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ON THE DEPENDENCE OF THE FORMATION OF INDICATORS OF MEADOW COMMUNITIES OF THE SEMIPALATINSK LANDFILL ON RADIOECOLOGICAL CONDITIONS

At the Degelen test site in 1992, an outpouring of water was recorded in 27 adits. At the same time, the estuary sites are more or less contaminated with radioactive substances. The value of the exposure dose rate is 1-5 μR/h. There is a migration of radioactive substances with water and their subsequent sorption by soil and vegetation. The process of formation of the radiation environment of the Degelen mountain range is far from complete and is currently progressing[1]. Here, in the valley of the Karabulak Stream, intrazonal ecosystems are formed. Soil–forming rocks are deluvial-proluvial deposits, underlain by dense rocks. Meadow saline loamy and heavy loamy soils are formed in the central part of the creek valley. They are characterized by a high humus content of up to 19% and a powerful humus horizon of up to 61 cm. Soils are saline from the surface up to 0.6%. Salinization of the upper layer is caused by constant feeding with a capillary border located near the soil surface.

In this ecosystem, the main pollutants are Cs137 and β-emitters, to a lesser extent U238 and α-emitters. Soils are contaminated with radionuclides in the upper horizons. 3 166 Bq/kg accumulates in a layer of 0-10 cm Cs137. The value of the integral β-activity in the 0-10 cm layer reaches 41 600 Bq/kg. The content of integral α-activity in the 0-10 cm layer is 1 057 Bq/kg. The equivalent dose power (PED) of γ-radiation is 150-210 μR/h. In these ecosystems, communities of Calamagrostis epigeios, Galatella biflora, Sanguisorba officinalis are represented.

Under the prevailing radioecological conditions, the species diversity in the contaminated site reaches 32 plants, at the control –28. This is due to the following factors: 1) the influence of radiation pollution; 2) the annual burning of meadow vegetation in the valleys of radioactive streams as a result of poaching cable removal (after burning the herbage, many weed species of Chenopodium album, Polygonum patulum, Lepidium latifolium, etc. 3) more favorable humidification conditions on the contaminated site. Significant anthropogenic pressure on the vegetation of the polluted area caused significant differences in the composition of related species in these communities. In the phenological spectrum of plants in the polluted area, an advance of the onset of the fruiting phase in Sanguisorba officinalis was revealed.

There were noticeable differences in the vital state of the plants: the development of most plants in the polluted area was satisfactory. Many individuals of Achillea asiatica and Potentilla virgata did not form generative organs. The control revealed the good development of all plants.

The heterogeneity of the horizontal structure increases in the polluted area. This is due to the following factors: 1) the appearance of radioactive streams after underground nuclear explosions; 2) the cessation of water from the tunnels after their demilitarization in 1996-1999; 3) clogging of herbage (Artemisia absinthium, A. sieversiana, Polygonum patulum) after burning; 4) violation of the soil surface: numerous pits 30-50 cm deep were formed, littered with fragments of concrete and other building materials. These factors contribute to the formation of a cellular structure of vegetation cover in polluted areas. In the vertical structure of the studied community, no distinct division into tiers was revealed either at the contaminated site or at the control. The total soil coverage by plants in this community on the contaminated site reached 85-95(100)%, on the control –90-100%. The soil coverage by plants is 55-65% in the polluted area. The ground cover was absent due to the annual burning of the herbage, at the control it reached 5-10%.

The soil layer most saturated with roots in the studied community is 0-35 (40) cm (0-30 cm in the control). The weight of monocotyledonous plants in the polluted area reaches 201.0-708.0 g/m2 (at the control –174.5-592.0 g/m2), the weight of dicotyledonous plants –325.0-348.3 g/m2 (at the control –256.2-302.0 g/m2). The value of aboveground biomass was 526.0-1056.3 g/m2 (476.5-848.7 g/m2 in the control).

With a PED of γ-radiation of 150-210 μR/h, the content in the most root-saturated soil layer of 0-10 cm of Cs137 3 166 Bq/kg, β-emitters 41 600 Bq/kg, α-emitters 1057 Bq/kg in community of Calamagrostis epigeios, Galatella biflora, Sanguisorba officinalis, there were plants with changes in the morphological structure of the aboveground part. They are Calamagrostis epigeios, Melilotus albus, Potentilla virgata, Odontites serotina, Lepidium latifolium, Berteroa incana, Linaria altaica. In 4 plants –Calamagrostis epigeios, Lepidium latifolium, Melilotus albus and Berteroa incana the anatomical structure of the stem and leaves was studied. As a result of these studies, it was revealed that radiation pollution causes a change in the anatomical and morphological structure of plants and leads to the formation of adaptive features.

Literature list
1. Smagulov S. G., Tukhvatulin Sh. T., Cherepnin Yu. S. Semipalatinsk polygon//"Report of the National Research Center of the Republic of Kazakhstan to the UN Commission". Kurchatov, 1998, 7p.

Section

Radiation ecology and methods of analysis (Section 3)

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