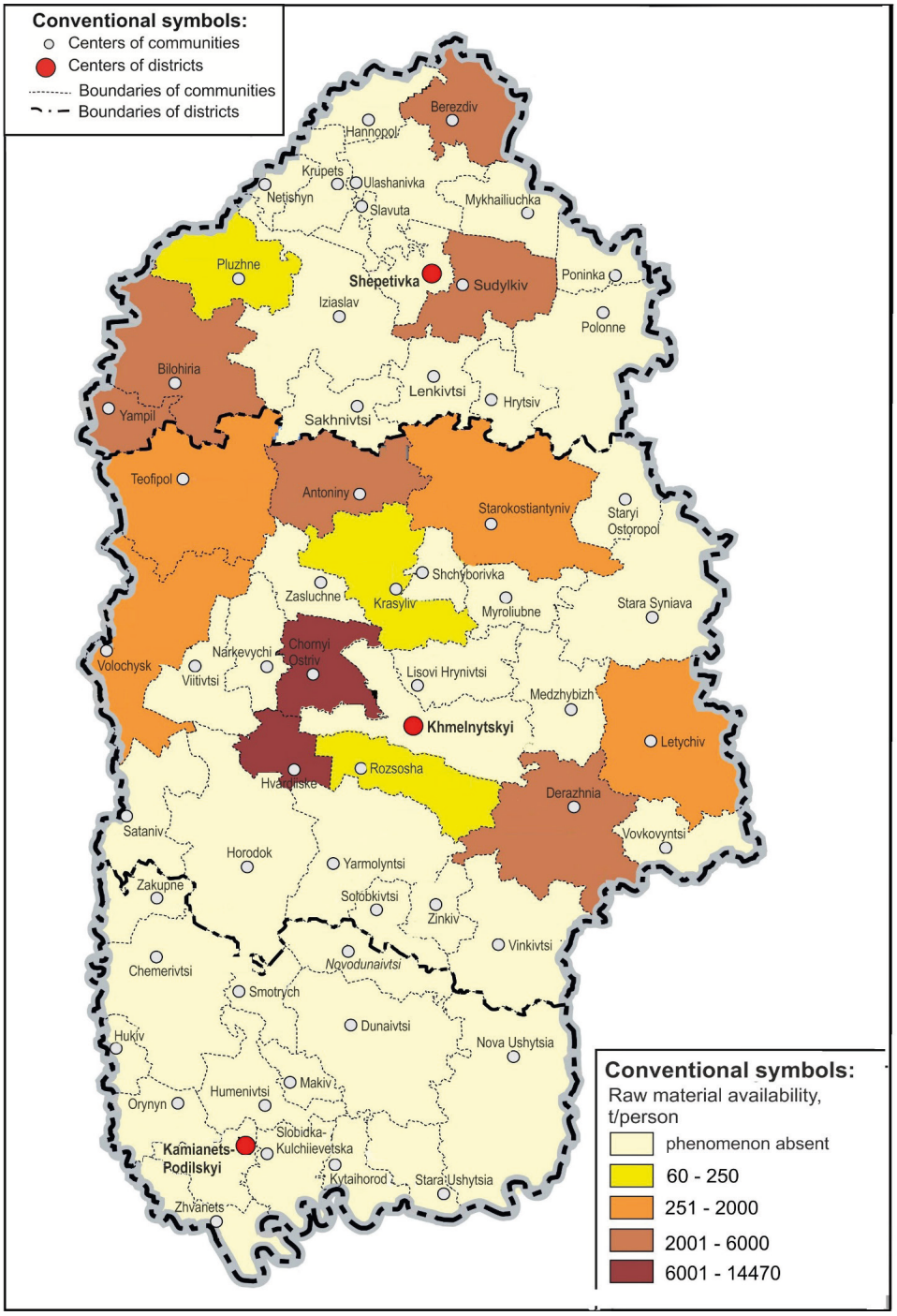

Figure 1. Location of peat deposits by territorial communities of Khmelnytskyi oblast

A similar picture is observed when considering the supply of raw materials in the administrative units of the oblast – in most of them this indicator is 10–100 tons / person, on average in the oblast – about 16 tons / person (Fig. 2).

As for the structure of explored reserves, it is worth noting that in certain territories (Krasyliv, Rozsosha, Solobkivtsi) they are assessed only by category C_2, that is, we should talk about a low degree of exploration of peat deposits in the oblast [2].

Peat in Podillia is used mainly for agricultural needs, to a lesser extent as a low-calorie fuel. The needs for this raw material are far from being fully satisfied, in addition, the issue of its rational use requires separate consideration, which, in our opinion, is currently particularly acute, so let's dwell on the problem in more detail.

The value of peat is generally determined by the presence of organic matter in it, so low-ash peats are considered the most valuable, which is generally not typical for lowland swamps developed in Podillia. Exceptions include carbonate and phosphate peats. The first of these is the so-called meadow lime, an excellent material for liming acidic soils. Phosphate peats or peat vivianites are formed during the circulation of phosphorus-enriched groundwater in peatlands. Such phenomena, in our opinion, may occur in some areas of the Khmelnytskyi oblast: in the Bilohiria TC, where promising areas of granular phosphorites have been discovered, the Letychiv TC, where an apatite-bearing area is known, possibly in the Khmelnytskyi, Derazhnya TCs and others. Phosphate peats can also be used as ameliorants. Peat vivianites, when applied to the soil in a double, and sometimes equal, dose relative to superphosphate, are not inferior to the latter in effectiveness.

In general, there are relevant State Standards for all types of peat raw materials, which regulate the requirements for raw materials for a specific purpose.

A significant part of peat is used as fuel in the form of peat briquettes. In small deposits, it is advisable to use lump peat, which provides significant savings in raw materials – 2,5 tons of lump peat are consumed for the production of 1 ton of conventional fuel, and 3,5 tons for the production of peat briquettes. Briquetting of peat and peat cover with fine aggregate coal is also used, which reduces production waste and improves the state of the environment.

2 Сивий М., Гавришок Б., Дем'янчук П. Мінерально-сировинний потенціал Хмельниччини: сучасний стан використання, перспективи: монографія. Тернопіль: ТНПУ ім. В. Гнатюка, 2023. 332 с.

Source: Author's research

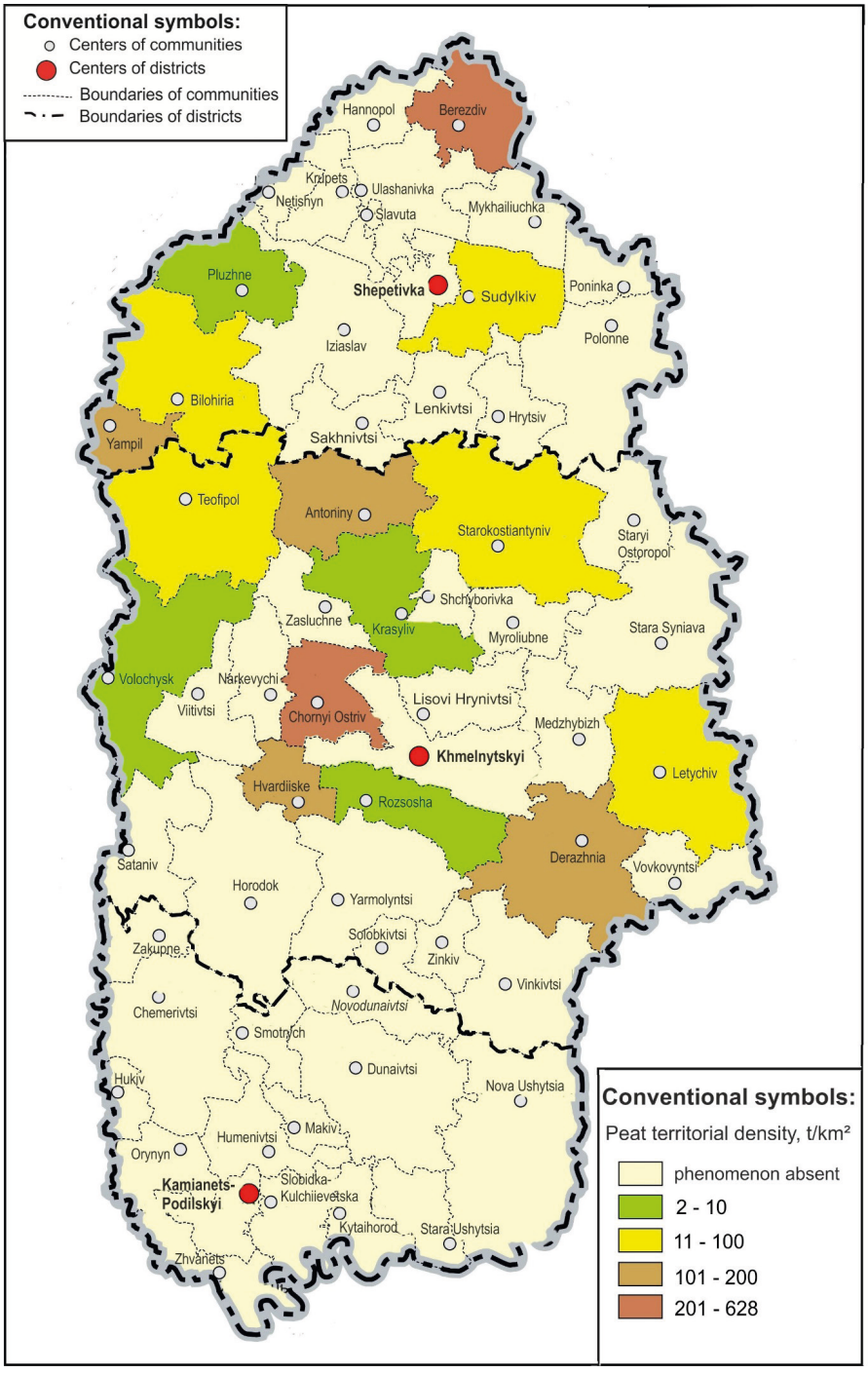

Figure 2. Peat reserves of territorial communities of Khmelnytskyi oblast

The introduction of peat into the soil as a fertilizer gives an increase in yield only at very high doses (200 t/ha and more), so it is advisable to use it mainly in the form of composts with manure, slurry, bird droppings. To improve the quality of peat as a fertilizer, it can be treated with ammonia water or anhydrous ammonia. When such peat is introduced in the same rates as nitrogen from mineral fertilizers with balanced phosphorus-potassium fertilization, increased yields of cereals and potatoes are obtained.

In general, peat compost with manure is obtained by first using peat as bedding in cowsheds, piggeries, and poultry farms. Air-dried (30–35 % moisture content) sphagnum peat litter absorbs 10–12 kg of liquid per 1 kg (three times more than straw), absorbs harmful gaseous products (ammonia, hydrogen sulfide), has antiseptic properties – prevents the development of pathogenic microbes and the decomposition of manure. The use of peat litter (instead of straw or sawdust) increases livestock productivity – milk yields increase by 7–15 %, and livestock weight gain by 10–18 %. The used litter is applied to the soil at a rate of 40-50 t/ha for potatoes, vegetables and fodder roots, 20–25 t/ha for grain crops. On average, each ton of such fertilizer increases the yield of potatoes, grains or vegetables by 1 centner. Various types of peat are suitable for compost, including lowland peat with a moisture content of up to 60 %, a degree of decomposition of at least 20 %, and an ash content of up to 25 %.

Peat is also used for the production of so-called complex granular organo-mineral fertilizers, which contain up to 30 % peat and a full range of mineral fertilizers. In this case, the addition of peat reduces the hygroscopicity of mineral fertilizers, increases their resistance to weathering and leaching. Such fertilizers can be stored in bulk for a long time, provided they are isolated from the soil and moisture. They reduce the acidity of soils, improve their agrochemical properties. Upper sphagnum peats are widely used as greenhouse soil or the main component for the production of artificial soils in greenhouse farming. For these needs, various peat-based products have been developed: peat nutrient briquettes, substrate peat blocks, peat hollow pots and peat nutrient substrate for filling them.

Another promising area of peat use in agriculture is the production of humic physiologically active substances from it – bioregulators of plant growth and adaptogens. Pre-sowing treatment of seeds with sodium humate obtained

from peat increases its yield, improves the quality of grown products, stimulates plant growth, etc.[3].

The Institute of Microbiology and Virology of the National Academy of Sciences of Ukraine recently developed a new complex preparation – biopeat fertilizer. It was created on the basis of highly effective strains of nitrogen fixers and phosphorobacteria. Peat from the Chernihiv and Cherkasy deposits was used as a carrier or filler for bacterial cultures. The number of microorganisms in it at a temperature of 25 ˚C remains quite high even 4 months after application. Microvegetation experiments have shown that the addition of BTC to the soil accelerates the emergence of seedlings of cucumbers, tomatoes and cabbage, the plants themselves become stronger, and their weight indicators increase. Expert examination of the preparation in state farms of Kyiv oblast also proved the feasibility of using the new fertilizer in floriculture. Currently, industrial production of experimental batches of biopeat fertilizer has been carried out[4].

Peats are also used in the production of so-called peat-based feed, when poorly decomposed peat with a moisture content of 45-60 % is mixed with post-alcohol peat in a ratio of 1 : 10. The use of this mixture allows animals to be fattened while completely eliminating roughage and concentrates from the diet. In addition, peat molasses (a solution of hydrolyzed sugar), sugary peat, feed protein and other products obtained from peat are used in agriculture.

It should be noted that the development of small (up to 100 hectares) peat deposits for agricultural needs is profitable only under favorable transport and economic conditions. Currently, as a rule, the costs of delivering peat to agricultural consumers are 3-4 times higher than the costs of its extraction. Therefore, small peat deposits that are not promising for commercial development can be utilized in agriculture through land reclamation. For this purpose, potash fertilizers are applied to drained peatlands, converting them into highly productive agricultural lands that possess huge nitrogen reserves and retain fertility for a long time.

Peats are a valuable raw material for obtaining peat wax, which is used in mechanical engineering, household chemicals, in the manufacture of technical paper, anti-adhesive lubricants, polyurethane foam products, some cosmetic and medical preparations, etc.

3 Гнєушев В. О. Торфові ресурси України і шляхи їх раціонального використання // *Альтернативні та відновлювані джерела енергії*. Рівне, 2002. *С. 22–27.*

4 Новинка – біоторф'яне добриво // *Вісник НАН України*. 2000. № 5. С. 53.

In world medicine, the use of peats as therapeutic muds is known. The raw material for the medical preparation torfot (for the treatment of eye diseases) is certain types of decomposed (20 %) lowland peat, rich in nitrogenous substances.

After the separation of waxy-resinous substances from peats, the raw material is used for the manufacture of activated carbon or natural dyes.

There is also a known method of producing a substitute for expanded clay based on peat, when finely ground ordinary clay is added to peat. The substitute is called vaculite, reinforced concrete products based on it are very light, their use is economically profitable. The material obtained on the basis of vaculite and plastics is extremely strong and moisture-proof, and is used in the construction of dams, weirs and other hydraulic structures[5].

Peat hydrolysis products – phenolic resins and cements are part of the so-called syntactics, a variety of which – peat plastic – are used in the construction of highways, well protect the road surface from destruction, prevent soil freezing, etc.

The listed areas and directions of peat application in industry and agriculture indicate the huge potential for the use of this extremely valuable natural product.

The presence of a significant number of small peat deposits in the oblast, the specifics of its use in everyday life and agriculture have led to a certain degree of decentralization of peat mining, the exploitation of often underexplored peatlands with unaccounted reserves by small local organizations at a very low technical level, without carrying out special preparatory and then reclamation works, without taking into account the complex nature of the raw material when choosing rational directions for its use. As a result, many deposits after partial temporary development become unsuitable for further exploitation, abandoned quarries become swampy, and their reclamation requires significant costs[6]. Therefore, the problem of rational resource use is particularly relevant for the peat mining industry. It can be solved on the basis of improving territorial organization, in particular by creating links that would ensure centralized peat extraction in several small deposits, subsequent reclamation of land resources, and the creation of agricultural lands on the site of former peat extraction.

5 Сивий М. Я. Торфовий фонд Поділля: сучасний стан освоєння та раціональне використання // *Регіональне географічне краєзнавство: теорія і практика*: матер. II Всеукр. наук. семінару. Тернопіль, 2002. С. 95–103.

6 Там само.

The peculiarities of the structure of peatlands also dictate the need to carry out a complex of reclamation works during their development, the principle direction of which should be to ensure the comprehensive long-term use of land and fuel and energy resources. Therefore, often in preparation for the development of large peat deposits, in parallel with the creation of a network of drainage structures (drainage channels), facilities are also built that will provide the necessary moistening of drained lands after the completion of mining operations (reservoirs, technical monitoring stations for the condition of drainage systems, etc.)[7].

7 Жуков С. О. Ресурсні аспекти будівництва підприємств торфової промисловості // *Вісник Національного університету водного господарства та природокористування*: зб. наук. праць. Рівне, 2007. Вип. 32. С. 153–158.