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Prospects and Problems of Implementation of Recreation Works in Degradated Areas

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Abstract

This article is devoted to work aimed at normalizing the condition of degraded soils in open-pit mines as a result of anthropogenic influences through phytomass. By creating a biological cover from plants, it has been achieved to improve the composition of the soil. Plants such as *Datura starmonium*, *Portuluca oleracea*, *Caspella bursa-pastoris*, *Chenopodium vulvaria*, *Chenopodium album*, *Plantago lanceolata*, *Vaccaria hispanica*, *Vicia angustifolia* were used for the research. The effect of micronutrients on plants was studied.

Keywords

Flora, Introducer, Phytomass, Degradation, Technical Recultivation, Biological Recultivation, Microelement

1. Introduction

Nowadays, as a result of the activities of industrial enterprises, the extraction and use of minerals and other anthropogenic factors, chemical pollution of the soil cover, changes in soil properties and productivity are observed all over the world. Various types of soil pollution lead to soil degradation, a decrease in the quality and quantity of productivity, as well as the formation of other problems related to the ecosystem [1] [2].

Land recultivation (latin prefix meaning re-return, restoration; cultivated-restoration of land that has become unusable due to extraction of minerals, construction of water facilities, construction of cities and other reasons, environment a set of activities aimed at improving environmental, ecological conditions [3] [4] [5]. The main task of land recultivation is to restore the disturbed fertile

layer of the soil and create conditions that ensure the effective management of agriculture or forestry [6] [7].

In the Republic of Uzbekistan, including in the area of irrigated agriculture, the following types of unusable land are considered to be in need of land reclamation: land where materials for construction (sand, gravel, stone, etc.) have been mined; exploration and inspection of gas and oil products and lands allocated for their use; lands whose fertile layer has been damaged due to the formation of depressions, humps or depressions that are excessively busy due to irrigation, draining, construction and repair of road networks; the part of the land allocated for temporary use during the construction of various construction structures and buildings, etc. [8].

Land reclamation is carried out using two-stage measures: technical and biological. First of all, preparatory works such as identification of unusable land, study, drawing up a future use plan and development of project-estimate documents are carried out. The technical stage of land reclamation is the preparation of the land for the purposeful use of the national economy, and the biological stage involves the restoration of the landscape and soil, making it suitable for agriculture or forestry [9].

In the territory of the Republic of Uzbekistan, there are 200,000 hectares of unusable land, of which 65,000 hectares correspond to areas with well-developed agricultural sectors. They were mainly caused by irrigation, drainage and construction of road network. As a result of their return to the agricultural cycle, it is possible to grow an additional 300 - 400 thousand tons of cotton and many vegetables, fruits, and fodder necessary for livestock every year [10] [11].

As a result of anthropogenic activities of mankind, hundreds of hectares of fertile land with fields, forests and other useful land are in danger of being completely destroyed. Natural landscapes are dying after large-scale man-made influence. In order to bring them back to life, it is necessary to carry out complex reclamation work on the restoration of degraded soils [12].

2. Research Object and Used Methods

As a research object, degraded areas in the area of "Marjonbulak gold beneficiation factory belonging to the Southern Mining Department" located in the Marjonbulak village, Gallaorol district, Jizzakh region, were selected (**Figure 1**).

For planting in the designated area, the common plants in the Marjonbulak mine area include *Solanaceae* family, *Datura starmonium* belonging to the *Datura* family, *Portulacaceae* family, *Portuluca oleracea* belonging to the *Portuluca* family, *Brassicaceae* family, *Caspella bursa-pastoris* belonging to the *Caspella* family, *Amaranthaceae* family, *Chenopodium vulvaria* belonging to the *Chenopodium* family and *Chenopodium* album, *Plantagianaceae* family, *Plantago lanceolata* belonging to *Plantago* family, *Caryophyllaceae* family, *Vaccaria hispanica* belonging to *Vaccaria* family, *Fabaceae* family, *Vicia angustifolia* belonging to *Vicia* family were selected [13] [14].

Figure 1. Experimental site on the territory of the Marjonbulak gold enrichment plant.

Comparative, chemical-analytical methods were used in the research work. Field-soil studies were carried out based on the methods of "Legal aspects of soil conservation and land cadaster works" [15].

Sowing and measuring the seeds of the selected plants were carried out according to "Методы фенологических наблюдений при ботанических исследований" by G. E. Shuls [15] and "Research works on the science of plant introduction" recommended by I.V. Belolipov, B.Y. Tokhtayev, H.K. Karshibaev, methodical instructions for transfer [16] were used. The obtained data were calculated on the basis of mathematical and statistical analysis.

3. The Obtained Results and Their Analysis

Cleaning and rehabilitation of soil contaminated with waste can be divided into the following stages:

1) Preparatory stage: study of the contaminated area, preparation of the field for conducting experiments, cleaning of the surface layers of the soil from large wastes;

2) Technical recultivation: removal of heavily polluted soil layer, mixing it with clean soil, carrying out chemical reclamation measures;

3) Biological recultivation: cleaning and restoring fertility by planting the seeds of selected plants in the prepared area (phytomelioration) [17].

Recultivation works were carried out in 2014-2022. For this, soil samples were taken from the soils of the hills filled with waste for chemical laboratory analysis (**Figure 2**).

For sampling, pits were dug at 40 cm intervals from every 100 meters of the sites, and samples were taken at 0 - 10 cm, 10 - 20 cm, and 20 - 30 cm and 30 - 40 cm was done.

Determination of the elemental composition of the obtained samples was checked by the ICP-OES (Inductive Plasma Optical Emission Spectrometer) instrument at the "Experimental Biology Laboratory" of Gulistan State University.

This tool provides a quantitative analysis of more than 20 elements in the soil (Table 1). A similar experiment was conducted to determine the heavy metals in plants (Table 3).

Figure 2. Soil sampling process.

Table 1. Elemental composition of soil that has become waste as a result of anthropogenic influence.

№	Soil sample	Mn 257.610 (mg/L)	Cr 267.716 (mg/L)	As 193.696 (mg/L)	Mg 280.271 (mg/L)	Ca 315.887 (mg/L)	Al 396.15 (mg/L)	K 766.49 (mg/L)	Se 196.02 (mg/L)	Ni 231.60 (mg/L)	Zn 206.200 (mg/L)
1	Example 1	6.404	0.002	0.605	23.781	10.002	0.998	0.001	−0.017	0.216	2.416
2	Example 2	0.012	0.001	0.327	0.619	11.503	0.975	0.337	−0.004	−0.004	0.026
№	Soil sample	Fe 238.20 (mg/L)	Cu 327.39 (mg/L)	Mg 253.652 (mg/L)	V 292.46(mg/L)	Se 189.927 (mg/L)	Ag 328.06 (mg/L)	Pb 220.353 (mg/L)	Na 589.592 (mg/L)	Cd 226.502 (mg/L)	Sb 206.830 (mg/L)
1	Example 1	0.338	0.146	−0.027	−9.271E−	−4.957E−	0.015	−0.104	0.166	0.004	−0.011
2	Example 2	0.633	0.011	0.002	0.086	−0.001	0.815	−0.001	2.261	−3.268E−	−0.006

Table 2. Elemental composition of planted plants.

№	Plant sample	Mn 257.610 (mg/L)	Cr 267.716 (mg/L)	As 193.696 (mg/L)	Al 396.15 (mg/L)	K 766.49 (mg/L)	Se 196.02 (mg/L)	Zn 206.200 (mg/L)	Fe 238.20 (mg/L)
1	Example 1	0.005	0.001	0.422	1.119	−0.036	0.013	0.008	0.204
2	Example 2	3.471	0.004	−0.154	12.959	−0.058	0.025	0.985	0.230
№	Plant sample	Cu 327.39 (mg/L)	Hg 253.652 (mg/L)	V 292.46 (mg/L)	Sn 189.927 (mg/L)	Ag 328.06 (mg/L)	Pb 220.353 (mg/L)	Na 589.592 (mg/L)	Sb 206.830 (mg/L)
1	Example 1	0.003	0.001	0.005	−1.586E−4	0.010	−1.818E−4	0.895	0.017
2	Example 2	0.748	−0.017	4.277E−4	0.002	0.011	0.004	0.205	0.012

Table 3. Effect of trace elements on *Althaea officinalis* plant.

Name plant	02.04.2019	14.04.2019					21.04.2019			28.04.2019			05.05.2019		
	Planting day		Control		$((NH_4)_6Mo_7O_{24})$	$MgCl_4$	Control	$((NH_4)_6Mo_7O_{24})$	$MgCl_4$	Control	$((NH_4)_6Mo_7O_{24})$	$MgCl_4$	Control	$((NH_4)_6Mo_7O_{24})$	$MgCl_4$
A. officinalis	50	50	50	24	12	13	24	15	19	25	18	15	27	18	12

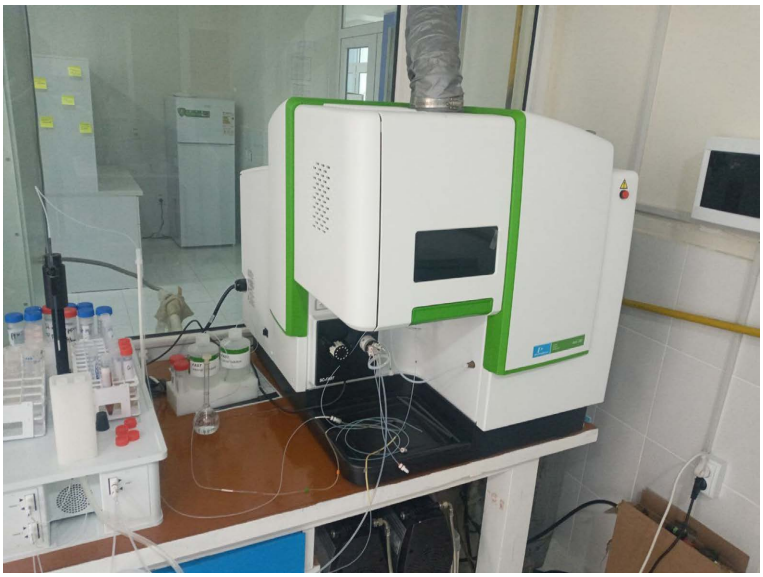

Figure 3. ICP-OES laboratory instrument. (ICP-OES is an optical emission spectrometer based on inductive plasma. The device for high-precision (0.001 mg/l) measurement of elements from solutions in argon flow.)

During the field experiments, the seeds of *Datura starmonium, Portuluca oleracea, Caspella bursa-pastoris, Chenopodium vulvaria, Chenopodium album, Plantago lanceolata, Taeniatherum crinitum, Vaccaria hispanica, Vicia angustifolia* were collected and separated from them into 100 seeds. received. A place was set aside for planting seeds on one of the hills filled with waste around the Marjonbulak mine (**Figure 3**). The area was clearly marked and the soil was loosened for planting the seeds. Soil samples with 5 different conditions were prepared for seeds. For this, natural soil was mixed with degraded soil in different percentages and 100 seeds were planted.

Datura stramonium L. is an annual weed belonging to the *Solanaceae* family. The stem is spreading and grows with upright branches; 1.2 m tall. The leaf is ovate, banded, pointed at the tip. The flowers are white, one in each leaf axil. The fruit is a green, four-celled ovoid capsule covered with thorns: up to 4.5 cm long, it produces about 500 kidney-shaped, black seeds. It blooms and fruits from May to June. It grows from the seed. The leaves, stems, and roots contain toxic

Table 4. Germination indicators of planted plants.

T/r	Familia	Genus	Spesies	Control %	100%	75/25%	50/50%	25/75%
1	*Solanaceae*	*Datura*	*Datura starmonium*	20	45	32	30	22
2	*Portulacaceae*	*Portuluca*	*Portuluca oleracea*	15	37	30	25	17
3	*Brassicaceae*	*Caspella*	*Caspella bursa-pastoris*	27	53	45	40	34
4	*Amaranthaceae*	*Chenopodium*	*Chenopodium vulvaria*	10	45	27	17	12
5	*Amaranthaceae*	*Chenopodium*	*Chenopodium album*	15	36	32	28	25
6	*Plantagianaceae*	*Plantago*	*Plantago lanceolata*	16	17	16	18	15
7	*Caryophyllaceae*	*Vaccaria*	*Vaccaria hispanica*	24	32	11	21	14
8	*Fabaceae*	*Vicia*	*Vicia angustifolia*	13	35	27	21	16

alkaloids such as hyoscyamine, scopolamine, and atropine. Medicines used in the treatment of rheumatism and neuralgia are prepared from the leaves. Control measures: Fields are sown by hand. All parts of the plant contain alkaloids [1].

Portulaca oleracea L. is an annual weed belonging to *Portulaca* family. The stem is straight, lying, sometimes upright. The leaves are small, fleshy, cylindrical, forming a ball. The flowers are yellow, simple or double petals. It blooms and bears fruit from May to November. One bush gives 50 - 75 thousand seeds. In Central Asia, it is widespread in irrigated farming zones. It grows abundantly in fields rich in humus when soil fertility is high. One bush of oleander produces up to 10,000 seeds.

Capsella bursa-pastoris (L.) Medic. is an annual weed belonging to cabbage family. 6 types are known. There is 1 species in Uzbekistan - *C. bursa-pastoris.* Hairy, sometimes glabrous stem, simple or branched, 10 - 50 cm tall. The leaves on the stem are crowded, simple, mostly feathery. The flowers are small, collected in sparse spikes. The crown is white. The fruit is an inverted heart-shaped triangular or pod. One plant produces up to 70,000 viable seeds. The plant begins flowering in early spring and continues to develop until late autumn. Grass forms a ball on the surface of the ground. The common gorse overwinters under the snow and resumes development in early spring. It is spread everywhere. It grows as a weed in many fields. It also grows on roadsides and ditches [18].

Chenopodium is a group of annual herbs belonging to the family of *Chenopodium.* In temperate climate zones, the city's *Ch. vulvaria, Ch. foliosum, (Ch. rubrum, Ch. album, Ch. murale* and other types are distributed. The height is 10 - 100 cm, the leaves are banded, triangular or ovate, covered with dust. The flowers are collected in a tufted inflorescence. It blooms and seeds in May-September. It grows from the seed. In Uzbekistan, salt marshes are found as a spring weed in almost all fields [19].

Plantago major L. is a group of 1 - 2 and perennial herbs belonging to the family of pantago. 260 species are known. There are 6 species in Uzbekistan. 4 types are used as medicinal plants. The leaves are arranged in a ball at the root

neck, banded, broadly ovate or broadly elliptic, rascally and strap-like. The flowers form a simple spike at the end of the stems and branches. The fruit is two- or many-seeded. The leaves and seeds contain vitamins C and K, carotene, mucilaginous and other substances. Tincture prepared from the leaves is used in the treatment of gastrointestinal diseases and wounds, and the mucilaginous solution of the seeds is used as a weak suppository [20] [21].

Vaccaria hispanica (Mill). is an annual weed of the carnation family. The stem is bare, grows upright, the upper part is branched, 30 - 100 cm tall. The leaves are opposite, ovate-rascally without bands. The flowers are collected in a pink or light-red shield-shaped inflorescence. The fruit is a spherical capsule with many seeds. It blooms and bears fruit from May to August. It grows from the seed. One bush contains 400 - 500 seeds. The seed turns blue at 5˚ - 10˚. The seeds contain poisonous saponin. It is not given to thousands of animals, widespread in Central Asia. Contaminates irrigated and dryland cereal crops, as well as millet and flax fields [1].

Vicia angustifolia L. is an annual herb. Height 15 - 65 cm. Flowers are located in the axils of 1 - 2 leaves. Pod 4 - 5 cm. It blooms and seeds in April-August. It grows as a weed in fields [22].

The genus *Vicia.* Representatives of this genus are perennial or annual herbs. Their stems are thin and delicate. They cling to other plants with the tips of their leaves and grow upright. This genus includes 150 species. They are distributed in the middle zone of the northern hemisphere and in North America. In the flora of the former union, there are 84 species of gorse, 16 species in the flora of Uzbekistan. They grow in different natural conditions [23].

Althaea officinalis plant was selected in order to determine the effect of micronutrients on plants. First, to determine the seed germination of the plant, 150 unripe seeds of *A. officinalis* were counted and divided into 50.50 of the isolated seeds were taken as a control and were not exposed to any substance, 50 were exposed to a 0.05% solution of Ammonium molybdate ($(NH_4)_6Mo_7O_{24}$) and the remaining 50 were exposed to Magnesium (IV) 0.05% solution of chloride ($MgCl_4$) was exposed. It was planted in the area designated for the experiment on 02.04.2019 and seed germination was calculated every 10 days (**Table 3**).

When *A. officinalis* was exposed to microelements, it gave the best results compared to other plants. This plant germinated very quickly after planting, that is, it germinated on 14.04.2019. The percentage of germinated seeds is 38%. 54% in the seeds planted for control. 36% of seeds germinated in a 0.05% solution of ammonium molybdate ($(NH_4)_6Mo_7O_{24}$). In the 0.05% solution of magnesium (IV) chloride ($MgCl_4$) it gave a good result with 24%.

Althaea officinalis L.-Medicinal marigold belongs to the *Althaea* L. family, *Malvaceae* family. It grows in orchards, gardens, swamps and meadows. The life form is a perennial herb. The arrow has a root system. The height of the stem reaches 70 - 150 cm. The cross-section of the stem is oval-circular, green in color, the branches are branched monopodially. The stem grows upright [24].

The leaves are simple, long-lobed, ovate, triangular, sometimes with 3 - 5 lobes. Both the stem and the leaves are covered with soft hairs [25].

The flower is located singly in the leaf axil, the flower is white or pink, 5 - 9 cm in diameter. The calyx is located in 2 rings. In the 1st ring, 3 sepals are joined, and in the next ring, 5 sepals are joined, corolla 5 free [26].

Androceum consists of an infinite collection of anthers. The color of the powder is pink. Geniceus also consists of infinite seeds. Pollination is allogamy, mainly pollinated by insects. The flower formula is $Ca_{(3)+(5)}\ Co_5A_\infty G_\infty$.

It blooms and bears fruit in June-September. The fruit is a berry with many seeds. During the dispersal of fruits and seeds, mainly zoochorea and partially anemochora are observed. Hemicryptophyte, hemixerophyte, glycogallophyte, heliophyte, thermophilic plant. It is a plant rich in medicinal and honey. A decoction prepared from the root is used against cough [27].

Reclamation works are carried out in two stages. According to Y.V. Yurchenko, technical and biological stages are separated for recultivation. In his article "Requirements for Recultivation of Degraded Lands", he noted that it takes an average of 7 months to implement recultivation.

Engaged in biological recultivation works. T.S. Chibrik and G.I. In his published monograph, Baturin selected 30 of the most resistant species from more than 200 perennial and annual grasses for recultivation and recommended planting them. Among these selected plants there are also representatives of *Fabaceae* family [28].

Biological stage of reclamation T.S. Chibrik, M.A. Glazirina, Y.I. Filimonova and N.V. Lukina's data, it is stated as follows: Biological recultivation is a set of works carried out after technical recultivation, and it is a stage of measures to restore the fertility of the land. It includes a complex of agrotechnical measures aimed at restoring flora and fauna [29].

In order to carry out recultivation works, it is recommended to first select plants that absorb free nitrogen from the air. It is advisable to use herbaceous representatives of the *Fabaceae* family. Another plant used in recultivation is *Populis nigra* [30].

Despite the fact that the development of human production, the development of the industrial sector has made great progress in the development of mankind, this sector has been and remains dangerous for the ecology and health of our planet. The reason for this is that mass mining of minerals and rocks, creation of mines and mines, large amount of industrial waste does not remain on the surface of the soil and is not processed for many years.

4. Summary

In conclusion, it can be said that the biological reclamation of the waste mounds around the "Marjonbulak gold enrichment factory", where useful ores have been extracted and subsequently degraded, is one of the most urgent issues facing biologists and ecologists.

The results obtained as a result of the laboratory analysis of the soil showed that the soil of the mining hills enriched with industrial waste as a result of anthropogenic influence contained harmful heavy metals.

As a result of the experiments carried out in this area, it was found that all the selected species have the highest index for recultivation and are fast-adaptable species, and their resistance to external adverse effects has been proven to improve the ecological condition of the area.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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