AGRO-ECOLOGICAL CONDITION OF SIRDARYA REGION AND THE WAYS TO IMPROVE IT

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Abstract. *This article presents that the main problems of our time are rise in groundwater levels, the increase in soil salinity, as well as agro-ecological problems arising in connection with the relief and climatic conditions of the Syrdarya region, which require special scientific solutions and, on their basis, the use of water-saving methods in irrigation, issues of using a complex agro-technological system suitable for agro-ecological conditions when using arable land, development and implementation of measures to prevent or reduce soil pollution.*

Keywords: *agroecology, geosystem, coefficient of ecological stability, agricultural landscape, aeration, filtration, drainage, agricultural regime, reclamation measures, hydrogeochemical processes.*

There are different approaches to agroecological assessment of irrigated and newly developed geosystems (M.A.Pankov, 1974, A.A.Rafikov, 1976, A.S.Hasanov, 1987, 1996, Parfenova, Reshetkina, 1995, Sh.Zokirov, L Z.Sherfeddinov 1987, A.N.Nigmatov, 2005, M.Matchanov, 2009, etc.). The authors introduced concepts such as "ecological stability coefficient", "ecological stress level", "ecological safety level". For example, Sh.Zokirov (1998) compared the area of developed areas with the total area of geosystems as a basis. Yu.I.Akhmadaliev (2000) proposed the concept of "natural-agrarian opportunities" for the region of Fergana Valley and determined the ranking of lands on the scale of districts.

N.I.Parfenova, N.M.Reshetkina and others (1995) introduced the "Environmental Stability Coefficient" (ESC) and proposed to calculate it as follows:

$$ESC = (Gu - Gb) : Gu$$

Here: Gu – total area of the studied area (agrolandscape); Gb – ecologically disturbed area.

According to this indicator, the authors divided the area into 3 types according to its environmental stability:

I type – In agrolandscapes with favorable ecology, the EBC is close to one (ESC = 0.9-1.0), the situation in water management and irrigated agriculture in these lands will not affect the hydrogeochemical processes in the soil.

II type - agrolandscapes of an acceptable ecological level (ESC = 0.8-0.9). In these areas, the ecological situation will deteriorate by 10-20%.

III type – areas whose ecology has fallen to the lowest limit of the acceptable level. Here, hydrogeochemical processes are disturbed up to 50% and more strongly compared to type I lands. In order to evaluate the agro-ecological condition in our studied object, we used the methodology proposed by A.N. Nig'matov, M.J. Matchanov, based on the general salinity in the 0-1 meter layer of the soil as a stable indicator. V.A. Kovda (1961), M.A. Pankov (1964) and other scientists believe that soil salinity with chloride-sulfate salts does not have a negative effect on the development of agricultural crops if it does not exceed 0.25%.

Therefore, such areas can be rated as 100 points (safe). Compared to this score, the salinity is 0.25-0.38%; 0.38-0.76%; We calculated the average value for the areas with salinity of 0.76-1.53% and above 1.53% and limited it to 100, 66, 33, 16 and 12 points. As a result, the degree of agro-ecological hazard of soils in regional geosystems was determined (Table 1).

1-table

Assessment of the level of agroecological hazard in the geosystems of the Syrdarya region

№	State of danger	Risk score	The amount of salinity (in % of dry residue)	Chloride-sulfate salinity даражаси (score)	Classification of soil salinity V.A.Kovda, V.V.Egorov (dry residue %)
1	Safe	100	<0,25	100	Do not salt (<0,25)
2	Dangerous	99-66	0,25-0,38	66	Low salted (0,25-0,4)
3	Moderately dangerous	65-33	0,38-0.76	33	Moderately salty (0,4-0,7)
4	High Dangerous	32-16	0.76-1.53	16	Strongly salted (0,7-1,2)
5	Emergency dangerous	16	>1.53	<12	(>12)

Other indicators that determine the level of agro-ecological danger in the region, that is, the level of underground water, the level of mineralization of surface and seepage water, are taken into account above in the water-salt balance equations.

Since they are directly involved in soil salinization, these indicators were not separated. For this reason, it was not reflected in the map of agro-ecological risk of soil salinity of Syrdarya region.

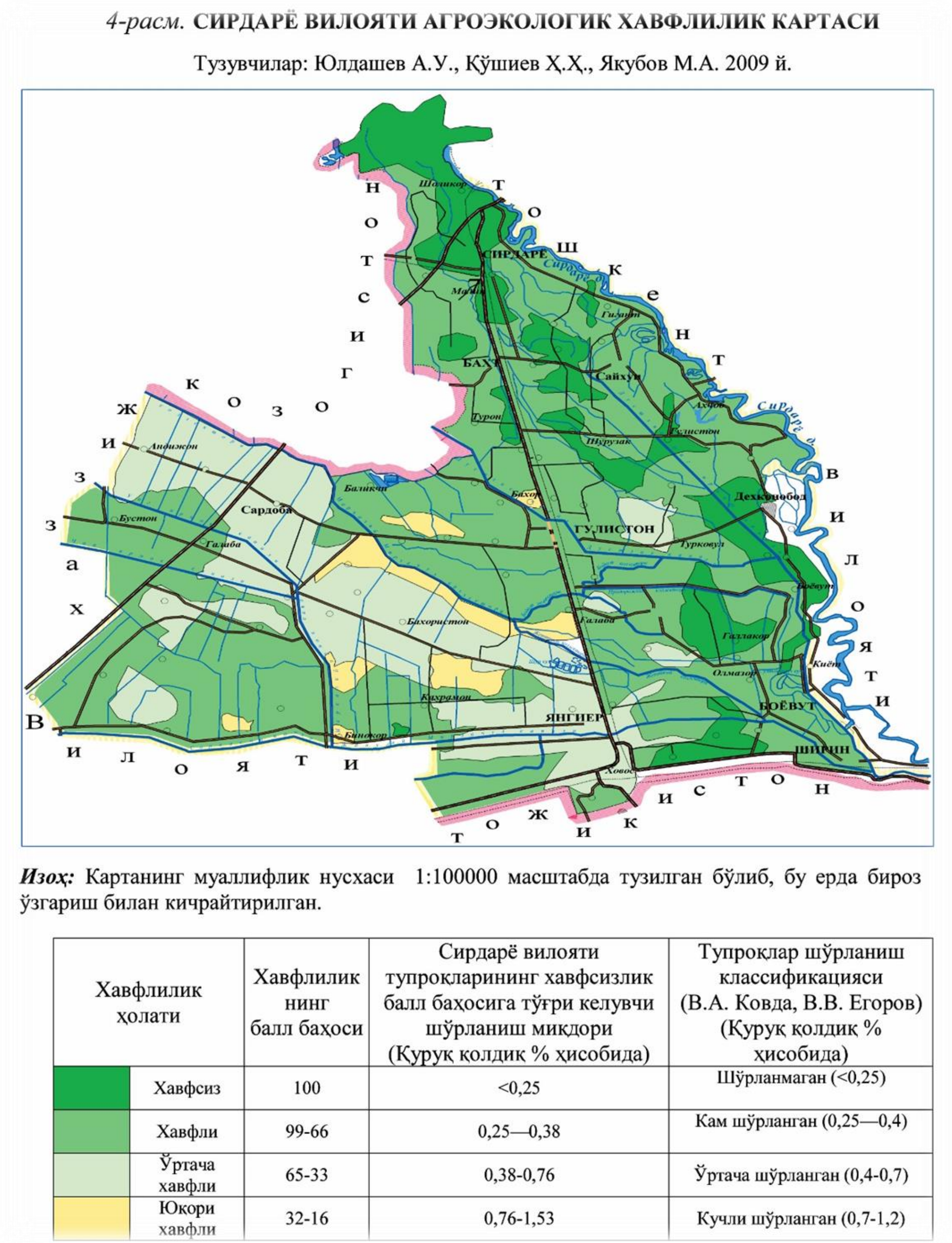
The analysis described above shows that factors such as the limitation of water resources, the change in the regime of use of large water reservoirs built in the basin promote the widespread introduction of new technologies that save existing water resources and the use of advanced methods in the management of soil reclamation in geosystems.

Foreign scientists pay a lot of attention to scientific research on the rational use and conservation of water resources (M. Parkin (1990), McConnel C., Brue S. (1990), Wonnacott P. et al. (1990), Begg (1991).

The problem of water conservation is wide-ranging and includes the following areas: improvement of irrigation techniques and technology, management of soil reclamation regime using collectors, increasing soil fertility using agrotechnical measures, etc.

The main expected result of these activities is to achieve the maximum result by reducing the unit of water used for each quintal of crop or other product.

Technologies that help to save water in the cultivation of any product unit are known from the world experience, and the most common methods are: subsoil irrigation, drip and rain irrigation, leveling using laser equipment, etc.



Хавфлилик ҳолати		Хавфлилик нинг балл баҳоси	Сирдарё вилояти тупроқларининг хавфсизлик балл баҳосига тўғри келувчи шўрланиш миқдори (Қуруқ қолдиқ % ҳисобида)	Тупроқлар шўрланиш классификацияси (В.А. Ковда, В.В. Егоров) (Қуруқ қолдиқ % ҳисобида)
	Хавфсиз	100	<0,25	Шўрланмаган (<0,25)
	Хавфли	99-66	0,25—0,38	Кам шўрланган (0,25—0,4)
	Ўртача хавфли	65-33	0,38-0,76	Ўртача шўрланган (0,4-0,7)
	Юқори хавфли	32-16	0,76-1,53	Кучли шўрланган (0,7-1,2)

4-table. Agro-ecological risk map of Syrdarya region

Compilers: Yuldashev A.U, Kushiev Kh.Kh, Yakubov M.A .2009.

Explanation; Author's copy of the card 1:100000 It is built to scale, here it is zoomed out with a little zoom.

State of danger	Risk score	Soils of Sirdarya region the security score is reasonable amount of noise (Dry weight in %)	Soil salinity classification (V.A Kovda , V.V Egorov) (Dry weight in %)
safe	100	<0,25	Unsalted

dangerous	99-66	0,25-0,38	lightly salted
medium dangerous	65-33	0,38-0,76	moderately salted
high dangerous	32-16	0,76-1,53	strongly salted

As a result of summarizing the works of the above-mentioned scientists, the potential of various technologies in saving water was evaluated (Table 2).

Many years of experience of foreign and local experts were also summarized. At the same time, water-saving technological methods that do not require additional investment have been identified, including: selection of optimal irrigation elements, irrigation with alternating current in water circulation, covering the paddy with a film, etc.

2-table

Assessment of the possibilities of advanced technologies in water saving

Irrigation method	The slope of the land	Type of crops	Amount of water saved, m^3/ha
Drip irrigation	> 0,05	grapes	1990-2040
	0,025 - 0,05	grapes	4000
		cotton	5500
	0,0075 - 0,025	cotton	2400
	0,0025 - 0,0075	cotton	3000-5200
	0,001 - 0,0025	cotton	2340-3090
Wetting from the ground	0,001 - 0,0025	cotton	1100-1300
Sprinkler irrigation	0,0025 - 0,0075	cotton	22-3050

On this basis, calculations related to the effective use of water in irrigation and the use of cost-effective methods and technologies for the natural conditions of the Syrdarya region were made. The calculations show that the application of such technologies, for example, as a result of improving the elements of drip irrigation and furrow irrigation, it is possible to reduce the water deficit during the growing season by approximately 30-40%.

The field studies conducted in the experimental areas proved that the use of such methods and technologies increases the possibility of preventing the secondary salinization of the soil in cultivated fields by saving water as well as stopping the rise of seepage water in the region of Sirdarya region, where the problem of water shortage and soil salinity is acute.

Measures to reduce soil salinity. It is known from world practice that one of the effective methods of combating soil salinity is the implementation of autumn-winter salt washing on the basis of a well-functioning ditch-collector.

The theoretical and practical basis of calculating the salt washing rates are well covered in many scientific works.

Various scientific organizations and experts (Central Asian Research Institute of Irrigation CARII, UzPITI, Uzmeliosuvloyiha, Soil science and agrochemistry SRI) Based on the analysis of salt leaching norms, which were developed taking into account the mechanical composition, type and salt reserve of the soil for the conditions of Mirzachol, and based on our field research, the norms for salt leaching of the land of Syrdarya region were developed (Table 3).

3-table

Recommended standards for salt washing of lands of Syrdarya region (based on data of Central Asian Research Institute of Irrigation CARII, UzPITI, Uzmeliosuvloyiha, Soil science and agrochemistry SRI experts)

The amount of salts in the upper layer, by solid residue, %	Types of salinity of soil layers			
	Chloride	Sulphate chloride	Chloride-sulphate	Sulphated
1	2	3	4	5
Soils with a light mechanical composition (salinity is quickly leached)				
$\alpha = 0{,}62$	$\alpha = 0{,}72$	$\alpha = 0{,}82$	$\alpha = 1{,}18$	
0,2-0,5	2,5	1,5	1,0	-
0,5-1,0	4,5	4,0	3,5	-
1,0-2,0	6,5	6,0	5,5	4,0
3,0-4,0	8,5	8,0	7,5	7,0
Medium-sandy, mixed composition, variable mechanical composition soils (moderately leachable salinity)				
$\alpha = 0{,}92$	$\alpha = 1{,}02$	$\alpha = 1{,}12$	$\alpha = 1{,}48$	
0,0-0,5	4,0	3,0	1,0	-
0,5-1,0	6,5	5,5	4,0	-
1,0-2,0	9,5	8,5	7,5	4,5
2,0-3,0	11,0	10,0	9,5	7,0
3,0-4,0	12,0	11,5	11,0	9,0
Clay and hard sand soils (difficult to wash off salt)				
$\alpha = 1{,}22$	$\alpha = 1{,}32$	$\alpha = 1{,}42$	$\alpha = 1{,}78$	
0,0-0,5	5,0	35	1,5	-
0,5-1,0	8,5	7,0	5,5	-
1,0-2,0	12,0	11,0	10,0	5,5
2,0-3,0	14,5	13,5	12,0	8,5
3,0-4,0	15,5	15,0	14,0	11,0

In farms specializing in cotton, salt washing activities are usually planned for the autumn-winter months, and its optimal period includes the period from November 15 to January 30. Because by this period, vegetation irrigation is stopped, the depth of seepage water drops to 2.8-3.0 meters, and enough space is created in the aeration layer of the soil for salts to dissolve and wash down. In addition, labor and water resources are usually sufficient.

The main indicators of salt washing activities (rate, method and time) depend on several natural and economic factors: mechanical structure of the soil, filtration properties, drained land, amount and composition of salts, lithology, etc. The most important factor is the availability of sufficient and free water resources. In this sense, it is worth noting that, despite the change in the working regime of the large water reservoirs built in the Syrdarya basin, the amount of flow in the river is always sufficient in the winter period, and nothing prevents the implementation of salt washing works in the region as planned.

For many regions of our republic (including Syrdarya region), the norms of autumn-winter salt washing have been sufficiently studied with the help of field experiments and observations, and their results can easily be widely used in regions with similar natural and economic conditions (Table 3). With the help of this table, it is possible to determine the recommended rates and times of salt washing for the geosystems of the Syrdarya region, the degree and amount of soil salinity, as well as other indicators.

Today, the agro-ecological problems arising in connection with the rise in the level of groundwater, soil salinity, water scarcity, relief and climatic conditions of the Syrdarya region require special scientifically based solutions.

Based on this, it is advisable to use water-saving methods in irrigation, to use a complex agro-technological system suitable for agro-ecological conditions in the use of arable land, to develop and implement measures that prevent or reduce soil salinity.

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