Influence of Orenburg gas condensate field development on ecological and biological condition of landscape-botanical complexes

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Abstract. The article presents the results of the study of the landscape-botanical complexes in the zone of influence of the Orenburg gas condensate field. The studies have found that the area objects in most cases are located on the territory of arable land, which occupy 60-90% of the terrain of the study area. Previously, natural vegetation was cut down and new trees and shrubs were planted. The studies have shown that during the reconstruction and construction works at industrial sites the soil was removed. During the work with the water wash the existing vegetation was subjected to species transformations, which led to the death of communities that can not withstand constant excessive moisture. Thus, the role of the floodplain as a natural filter under the condition of surface water pollution was violated. Water-washing works led to a change of the Ural river bed: the right bank became more steep, the river bed expanded, which affected the decrease in the flow rate, the process of silting of the river was outlined.

1. Introduction
Modern rates of gas production, developed industry, high technologies in the field of construction and operation of wells, product pipelines and other gas industry facilities increase man-made pressure on the environment. Increasing environmental control does not fully solve the problem of negative impact on natural objects, in particular, landscape and Botanical complexes. In this regard, the main aim of this work was the study of the contemporary landscape and Botanical complexes in the zone of influence of Orenburg gas condensate field.

The study area is located in the Southeast of the European territory of Russia between 51°45' and 51°58' S. sh. and from West to East between 54°43' - 54°56' in. d.

2. Materials and methods
The studies were conducted in the area of influence of wells under construction, product pipelines and auxiliary engineering structures, which is 1500 m from the axis of the reconstructed product pipelines,
and within a radius of 1500 m from the sites of auxiliary structures. The width of the study area corresponds to the area of environmental impact of the pipeline.

The right Bank of the valley of the Ural river, composed mainly of upper Permian sediments, is steep and is characterized by a dissected relief. In relation to landscape the area is a fescue-feather grass steppe, mostly plowed.

On the right Bank of the Ural river and in the South, on the right Bank of the Donguz river, a small area of the study area belong to denudation type of relief, which is represented sartova ridge (dividing ridge) terrain, rugged valley-beam type. The watershed ridge (certovo ridge) terrain type formed by a weak ridge and a convex dividing spaces with steep slopes from 30 to 70, occasionally to 150. The root rocks are clays, sandstones, siltstones of the lower Triassic and upper Perm, which are covered with eluvial-deluvial Quaternary deposits. Within its limits developed zonal soil subtypes with weak and medium degree of washout. Soils - southern chernozems, often southern carbonate, weakly-and medium-washed, weakly sedimentary and rocky atmospheric insufficient moisture. The leading exogenous process is slope erosion.

3. Results and discussion

As a result of the reconstruction of industrial sites and gas condensate pipeline routes within the study area, the following forms of anthropogenic relief can be distinguished: a) flat surfaces with a slope of less than 30, b) positive landforms, C) negative landforms.

Natural communities of the watershed ridge landscape type - tyrsova grassland, pasture polinkova-fescue Association. Sometimes there are petrophyte-polinkova Association. At the watershed of the ridges is dominated by grasslands. On the landscape map within this type of area are the following separate areas of types of tracts:

- the true and dry steppes on plains and gentle slopes with grass sagebrush-fescue, feather grass-fescue, fescue-feather grass, annual vegetation. Soil: black soil of the South, small and medium, clayey, loamy, lack of atmospheric moisture;
- real steep slopes and dry grass steppes with fescue and feather grass, sagebrush-fescue, feather grass-fescue, annual vegetation. Soil: chernozems southern carbonate salinomycin clay, heavy and medium loam on salinomycin, steep slopes, atmospheric-waste insufficient moisture;
- crushed dry steppes on sloping and steep slopes. Community grass: fescue-feather grass, feather grass-fescue. Soil: chernozems of the South underdeveloped medium and selfnimate clay and loam, atmospheric-waste insufficient moisture;
- man-made tracts:
  - agricultural land, including fields of various crops, sown meadows, pastures. Soil: a variety of agro-soils depending on the Genesis;
  - settlements, economic and industrial facilities, man-made severely disturbed areas around settlements and facilities of the gas production complex;
  - artificial forests. Soils: southern chernozems, southern carbonate low-and medium-grained, clay, heavily loamy on plains and gentle slopes, lack of atmospheric moisture.

Based on the conditions of migration of chemical elements, which are determined by water supply and runoff, the above types of tracts can be distinguished as transeluvial upper (at least 2-30), relatively steep slopes, food, mainly atmospheric precipitation, with intense lateral flow and plane washes and significant microclimatic differences depending on the exposure of slopes. In areas of this type of landscape, especially those associated with agricultural tracts, moderate water slope erosion can occur, as well as leaching of mobile forms of chemical elements, including nutrients, from the upper soil horizon[1-3].

On the right Bank of the Urals to the valley-beam type of terrain includes ravines, gullies. Dissected terrain this type of terrain determines wide variety of dynamic environmental conditions.

According to the geochemical classification of the tract of valley-beam type of terrain can be divided into two parts. These are the lower parts of the slopes and foothills with abundant moisture due to the flowing downhill runoff, often with the deposition of deluvium. They belong to the eluvial-
accumulative or transalkylation types of landscape. The ravines and gullies, floodplains and riverbeds of small rivers belong to the subaqueous type of elementary landscape[4-6].

200 m from the steep slope of the right Bank of the Ural river within the watershed ridge of terrain on the border with the hilly-sandy located the unit-14. Fragmentary developed massifs of hilly Sands are represented by fine-grained, not fixed, deflated Sands of modern age with weakly fortified vegetation, of alluvial-Delta and Eolian origin. Quaternary deposits - undifferentiated eluvial perlove and education, blocks of quartzite-sandstones and quartzite-conglomerates. Soil in open sandy areas of the southern chernozems of medium - and claudelalanne subguarantee. Open Sands covered samotino-forb communities, shrub thickets. In the study area are widespread as a narrow band on the third floodplain terrace of the right Bank of the Ural river[7,8].

In the valley of the Ural river there are floodplains of low, medium and high levels, the first, second and third floodplain terraces. The slopes of the left indigenous Bank in the valley of the Ural river, composed mainly of clay rocks of Neogene, flat, slightly hilly. In the direction of the watersheds, composed of upper Permian and Mesozoic sediments, the relief becomes hilly.

Valley of the Ural river has a width of 20 km of the Floodplain of the Urals in the survey area is well developed, and the flood can reach widths of up to 7 km. Direction - winding, the river is calm. The main feature of the floodplain type, which distinguishes it from all other types of terrain, is the regime of spring flood, during which this part of the valley is annually flooded with water. Unit 12 and 15 is located in the area of accumulative relief in the floodplain of the river Ural to artificial embankments at a height of over 2 m. the Platform unit 12 and 15 is paved. According to the type of landscape, the territory of the UKPG belongs to man-made man-made tracts. The lower floodplain is formed on rough riverbed sediments. It is annually flooded with floods and consists of a narrow strip, overgrown with dense thickets of willow and sedge. The middle floodplain is elevated above the low-water level of the river by 2-4 m. it is characterized by a large number of dry hollows, Grivas, oxen and lakes. The floodplain is composed of modern alluvial deposits: sand, sandy loam, loam, pebbles. The upper floodplain is raised above the river by 4-10 m. its structure is dominated by clay and loam, which under the meadow steppe with thickets of bushes formed Chernozem soil. The upper floodplain is usually given for hay lands, often plowed under fodder and vegetable crops. The soils of the floodplains - sod alluvial rich black soil of the southern residual-meadow (humus content of 3-6%). In some places there are also meadow-marsh gley saline soils. Complexes of alluvial soils and saline meadow occupy from 5 to 25%[9-11].

Floodplain type of area of the Ural river of UKPG areas-1, 2, 3, 6, 7, 8, 9, 12, 14, 15; DKS-1, 2 and includes the following types of tracts:

- dry meadows overgrown with grass-couch grass couch grass vegetation, forb narrow-leaved bluegrass, sagebrush-fescue and annual vegetation. Soils: alluvial sod-meadow medium-and light-loamy soils of floodplains. Atmospheric moisture;
- floodplain forests-oak forests with sedge and maple. Soils: alluvial sod rich medium-and light-loamy soils of floodplains. Atmospheric moisture;
- floodplain bushes on alluvial turf saturated medium-and light-loamy soils of floodplains;
- dry saline short-field meadows with mixed grass-grass vegetation on alluvial sod-meadow saline clay and heavily loamy soils. Atmospheric moisture;
- marsh meadows with mixed grass-grass-sedge vegetation on meadow-bog clay soils of depressions. Atmospheric soil moisture.
- floodplain alluvial sands.

The territory of the floodplains of the Ural river is of great water protection value. Floodplain plays the role of a natural filter of polluted river waters. On their cleaning work algae, macrophytes, meadow grass, shrubs, bacteria, invertebrates. The width of water protection zones in the Ural river valley is one km. Floodplains are used as hay and pasture lands, and also have recreational value. In the area of location of UKPG-12, 15 in the floodplain of the Ural river, the processes of channel deformation are actively developed, expressed by free meandering of the river bed in the studied area, which is well traced in satellite images. These morphological changes in the structure of the riverbed
and floodplain occur as a result of the transfer and accumulation of river sediments under the action of river waters. According to research, the main reasons for the meandering of the river are:

- instability (turbulence) of the river flow of the Ural river, which leads to the tortuosity of the dynamic axis of the flow and is caused by the confluence of a large right-Bank tributary of the Sakmara river. A number of researchers connect the meandering processes of the main river bed with the effect of Coriolis acceleration on the river flow after the confluence of large tributaries;
- seasonal variability of expenditures and levels of the Ural river in time and their seasonal fluctuations;
- reduction of the transport capacity of the Ural river on the studied area as a result of the flow rate decrease at the exit from the mountain part of the catchment area to the plain, as well as the confluence of a large tributary of the Sakmara river;
- increased turbidity of the Ural river flow after the confluence of the Sakmara river and small rivers of the right Bank and left Bank, on the catchments of which linear, planar and lateral erosion occurs intensively.

The district of Orenburg belongs to the zone with moderate erosion activity. The volume of sediment load is an average of 1400 thousand t/year in the module of sediment load and 32 t/km² per year, downstream of the river in the district of Uralsk the quantity of sediment load is reduced to 320 thousand t/year with a module of the sediment load of 8 t/km² per year. Since the main water flow in the basin of the Ural and Sakmara rivers is confined to the spring flood and ranges from 55 to 75% of the total, and the value of water level rise above the low floodplain in the study area can be 8-9 m. during this period, there may be significant processes of deformation of the river bed, flooding and According to the existing standards, river floodplains flooded with floods of more than 4% of security (repeatability more than once in 25 years) are not suitable for construction and fall under water protection restrictions. Thus, the sites of UKPG-12, 15 are in the zone of high landscape instability and environmental risk of industrial development. More than 50% of the territory, within the location of the objects of technical re-equipment and reconstruction of the Orenburg gas condensate field, is occupied by the floodplain-terrace type of the area of the left Bank of the Ural river. Here are UKPG-1, 2, 3, 6, 7, BSM and DKS-1, 2. UKPG-1 is located on the first terrace above the floodplain river Ural. DKC-2 and UKPG - 2 on the second terrace above the floodplain. UKPG-3, 6, 7; DKC-1; BSM on the third terrace above the floodplain. The relief of the terraces is composed of early upper Quaternary sandy loam, sand, loam, pebbles. It is a slightly dissected flat ancient alluvial plains. From the valley plakors separated by a well-visible ledge. The surface can be cut by shallow hollows of runoff and smoothed depressions of individual oxbow lakes and channels - relics of the floodplain landscape. Soils alluvial terrace South, South of carbonate and claudelalanne medium and low humus content, meadow-Chernozem soil medium in a complex with solonetz meadow-steppe 5-10%[12,13].

The following types of tracts are located within the framework of the above-floodplain-terrace type of the area:

- the true and dry steppes on plains and gentle slopes with grasses with sagebrush-fescue, feather grass-fescue, fescue-feather grass, annual vegetation. Soil: black soil of the South, small and medium, clayey, loam on the plains and gentle slopes, lack of atmospheric moisture;
- man-made tracts;
- agricultural land, including fields of various crops, sown meadows, pastures. Soil: a variety of agricultural soils;
- settlements economic and industrial facilities, man-made severely disturbed areas around settlements and facilities of the gas production complex;
- the artificial forest (the forest belt of the red mountain). Soils: southern chernozems, southern carbonate low-and medium-grained, clay, heavily loamy on plains and gentle slopes, lack of atmospheric moisture.
Within the floodplain and the first floodplain terrace of the river Donguz, the following types of tracts can be distinguished:

- **Dry meadows with grass-couch grass, narrow-leaved bluegrass, sagebrush-fescue, annual vegetation. Soils: alluvial meadow medium-and light-loamy, atmospheric short-term moisture;**
- **The true and dry steppes on plains and gentle slopes with grasses with sagebrush-fescue, feather grass-fescue, fescue-feather grass, annual vegetation. Soil: black soil of the South, small and medium, clayey, loamy, lack of atmospheric moisture;**
- **Agricultural land, including fields of various crops, sown meadows, pastures. Soil: a variety of agricultural soils;**
- **Settlements, commercial and industrial objects, man-made, highly disturbed areas around settlements and objects of a gas complex.**

Floodplain R. Donguz refers to the accumulative type of relief. It is composed of modern alluvial deposits: sand, sandy loam, loam, pebbles. Floodplain soils - alluvial meadow medium and light loamy. The soils of the first and only floodplain terrace of the river Donguz - southern black soil, small and medium, clay, heavily loamy.[14,15]

The main exogenous processes in the floodplain of the river Donguz are lateral, river erosion and free meandering of the riverbed. The most strongly these processes can be expressed during the spring flood and summer-autumn rain floods. Territory venues UKPG - 8, 9 and 10 are presented of near-valley hill-plains type areas. For near-valley hill-type area is characterized by flat and undulating slopes that have a slope of not more than 30. Common signs of Platonov are: poor development of sheet erosion, complete absence of the deep erosion, the deep groundwater table (8-20 m), good drainability of the surface. Ravninnoe transit violated deeply incised gullies and ravines.

In a number of works, the near-valley plain of the Ural river is called the ancient 4th floodplain terrace, which was formed as a result of filling the ancient landforms depressions with sediments of the akchagyl sea. Left Bank aksayskie plains, generally have abrasion-accumulative origin and was later reworked talus and erosion processes[16,17].

The soil cover of the near-valley plakors of the right Bank of the Ural river is quite monotonous: these are typical (sometimes carbonate) southern black soils. Modern natural structure of near-valley hill placharov consists entirely of anthropogenic tract: field (agricultural), silvicultural, residential, and transportation. The near-valley hill plakari valuable arable land, so here is concentrated the main part of the cultivated grain crops of the Orenburg region. These are areas with high soil fertility potential. The allocation of these lands for non-agricultural purposes should be extremely justified[18,19,20].

Agroecoses, residential and industrial landscapes make up more than 90% of the territory of the above-floodplain-terrace and near-valley-plakor type of the area of the left Bank of the Ural river. In addition to agricultural tracts in the framework of near-valley hill-plains the type of terrain located tracts:

- **The true and dry steppes on plains and gentle slopes with grasses with sagebrush-fescue, feather grass-fescue, fescue-feather grass, annual vegetation. Soil: black soil of the South, small and medium, clayey, loamy, lack of atmospheric moisture;**
- **Saline and saline steppes on plains and gentle slopes with pollen-grass vegetation. Soil: chernozems southern solonetzic, lack of atmospheric moisture;**
- **Dry steppe meadows with grass-mixed vegetation on meadow-black-earth soils of depressions, atmospheric runoff and sinter moisture; agricultural lands, including fields of various crops, sown meadows, pastures. Soil: a variety of agricultural soils;**
- **Settlements, economic and industrial facilities, man-made severely disturbed areas around settlements and facilities of the gas production complex.**

About 5% of the left Bank of the Ural river is occupied by the valley-beam type of terrain, which covers the hydrographic network of small rivers, temporary streams and adjacent slopes, as well as ravines and beams. Complex modern erosion-proluvial sediments. Includes outcrops of Neogene-Quaternary and Permo-Triassic rocks. Soil - washed away-washed layered selenocyanate and
selfnominate, often with buried horizons. The Genesis of the relief of the slopes of the valleys - erosion-denudation. The main exogenous processes are: surface, linear erosion and gully formation. The bottoms of the valleys belong to the erosion-accumulative type of relief. Leading exogenous processes in the bottom of the valley-river, deep and lateral erosion. Erosion forms are numerous and varied in morphology. The most intensive erosion processes occur on the southern slopes, as the southern slopes are better lit during the year, they get more solar radiation, which accelerates the processes of slope erosion during the spring snowmelt and contributes to the growth of ravines. The emergence of the tops of the gullies occurs most often on the banks of rivers with difference of the longitudinal profile of the watercourse, where under the action of convergence of the sloping rib network formed chutes or falling streams, leading to the formation of gullies. The erosion of the drop leads to the upward movement of the top of the emerging ravine towards the direction of flow, while the bottom of the ravine is deepening. Gully erosion usually accompanied by landslides, talus, olygamy of the soil, resulting in formation of a characteristic almost vertical slopes. To the valley-beam type of terrain are large ravines and beams of the left Bank of the Ural river with a secondary cut, shallow spoon and beams, separating a complex of terraces to the individual segments. A number of them are timed to the valley of the river Donguz. In those places where Ural forms are embedded in the terraced plain of the meander, i.e. close to the steep cliffs, and a short but fresh deep ravines. A well-defined gully network is located near the UKPG -2, 3, 6, 10. Upper beams dressed oak-birch and birch-aspen forests, along the streams often stretch gallery black and white or willow thickets.

4. Conclusion
Thus, almost all the old and new area objects of the Orenburg gas condensate field are located among the arable lands, which occupy 60-90% of the area under study. Some untilled areas, confined in most cases to the inconveniences associated with the dismemberment of the terrain, as well as to the riparian slopes, have been preserved. But in such areas, natural vegetation has undergone significant changes. There are also disturbed lands, deprived of vegetation, which have a destroyed soil profile. These sites are either newly planned by bulldozer and have not had time to grow, or are used by cars and other modes of transport. All this caused a deep technogenic change of landscapes and affected all components of biogeocenoses. Natural-anthropogenic steppe geocomplex the result of gas-field works acquired new features Positive forms of relief represented by earthworks of a height of 1.0-1.5 m and stockpiles of topsoil and loam with a height of 1.0-3.5 m. In these relief elements of the natural growth is at different rates. On the earthen rampart spread complex plant groups with a coating of more than 50%, the dumps of black soil and loam have a sparse vegetation cover, represented by pioneer and simple groups with a coating of less than 50%. Negative landforms formed drainage (mountain) ditches along the tracks depth from 0.5 to 1.0 m. the Natural growth in depressions is very intense, complex groups have the coverage of 90-100%. This is due to the fact that in the decreases there is increased soil moisture and there is an accumulation of organic matter washed off from the neighboring elevations. As a result, the research area has become more prone to the development of erosion processes, confined to the areas occupied by agricultural land, the old routes of condensate pipelines, river valleys, gullies and ravines. A mandatory component of the landscape became protective and recreational forest strips.

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