Economic Appraisal of Land Resources at Electrochemical Purification of Oil-Contaminated Soils

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Abstract. The work highlights the effects of environmental pollution. The methods of economic appraisal of natural resources include the market, rental, cost-based methods, approach on the basis of the alternative cost and on the basis of the general economic value. It is proposed to apply the cost concept to assess the value of land contaminated by oil and oil products. To assess the economic damage caused to land resources, the authors recommend using the alternative cost approach. Based on the estimated (possible) damage to agriculture and using the results of experimental data of electrochemical purification of oil-contaminated lands, the authors estimated the one-time costs and compared them with the results of calculations of the economic damage caused to land resources.

1. Introduction
Socio-economic development of various socio-political systems, as a rule, is associated with their economic growth. However, in addition to the positive aspects (increase in gross domestic product per capita) there are also negative phenomena, for example, aggravation of the ecological situation. The main features that characterize the current unfavorable environmental situation are the following:
- accumulation of industrial, agricultural, household waste in quantities that violate natural, including biological processes;
- pollution by industrial and household waste water systems;
- pollution of the atmosphere by products of combustion of fuel;
- the use of materials and products containing harmful and toxic substances that adversely affect the geochemical and biological conditions of life;
- environmental pollution by various types of noise, vibrations, radiation;
- development of mineral deposits without timely land restoration that leads to destruction of soils, landscapes and to the subsidence of the land surface;
- violation of forests at low rates of their recovery;
- reduction of arable and agricultural land leading to the development of erosion processes;
- extermination of certain types of wildlife to meet the needs of raw materials or food;
- negative social behavior of people caused by economic factors and leading to the degradation of individual or to violations in the sociogenetic code.

One of the ways to solve the problems outlined above is the development of environmental protection measures that allow recycling production wastes. The paper considers the results of
research on the electrochemical purification of oil-contaminated soils in the context of methodological foundations of the economic appraisal of land resources.

2. Relevance
Among the available methods and approaches to determine the economic appraisal of natural resources, in particular, land resources there are the market, rental, cost-based methods, approach on the basis of the alternative cost and on the basis of the general economic value.

Market-value appraisal of natural resources is based on the determination of prices for natural resources under the influence of supply and demand for them. However, in this case, the degradation of the environment and the depletion of natural resources are not taken into account which as a result yields lowered incentives for the efficient use of natural resources and environmental protection. Thus, the traditional market allows more or less satisfactorily appraisal of only one function of the environment - the provision of natural resources; the other two functions - assimilation of waste and pollution as well as providing people with natural services (recreation, aesthetic pleasure) are not adequately reflected in the market system.

At the basis of the use of rent assessment of natural resources, the following is assumed: a better-quality resource (more fertile land, high-quality oil, rock with high ore content) allows obtaining (other things being equal: staff qualifications, equipment and technology) much better economic results compared to poorer natural resources. The difference in the results obtained at different quality of natural resources and their different location is the basis of differential rent and determines its value.

The cost method of natural resources is based on taking into account the cost rate for the preparation and use of natural resources. This approach is widely used to estimate the cost of recreating natural resources when it is lost or degraded. In this case, it calculated all expenses required for replacing a consumed or damaged resource with an identical one at a given or alternative location. For example, if the fertile soil layer is removed (or destroyed) as a result of mining, then the cost of restoring the fertility of the site (recultivation) or increasing the fertility of another site to compensate for the loss of the first site will be used as an economic appraisal of the degraded soil.

Despite the relative simplicity and the possibility of wide use, the cost approach contains an essential contradiction. The better the quality of natural resource, the less appraisal it will receive (in accordance with the cost concept), because the higher the quality of the resource, the easier it will be to exploit (and the lower the costs are needed for it); consequently, its economic appraisal is lower. This contradiction significantly limits the application of the cost approach to the economic assessment of natural resources.

The following method of economic assessment of natural resources is the concept of alternative cost (improved benefit). Alternative cost allows you to evaluate a natural object or resource that has a low market price through lost income and benefits that could be obtained by using this object or resource for other purposes. For example, the alternative cost of protected natural areas is as follows. Firstly, the loss of profits that society loses due to the conservation of the areas (shortfall in production from protected animals, plants, and wood). Secondly, missed benefits from alternative use (development of agriculture or forestry). As a rule, this approach is used in practice to measure the "cost of conservation", i.e., how large the losses would be from non-conservation of a natural object as a result of its economic exploitation.

The latter approach to the economic assessment of natural resources is based on the concept of total economic value (cost) which is an integrated approach to the assessment of nature, taking into account not only direct resource functions but also natural services. The total economic value is the sum of the following indicators: the cost of use and the cost of non-use.

The results of the economic assessment of natural resources are used in the construction of the scale of payments for their use as well as in determining the economic damage from environmental pollution. The possibility of improving the environmental situation in conjunction with positive economic results will increase the investment attractiveness of the region.
3. Research objective
An industrial activity of enterprises of oil production, refining and petrochemistry causes land pollution with oil and oil products. Various methods of oil-contaminated land reclamation are known and applied [3].

The branch of Federal State Budget Institution of Higher Education in Ufa State Petroleum Technical University in Sterlitamak carries out research on the electrochemical purification of oil-contaminated lands [2].

Based on the analysis of the known areas of assessment of economic damage from land pollution [1], the paper proposes the most appropriate method for calculating it.

The paper discusses the use of one of the methodological approaches to the assessment of land resources and the economic damage caused to them. Calculation data of economic damage from the pollution of land resources are compared with the one-time cost of electrochemical method of purification of oil-contaminated soil.

4. Theoretical part
We believe that the cost concept is suitable for estimating the value of land plots contaminated with oil sludge. In assessing the one-time cost of the electrochemical method of cleaning oil-polluted lands, the costs of manufacturing and mounting the installation for electrical processing of contaminated soil, removing oil products from deep soil layers and subsequent phytoremediation (sowing plants degrading oil products) [3] were taken into account.

The assessment of the economic damage caused to land resources is best carried out on the basis of alternative cost. This approach is well developed in determining damage to the environment based on local damage. One of the elements of integrated economic damage is damage to agriculture. When calculating it, the following elements are taken into account: damage from the withdrawal of land from agricultural use, damage from shortage of crop products, damage from shortage of animal production.

5. Practical relevance of the research
Using the results of experimental data on the electrochemical purification of oil-contaminated land resources [3] we obtained the following results.

When cleaning the land area of 400 m2, one-time costs amount to 158,5 thousand rubles (according to the method of electrochemical purification of oil-contaminated soil). Considering an alternative method (installation for microbiological cleaning of soils contaminated with heavy metals and petroleum products), one-time costs will be equal to 180,5 thousand rubles.

Using the data on the work of agricultural enterprises on average in the Russian Federation [7] for 2017 we obtained the following results in terms of amount of averted damage to agriculture: damage from the withdrawal of land from agricultural use (400 m2) - 1,313 million rubles; damage from shortage of crop production (calculated on rye) - 1,868 million rubles; damage from the shortage of livestock products (calculated on the number of livestock and poultry) - 0,541 million rubles.

6. Summary
Thus, using solely static methods for estimating costs and economic damage to land resources we found that the electrochemical method of purification of oil-contaminated lands that we propose is lower in cost than the closest alternative method of land restoration by 12%. Comparing this with the results of damage to agriculture as a result of contamination of land with oil products, we obtained the following data. The one-time cost of electrochemical purification of oil-contaminated land is 88% less than the cost of damage caused by the withdrawal of land from agricultural use; 92% less than the cost of damage from shortage of crop products; 71% less than the cost of damage from shortage of livestock products.

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