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Satbayev University

Х А Б А Р Л А Р Ы

ИЗВЕСТИЯ

НАЦИОНАЛЬНОЙ АКАДЕМИИ НАУК
РЕСПУБЛИКИ КАЗАХСТАН
Satbayev University

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Zh. S. Mustafayev[1], L. V. Kireicheva[2], L. K. Zhusupova[3]

[1] Kazakh National Agrarian University, Almaty, Kazakhstan;
[2] FSBSI «All-Russian Research Institute of Hydraulic Engineering and Land Reclamation named after A. N. Kostyakov», Moscow, Russia;
[3] Kyzylorda State University named after Korkyt-Ata, Kazakhstan.
E-mail: z-mustafa@rambler.ru

APPLIED MODEL OF METHODS FOR RECLAMATION OF SALT LAND

Abstract. Based on the available achievements in the field of methodology, natural sciences and research in the field of environmental management, a method is proposed for constructing an applied model for the development of saline lands as "activity-natural objects" of the «Soils", including cognitive activities, transforming activities, transformations natural materials and materials formed as a result of anthropogenic activities, within the framework of which an applied model of methods for the reclamation of saline lands has been developed.

On the basis of an applied model transforming the activity of saline lands, a method for developing saline lands has been developed, including the preparation of temporary irrigation and drainage networks and checks, deep ameliorative loosening of the soil across the drains with alternating loosened strips with the same width with the subsequent supply of flushing water to the checks. The method differs in that the development of saline lands is carried out in two symmetrical and parallel-sequential actions in time in annual intervals, with desalinization of saline soils to a certain permissible level with the supply of a leaching rate, taking into account the environmental requirements of environmental management and classification of saline soils and salt tolerance of agricultural crops from very highly saline to highly saline, from highly saline to medium saline, from medium saline to slightly saline and from slightly saline to non-saline, with subsequent cultivation of the corresponding salt tolerant crops: very resistant – resistant – medium resistant – medium sensitive – sensitive.

Keywords: saline lands, reclamation, desalinization, method, applied model, technique, soil, system, object, activity, development, ecology, landscape.

Introduction. The problem of reclaiming saline lands has existed for several millennia and is becoming more and more acute in connection with the involvement of agricultural crops in their cultivation. The only radical way to solve the problem with the proven thousand-year experience of irrigated agriculture is leaching with removal outside the irrigated massif using drainage, taking into account the soil-hydrogeological conditions of the landscape or leaching accompanied by sown halophyte plants [1]. At the same time, it should be noted that the existing methods of reclamation of saline lands do not ensure sustainable leveling of reclaimed and background soils in terms of their productivity. The reason for this is the ascending currents of saline solutions of the upper soil layer during the growing season of the vegetation cover, as a result of which cyclical salinization occurs, which does not provide the ecological stability of the developed lands for the cultivation of agricultural crops [2; 3].

Purpose of the study. Development of an applied model of methods for the reclamation of saline lands for the cultivation of agricultural crops, which will allow removing salts from the soil to a certain level according to the degree of salinity in stages on a time scale in annual intervals with the supply of an appropriate leaching rate, followed by the cultivation of agricultural crops according to the salt tolerance, which constantly provide a decrease in the volume of collector-drainage water into natural water drainage facilities.

Materials and research methods. Scientific research is based on the classical doctrines of soil, soil-forming processes, soil fertility, salinization processes by V.V. Dokuchaev, V.I. Vernadsky, V.R. Williams, A.N. Kostyakova, V.A. Kovdy, B.G. Rozanova [4]; work on the development of degraded soils on the principles of ecological balance of irrigation, forest reclamation, agromeliorative and other impacts (B.M. Kizyaev, I.P. Kruzhilin, V.I. Petrov, K.N. Kulik, L.V. Kireicheva, V.V. Borodychev, E.B. Gabunshchina, Zh.S. Mustafaev, A.T. Kozykeeva and others) [5]; in terms of the desalting and desalting ability of plants (B.P. Strogonov, P.A. Genkel, G.V. Udovenko, P.P. Beguchev, B.A. Zimovets, Z.Sh. Shamsutdinov, O.A. Lachko, L. V. Rudnev) [6]; on the ecological and energy assessment of the efficiency of agriculture and the energy of soil-forming processes - A.N. Engelgard, K.A. Timiryazev, V.R. Volobuev, K.K. Gedroyts, V.M. Volodin, V.V. Korenets, Zh.S. Mustafaev and others [6].

To implement such a worldview when constructing an applied model of methods for the development of saline lands, it is advisable to use methods for constructing models of activity-natural objects (ANO), which are elements of activity-natural systems (ANS), which is a concept that includes elements of three categories: activity (A), natural material (M) and transformed material (TM) as a result of anthropogenic human activity [2].

For a correct understanding of the goals and objectives of the development of saline lands for agricultural production, determine the value system and designate the objects of influence, that is, at present, such values are a person and his habitat, and the objects of influence are soil, as the main component of the biosphere of the landscape as a whole and as the main means and object of labor in the conditions of anthropogenic human activity. At this level, the system «reclamation activity-soil» can be considered as «activity-natural objects» (ANO) of the «Soils», saturated with specific content, performing ecological and economic functions in the spheres of nature management and nature development.

Research results. The proposed new conceptual approach to the construction of an applied model for the development of saline lands lies in the orientation of the system "reclamation activity-soil" on the strict account of natural processes and their rhythmic fluctuations by felting changing climatic factors and consideration of nature as a single organism inherent in it cyclic movements of flows of substances in large and small cycles.

In the natural system, during the development of saline lands for the cultivation of agricultural lands, their objects of influence, that is, the soil and the soil-forming process as a whole, are ecologically unstable and therefore it is necessary to develop a set of control measures in order to optimize their functioning, that is, to transfer their regime to dynamically stable development with a set of corrective influences known by the method, method, intensity and time [2; 3].

The formation and functioning of the soil and vegetation cover in the desert and semi-desert is characterized by two parameters, that is, the soil cover is formed in the process of moisture and salt transfer, which characterize the evaporative features of the geochemical barrier, leading to the salinization process, and the vegetation cover - by biomass and species diversity on based on the law of genetic diversity.

Different types of plants in natural conditions do not grow in isolation from each other, but form certain combinations, characterized by special relationships with each other and with environmental conditions. Such a historically established stable set of species in a homogeneous area of the territory is called a plant community [7; 8; 9; 10].

Thus, on the basis of a natural-scientific approach to the doctrine of thinking and activity, the principles of constructing an applied model of methods for the development of saline lands as «activity-natural objects» of the «Soil» were formed, within the framework of cognitive activity, transforming activity, transformations of natural materials and formed materials as a result of anthropogenic activities.

The cognitive activity of the natural hydrogeochemical process is an active study of the surrounding reality, which begins with orientation and research activities, for the examination of the studied subject and in obtaining a variety of information about the degree of soil salinity and the distribution of biocenosis species necessary for transforming activities that increase their purchasing value.

At the same time, the stability of the vegetation cover of saline lands largely depends on the salt resistance of plants that determine the structure of the ecosystem, that is, the species diversity of the vegetation cover directly depends on the degree of soil salinity, which leads to a change in the balance and stability of natural landscapes (figure 1) which allowed us to build an applied model of those who know the activity of saline lands.

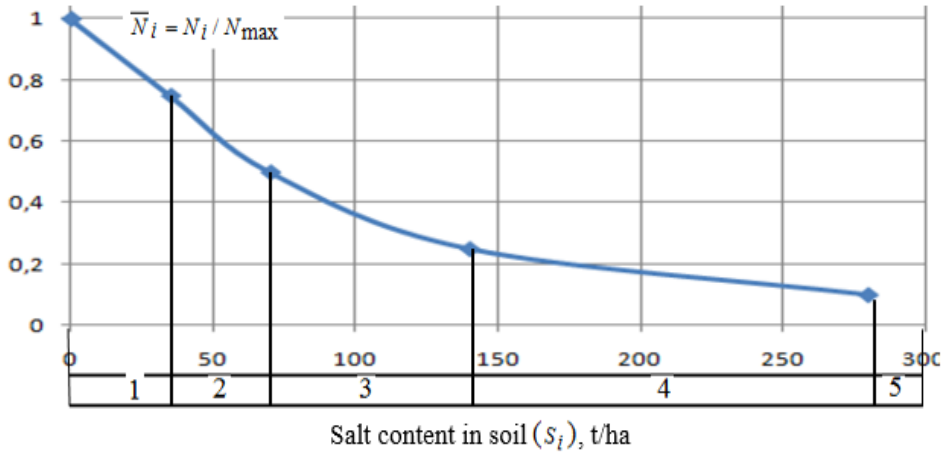

Figure 1 – Distribution of species in the biocenosis by numbers depending on the degree of soil salinity: 1 – non-salted; 2 – slightly salted; 3 – moderately salted; 4 – highly salted; 5 – very highly salted; N_i – number of *i*- plant species; N_{max} – maximum number of plant species

A wide range of wild-growing grasses are much less responsive to changes in natural conditions than communities consisting of a small number of species. Using the species diversity of communities and the Shannon information measure of diversity as a characteristic of the sustainability of the ecosystem, it is possible to estimate the relative resistance of the plant community depending on the degree of soil salinity based on the quantitative composition of plant species (when $P_i = 1/n$) [10; 11]:

$$D = -\sum_{i=1}^{n} P_i \cdot \ln P_i ;\ P_i = N_i / N ;\ N = \sum_{i=1}^{n} N_i ,$$

where n – number of plant species in the community; N_i – number of *i*-species; D – community resilience; P_I – share of this species in the community.

As can be seen from Figure 1, the number of plant species in landscape systems largely depends on the degree of salinity, which species diversity is formed strictly by their salt tolerance. In general, the success of bioorganisms in the struggle for existence on saline lands can be achieved in various ways. One of them is the adaptability properties of organisms to changing environmental conditions by increasing the number of the species, expanding the area of its settlement. At the same time, it should be noted that under conditions of rhythmic fluctuations in the climate, the natural process of desalinization and salinization is observed in nature, which, to a certain extent, has an effect on the quantitative composition and structure of the species plant cover of saline soils. With the process of soil desalinization under natural conditions, more salt-tolerant plant communities give way to more salt-sensitive plant communities.

In the process of cognizing the activity of the natural hydrogeochemical process, an applied model transforms the activity of saline lands, that is, anthropogenic changes in the existing ecological balance to increase their ecological and economic functions, ensuring an increase in the biological productivity of soil and plant cover of natural landscape systems.

At the same time, the applied model transforming the activity of saline lands is based on the principles of coexistence of a plant community on saline soils, where more salt-sensitive plant communities give way to more salt-tolerant plant communities, that is, according to the scheme, very highly saline - highly saline - moderately saline - slightly saline - non-saline, followed by replacement appropriate salt tolerant crops in the soil cover: very tolerant - tolerant - medium tolerant - medium susceptible - sensitive (figure 2).

Based on the laws of the «predator-prey» system in Voltaire, in this case, the role of the «predator» during desalinization of saline soils is played by more salt-sensitive plant communities, and the role of «prey» is played by more salt-tolerant plant communities [12]. At the same time, according to the law of evolutionary-ecological irreversibility, an ecosystem that has lost some of its elements or has been replaced by another as a result of an imbalance of components cannot return to its original state if evolutionary changes occurred in ecological elements during the changes [12]. Therefore, it is necessary to

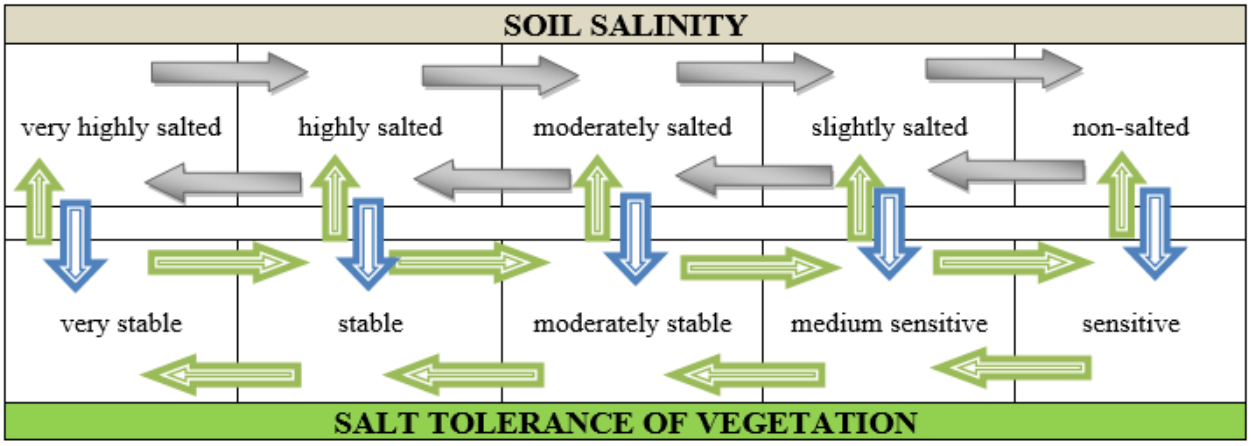

Figure 2 – An applied model transforming the activity of saline lands
(schemes of natural direct and feedback in the soil-hydrogeochemical process and the plant community)

take into account that during the development of saline lands for the agrolandscape system of natural landscapes, an irreversible evolutionary process occurs as a result of a strong decrease in the number of species of the plant community with replacement by cultivated plants.

At the same time, according to the Le Chatelier-Brown principle - under external influence, that is, when saline soils are salted, which brings the system out of a state of stable equilibrium, the equilibrium shifts in the direction in which the effect of external influence is weakened as a result of the structure and composition of the plant community change towards more salt sensitive plant communities [12].

On the basis of the applied model transforming the activity of saline lands, a method for developing saline lands has been developed, including the preparation of temporary irrigation and drainage networks and checks, deep ameliorative loosening of the soil across the drains with alternating loosened strips with the same width, followed by the supply of flushing water to the checks. The method differs in that the development of saline lands is carried out in two symmetrical and parallel-sequential actions in time in annual intervals, with desalinization of saline soils to a certain permissible level with the supply of a leaching rate, taking into account the environmental requirements of environmental management and classification of saline soils and forest tolerance of agricultural crops from very strongly saline to highly saline, from highly saline to medium saline, from medium saline to slightly saline and from slightly saline to non-saline, followed by cultivation of the corresponding salt tolerant crops: very resistant - resistant - medium resistant - medium sensitive [5].

To implement the method for the development of saline lands on the basis of the laws of nature and natural hydrogeochemical processes, a method for flushing saline soils has been developed, including hydrotechnical and agrotechnical measures, is carried out by alternation in a pressure mode until complete moistening, and then before flushing in a non-pressure mode, is carried out in the following order, that is, on fields with zero marks, temporary irrigation networks are cut from the opposite side of the irrigated area and furrows with a deepening towards the center of the site, while the feed of the leaching rate using the furrow is carried out simultaneously with counter jets at the same flow rates, until each collision with the other in the center of the plot, followed by leveling the water layer in the furrow along the front of the water supply [13].

A distinctive feature of the proposed scheme for the development of saline lands from similar developments is the linkage of the method of development of saline lands with the classification of saline soils and salt tolerance of agricultural crops.

At each stage of the development of saline lands, firstly, it is necessary to determine the degree of soil salinity (S_i) and secondly, the level of expected productivity of agricultural crops, taking into account salt tolerance ($\overline{Y}_i = Y_i / Y_{\max}$, where Y_i – crop yield at a given degree of soil salinity, centner/ha; $Y_{\max}$ – maximum yield of agricultural crops with an acceptable degree of soil salinity, centner/ha).

Saline land leaching rates (α) at each stage of development is determined based on the system of the following equations [13]:

$$Y_i = Y_{\max} \cdot \exp\left[-k(S_i / S_{\partial oni} - 1)^b\right];$$

$$N_i = (\alpha / \beta) \cdot \lg(S_i / S_{\partial oni}),$$

where α – salinity coefficient; β – parameter that depends on the stirring speed; $S_{\partial oni}$ – permissible content of soil salts at the stage of development of saline lands, t/ha; k – coefficient of salt tolerance of agricultural crops; b – equation parameter.

If the expected amount of leached salts from the soil layer (0–100 cm) (ΔS_i) at each stage of the development of saline lands will be greater than their maximum permissible value ($\Delta S_{\partial on}$), which is determined based on the level of the anthropogenic load of the natural system in the annual interval, then in this stage of development is divided into several sub-stages, that is, the number of sub-stages is determined by the formula: $n = \Delta S_i / \Delta S_{\partial on}$.

The duration of leaching of saline soils (t_i) at each stage of their development is determined by the formula: $t_i = N_i / [(V_o + K_\phi) / 2]$, where V_o – is the rate of water absorption into the soil at the end of the first hour; K_ϕ – filtration coefficient.

Transformations of natural materials as a result of transforming activities on saline lands – the process of changing the direction and intensity of natural hydrogeochemical processes that ensure sustainable development of the biosphere, which reflects the key position of modern ecology, based on knowledge of the essence of the formation of soil-forming process, which provides sustainable soil desalinization.

Thus, based on the laws of nature and noting the presence of direct and reverse relationships in the soil, one can raise the question of self-regulation and consider the soil as an object of self-regulation and use them to develop environmentally safe ways of developing saline lands for agricultural production.

Moreover, if the technology for the development of saline lands is based on the formation of saline lands and the process of soil desalinization in natural systems, then the change in the natural process under the influence of natural factors will coincide with the direction and intensity of the natural process or will approach them.

Consequently, on the basis of this position, the development of saline soils should be carried out according to a stepwise principle, using the classification of saline soils from saline to highly saline, from highly saline to moderately saline, from moderately saline to slightly saline and from slightly saline to non-saline, which represent an applied model of natural transformations. materials as a result of transforming activities on saline lands (figure 3).

Classification of saline soils depending on the content of solid residue					Indicators	
					$S_{\max}$, t/ha	$\frac{Y_i}{Y_{\max}}$
Salt marshes					<280,0	0,0
Highly salted	Highly salted				280,0	0,25
Moderately salted	Moderately salted	Moderately salted			140,0	0,75
Slightly salted	Slightly salted	Slightly salted	Slightly salted		70,0	0,80
Non-salted	Non-salted	Non-salted	Non-salted	Non-salted	35,0	1,00

Figure 3 – Applied model of transformations of natural materials as a result of transforming activities in saline lands

Thus, in the ecological substantiation of the methods of reclamation of saline lands, an important role belongs to the cultivation of crops that are able to successfully resist the harmful effects of mineral salts, which are components of saline soils. At the same time, the cultivation of salt-tolerant crops, taking into account the degree of soil salinity, creates a favorable agrobiological background and increases not only their fertility, but also the productivity of agricultural crops [2].

In connection with the diversity and dynamism of the hydrogeochemical indicators of the soil system of saline lands in the process of their agricultural development on a time scale, the technology of their optimization should be focused on the regulation and management of the life of the species community of the vegetation cover.

When solving the set goals, the classical classifications of soils by salinity and salt tolerance of agricultural crops and their variations were taken as a basis, which made it possible to draw up an applied model of technological schemes for the development of saline lands for the cultivation of agricultural crops, taking into account the maximum permissible level of technogenic loads of the natural system (figure 4).

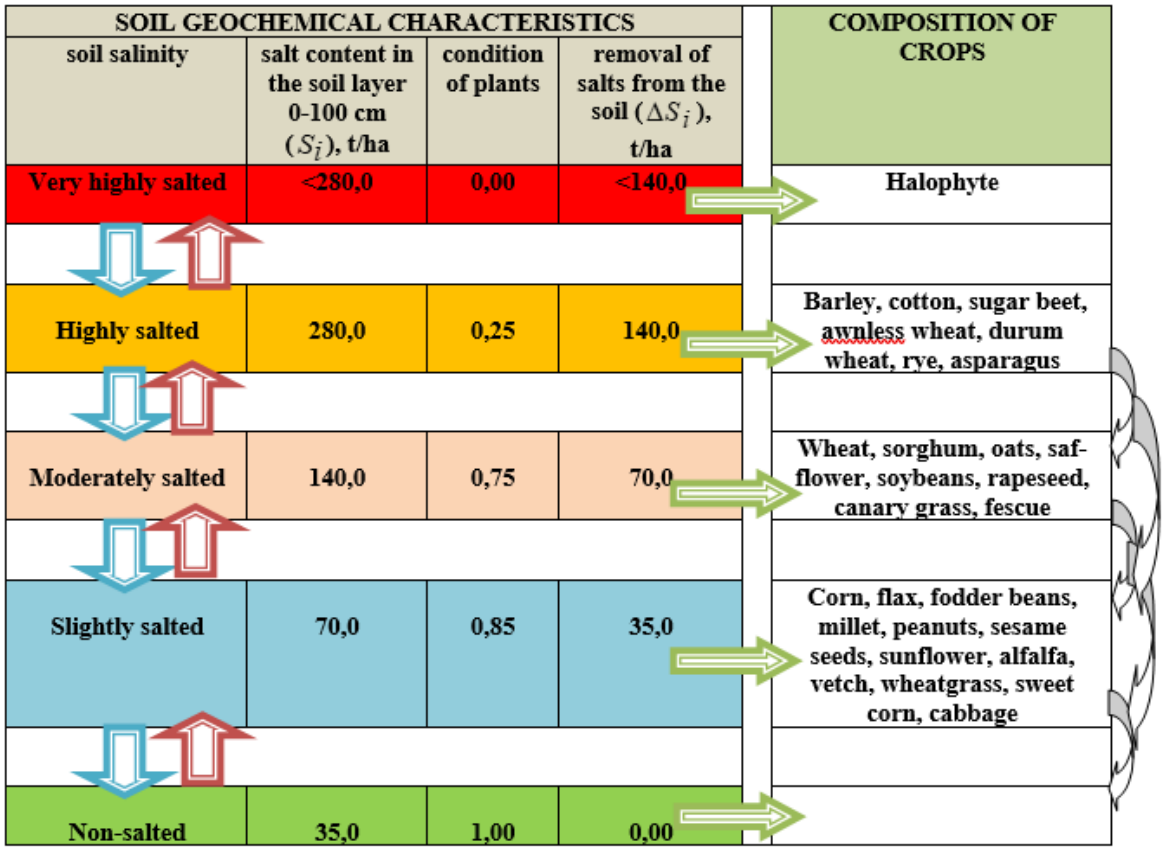

Figure 4 – Applied model of technological schemes for the development of saline lands for the cultivation of agricultural crops, taking into account the environmental requirements of nature management

On the basis of the proposed technological scheme, the development of saline lands should be carried out in stages on a time scale in annual intervals, using the classification of saline soils and salt tolerance of agricultural crops from very highly saline to highly saline, from highly saline to moderately saline, from moderately saline to slightly saline and from slightly saline to non-saline with the cultivation of agricultural crops.

At the same time, at each stage of the development of saline lands, a certain state of the land corresponds to the degree of soil salinity and, therefore, certain reclamation tasks related to this stage are solved.

For the development of an applied model of the formed hydrogeochemical process as a result of anthropogenic activity, as an integral criterion for assessing changes in environmental factors as a result of transforming activity and transformations of natural materials, a hydrothermal regime is used, which characterizes the heat and moisture supply of the soil and vegetation cover («dryness index» M. I. Budyko – $\overline{R}_i$) (figure 5) [14; 15; 16; 17]: $\overline{R} = R / LO_C$, where $\overline{R}_i$ – «dryness index»; R – radiation balance, which determines the influx of solar energy and the amount of photosynthetic active radiation, kJ/cm^2; L – latent heat of vaporization, kJ/cm^3; O_c – atmospheric precipitation, mm.

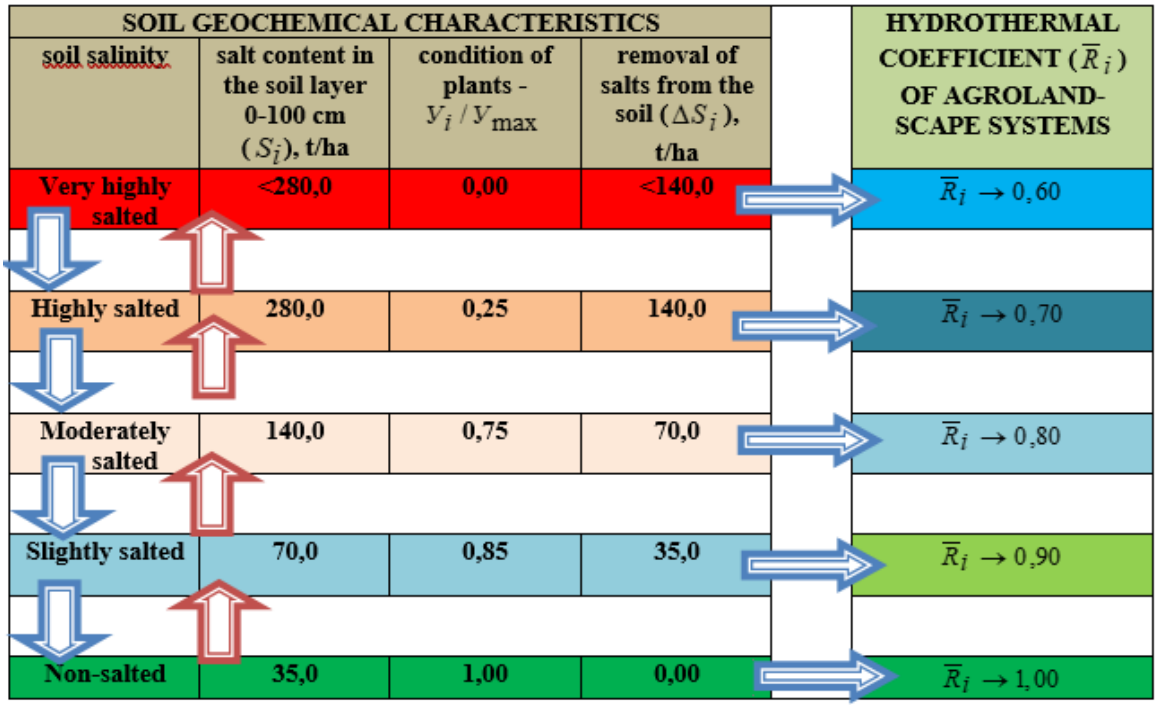

Figure 5 – Applied model of the formed hydrogeochemical regime as a result of anthropogenic activity on saline lands

Consequently, the hydrothermal regime of the soil and vegetation cover ($\overline{R}_i$), characterized by the «dryness index» of M. I. Budyko, determines the general direction of biochemical processes, manifested in balances and modes (water, salt, heat, nutrient) and properties of natural material, consideration of activity-natural processes in the development of saline lands will allow to investigate the causal relationships between cognizing activities, transforming activities, transformations of natural materials and materials formed as a result of anthropogenic activities.

Conclusions. The developed applied model of the method of reclamation of saline lands represents «activity-natural systems», which includes elements of four categories: cognitive activity, transforming activity, transformations of natural materials and formed materials as a result of anthropogenic activity, based on optimization of the conditions of the soil-forming process and growth agricultural crops in agrolandscape systems that perform ecological and economic functions, for farms-land users ensure the adoption of prompt and informed decisions on purposeful management and regulation of soil-reclamation processes hydroagrolandscape systems allow the environmental sustainability of the environment and human habitat.

Ж. С. Мұстафаев[1], Л. В. Кирейчева[2], Л. Қ. Жүсупова

[1] Қазақ ұлттық аграрлық университеті, Алматы, Қазақстан;
[2] ФМБҒМ «А. Н. Костяков атындағы Бүкілрессейлік гидротехника және мелиорация ғылыми-зерттеу институті», Мәскеу, Ресей;
[3] Қорқыт-Ата атындағы Қызылорда мемлекеттік университеті , Қазақстан

ТҰЗДАНҒАН ЖЕРЛЕРДІ ИГЕРУДІҢ ТӘСІЛІНІҢ ҚОЛДАНБАЛЫ ҮЛГІСІ

Аннотация. Табиғаты пайдалану және табиғаты үйлестіру саласындағы зерттеулер және жаратылыстану ғылымының әдістемелік жүйесіндегі қолда бар жетістіктердің негізінде, тұзданған жерлерді игерудің қолданбалы үлгісін құрудың әдістемесін, құрамына антропогендік қызметтің жүргісі ретінде, танымдылық және түрлендіру қызметі, табиғи заттарды тасмалдау және заттардың қалыптасу қызметтері кіретін, «Топырақ» «қызметтік-табиғи жүйе» ретінде қарастыра отырып, тұзданған жерлерді игерудің әдістерінің қолданбалы үлгісі жасалды.

Тұзданған жерлерді түрлендіру қызметінің үлгісі бойынша, құрамына уақытша суғару арықтары, кәріз желілері және атыздар кіретін, тұзданданған жерлерді игерудің тәсілі құрылған және ол ені бірдей атызды, кәрәзге қарама-қайшы топырақты терең қопсыту жүйектерін кезектесу арқылы, шаю мөлшерін атызға беруге негізделген. Тұзданған жерлерді игерудің ерекшелігі, ол жыл ішіндегі уақыт аралығында екі симметриялы және қатарлас-жүйелік тізбектелген әрекет арқылы, тұзданған топырақты белгілі бір шектелген мүмкіншілік деңгейіне дейін шаю мөлшерін, табиғаты үйлестірудің экологиялық талабын ескере отырып, тұзданған топырақтың жіктелуі және ауылшаруашылық дақылдардың тұзға төзімділігін негізделген, яғни өте жоғарғы тұзданудан жоғарғы тұзденуға, жоғары тұзданудан орташа тұзденуға, оратша тұзданудан әлсіз тұзданға, әлсіз тұзданудан тұзданбаған деңгейге дейін, тұздан арылғанша беруге және одан кейін тұздану дәрежесіне сай келетін тұзға төзімді ауылшаруашылық дақылдарды өте төзімді-төзімді-орташа -төзімді-орташа - сезімді -сезімді қатармен өсіруге негізделген.

Түйін сөздер: тұзданған жер, игеру, тұздан арылу, тәсіл, қолданбалы үлгі, әдістеме, топырақ, жүйе, нысан, қызмет, құру, экология, ландшафт.

Ж. С. Мустафаев[1], Л. В. Кирейчева[2], Л. К. Жусупова[3]

[1] Казахский национальный аграрный университет, Алматы, Казахстан;
[2] ФГБНУ «Всероссийский научно-исследовательский институт гидротехника и мелиорации им. А. Н. Костяков», Москва, Россия;
[3] Кызылординский государственный университет им. Коркыт-Ата, Казахстан

ПРИКЛАДНАЯ МОДЕЛЬ СПОСОБОВ ОСВОЕНИЯ ЗАСОЛЕННЫХ ЗЕМЕЛЬ

Аннотация. На основе имеющихся достижений в области методологии естественных наук и исследований в сфере природопользования и природообустройства предлагается методика построения прикладной модели освоения засоленных земель как «деятельностно-природные объекты» «почвы», включающие познающую деятельность, преобразующую деятельность, трансформацию природных материалов и формировавшихся материалов в результате антропогенной деятельности, в рамках которых разработана прикладная модель способов освоения засоленных земель.

На основе прикладной модели преобразующей деятельности засоленных земель разработан способ освоения засоленных земель, включающий подготовку временной оросительной и дренажной сетей и чеков, глубокое мелиоративное рыхление почвы поперек дрен с чередованием рыхленных полос с одинаковой шириной с последующей подачей промывной воды в чеки. Способ отличается тем, что освоение засоленных земель проводится в двух симметричных и параллельно-последовательных действиях по времени в годовых интервалах, с рассолением засоленных почв до определенного допустимого уровня с подачей промывной нормы, с учетом экологических требований природообустройства и классификации засоленных почв и солеустойчивости сельскохозяйственных культур от очень сильнозасоленных до сильнозасоленных, от сильнозасоленных до среднезасоленных, от среднезасоленных до слабозасоленных и от слабозасоленных до незасоленных с последующим возделыванием соответствующих им солеустойчивых культур: очень устойчивые – устойчивые – среднеустойчивые – среднечувствительные – чувствительные.

Ключевые слова: засоленные земли, освоение, рассоление, способ, прикладная модель, методика, почва, система, объект, деятельность, разработка, экология, ландшафт.

Information about authors:

Mustafayev Zhumakhan Suleimenovich, Doctor of Technical Sciences, Professor, Professor of the Department «Water Resources and Melioration», Kazakh National Agrarian University; z-mustafa@rambler.ru; https://orcid.org/0000-0003-2425-8148

Kireicheva Lyudmila Vladimirovna, Scientific adviser on land reclamation, FGBICU «All-Russian Scientific Research Institute of Hydraulic Engineering and Land Reclamation named after A. N. Kostyakov», Doctor of Technical Sciences, Professor; kireychevalw@mail.ru; https://orcid.org/0000-0002-7114-2706

Zhusupova Liza Kuanyshnovna, teacher of Kyzylorda State University named after Korkyt-Ata, Master; liza_zk@mail.ru; https://orcid.org/0000-0002-6379-3488

REFERENCES

[1] Grammatikati O.G. The concept of reclamation crop rotations on saline lands // Melioration and water management. 1993. No. 1. P. 29-30.

[2] Mustafayev Zh.S. Methodological and ecological principles of agricultural land reclamation. Taraz, 2004. 306 p.

[3] Telitsyn V.L. Conceptual model of reclaimed lands // Melioration and water management. 1995. No. 4. P. 21-23.

[4] Kovda V.A. Problems of combating desertification and salinization of irrigated soils. M.: Kolos, 1984. 304 p.

[5] Mustafayev Zh.S., Kireicheva L.V., Kozykeyeva A.T., Zhusupova L.K. Ecosystem substantiation of the methods of development of saline lands // Agroecology. 2015. No. 2(4). P. 4-9.

[6] Dedova E.B. Increasing the natural resource potential of degraded agricultural lands in Kalmykia by means of complex land reclamation // Abstract of dissertation for the degree of Doctor of Agricultural Sciences. M., 2012. 45 p.

[7] Vernadsky V.I. Scientific thought as a planetary phenomenon. M.: Nauka, 1991. 271 p.

[8] Sukachev V.N. Plant communities (introduction to phytosociology). L.; M.: Book, 1928. 232 p.

[9] Levich A.P. The structure of ecological communities. M.: Publishing house of Moscow University, 1980. 181 p.

[10] Odum Y. Ecology // Ed. Academician V. E. Sokolov / Transl. from English. B. Ya. Vilenkina. M.: Mir, 1986. Vol. 2. 376 p.

[11] Claude Elwood Shannon // Computer News. 1998. No. 21. [http: // kv. minsk.by/ index1998211801.htm; http://book.kbsu.ru / theory / chapter3 / shannon.html].

[12] Reimers NF Ecology (theories, laws, rules, principles and hypotheses). M.: Journal «Young Russia», 1994. 367 p.

[13] Mustafayev Zh.S., Kozykeyeva A.T., Mustafayev K.Zh., Abdeshev K.B. Modeling of soil salinity and desalinization. Taraz, 2013. 204 p.

[14] Budyko M.I. Global ecology. M.: Mysl, 1977. 327 p.

[15] Adilbektegi G.A., Mustafayev J.S., Uvatayeva T.K., Dulatbekova Z.N., Jozef Mosiej. A new approach to the evaluation of bioclimatic potential of landscapes on the example of northern Kazakhstan // News of the National Academy of sciences of the Republic of Kazakhstan. Series of geology and technical sciences. ISSN 2224-5278. 2019. Vol. 5, No. 437. P. 16–25. https://doi.org/10.32014/2019.2518-170X.121

[16] Adilbektegi G.A., Mustafayev J.S., Uvatayeva T.K., Dulatbekova Z.N., Jozef Mosiej. Quantitative and qualitative assessment of biological and ecological potential of tne landscapes of southern Kazakhstan // News of the National Academy of sciences of the Republic of Kazakhstan. Series of geology and technical sciences. ISSN 2224-5278. 2019. Vol. 6, No. 438. P. 96–103. https://doi.org/10.32014/2019.2518-170X.160

[17] Mustafayev Zh.S., Kozykeyeva A.T., Kalmashova A.N., Aldiyarova A.E., Arvydas Povilaitis. Ecological and water economic assessment of the Yesil river basin catchment area // News of the National Academy of sciences of the Republic of Kazakhstan. Series of geology and technical sciences. ISSN 2224-5278. 2020. Vol. 2, No. 440. P. 123-131. https://doi.org/10.32014/2020.2518-170X.39

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