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Issues concerning the use of anti-erosion measures in land management projects

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Abstract. Soil erosion is the process of erosion in the most fertile upper layers of soil and the atmospheric precipitation of underground rocks, as well as irrigation water, wind, and other effects. Natural soil erosion occurs relatively slowly, and the soil is restored in the process of natural formation. The article discusses the factors to be taken into account in the development of land management projects for eroded areas: the choice of soil composition and rotation systems and their placement, taking into account the level of erosion risk in the area; the design of irrigation plots; and the use of water-saving technologies and methods.

1. Introduction
Attention is paid to the effective use of available land resources to ensure food security in the world and to the implementation of targeted scientific research aimed at improving methods for organizing optimal use of agricultural land in areas where there is a risk of erosion in land management projects [3]. One of the important tasks in this regard includes the composition of land types required for land users and methods aimed at optimizing them, as well as improving the work of land management projects based on them.

2. Materials and Methods
The research was conducted on eroded lands of the Kashkadarya region and was aimed at improving irrigated areas and creating and exchanging arable land, taking into account the level of land erosion agricultural enterprises. The study used a wide range of monographic research and experimental design methods.

3. Results and Discussion
The natural and economic conditions of the Kashkadarya region have features that are more specific. These characteristics allow the region to grow a variety of agricultural crops and produce better agricultural products.

In 2020, a total of 50 farms operated in the massif, including 40 cotton-grain, 2 grain-vegetable, 3 horticultural, and 5 livestock. One of the main tasks of creating internal land plots in an agricultural enterprise is the organization of land types and their crop rotation. The organization of land types and crop rotations requires solving a number of internal related issues [1, 2]. The main purpose of organizing land types and crop rotation is to increase the intensity of land use and the efficiency of cultivation, taking into account the economic interests of landowners and land users. In this instance, stringent adherence to environmental regulations is required because, otherwise, soil fertility would decline and erosion and degradation processes would occur.

The composition of farming land was decided based on the above requirements, and their areas were calculated and located on the territory.

After the placement of land types and crop rotation areas in the territory of the massif, the territory of each alternating sowing massif was established, in which irrigation (working) plots, fields, field roads, and shelter trees were placed. Because the massif is in a saline area, drainage on these lands should be located between two adjacent irrigation ditches that are either permanently or temporarily operational.

In Table 1, on recommendation of V. M. Legostaev, the approximate distances between the drains for cotton farms are indicated.

Table 1. Approximate distances between drains at a depth of 2–2.5 m*.

The level of soil salinity	**depth of groundwater, m**		**The distance between drains, "L", m**		
	before watering and washing	**after washing the saline**	**Heavy mechanical content soil**	**Medium mechanical content soil**	**Light mechanical composition soil**
1	**2**	**3**	**4**	**5**	**6**
Less	2–3	1–2	The devices of private collectors are located at low levels		
Medium and strong 400-600	2–3	1–2	250–300	300–400	400–600
Weak 500-600	1–2	1–2	300–400	400–500	500–600
Medium and strong 300-400	1–2	1–2	200–250	250–300	300–400
Weak 250-350	0–1	1–2	150–200	200–250	250–350
Medium and strong 200-300	0–1	1–2	100–150	150–200	200–300

Using Table 1, the distance between the drains was determined and the width of the irrigated area (V = L/2), then its area was calculated according to the following expressions:

$$P = \frac{B^2 K}{10000} \tag{1}$$

where: K is the ratio of the field length to the width.

$$(K = \frac{A}{B}). \tag{2}$$

Based on this formula, using the data in Table 2, the optimal dimensions of irrigated fields with different levels of salinity, depth of groundwater and mechanical composition of the soil were determined (Table 2).

Table 2. Optimal dimensions of irrigated fields.

The level of soil salinity	Depth of groundwater, m		Optimal size of irrigated fields, hectares		
	Before watering and washing	**After washing the saline**	**Heavy mechanical content soil**	**Medium mechanical content soil**	**Light mechanical composition soil**
1	**2**	**3**	**4**	**5**	**6**
Less	2–3	1–2		16–36	
Medium and strong 400–600	2–3	1–2	4.1–5.9	7.2–10.4	16.2–23,4
Weak 500–600	1–2	1–2	7.2–10.4	11.3–16.3	16.3–23.4
Medium and strong 300–400	1–2	1–2	2.8–3.4	4.1–5.9	7.2–10.4
Weak 250–350	0–1	1–2	1.8–2.6	2.8–4.1	5.5–8.0
Medium and strong 200–300	0–1	1–2	1.0–1.5	1.8–2.6	4.1–5.9

The size of irrigated areas in the areas that are dangerous for erosion is affected by the erosion protection conditions of this territory. In the case of wind erosion, the range of distances in the area of protective forest belts has a limiting effect, and in the case of irrigation erosion, the permissible length and flow rate of irrigation furrows [11].
Table 3 shows the findings of our study to identify the best size of irrigated areas on land prone to irrigation erosion.

According to the experts [4, 5, 6, 9, 10], in some cases, the decrease in crop yields along with their simultaneous enrichment is associated with the problem of water scarcity. To address this issue, energy-saving technology must be used in the irrigation system, as well as water waste prevention.

The advantage of drip irrigation technology is that with this method of irrigation, the soil moisture and the amount of water supplied to create it are controlled, and the water is evenly distributed throughout the field in accordance with the specific time needs of each crop. Drip irrigation, unlike other irrigation technologies, generates a water-physical environment that is ideal for the plant in the soil layer where the crop's root grows [7, 8].

Table 3. Recommended optimal areas of the irrigated fields.

Mechanical composition of soil, water permeability	**Water consumption of site water distributors, l/s**	**Areas of irrigation fields, hectares**			
		0.01	0.007	0.002	0.005
1	**2**	3	4	5	6
Sand and light sand are strongly permeable	200	18.0	18.0	18.0	18.0
	250	21.0	22.5	24.0	22.5
	300	24.0	27.0	30.0	27.0
Light strong sand, high permeability	200	18.0	18.0	18.0	22.5
	250	22.5	24.0	27.0	30.0
	300	27.0	30.0	27.0	30.0
Medium sand, moderately permeable	200	21.0	15.0	18.0	27.0
	250	26.2	22.5	27.0	27.0
	300	31.5	30.0	27.0	36.0
Heavy soil, low water permeability	200	18.0	18.0	12.0	21.0
	250	24.0	27.0	24.0	21.0
	300	30.0	27.0	24.0	31.5

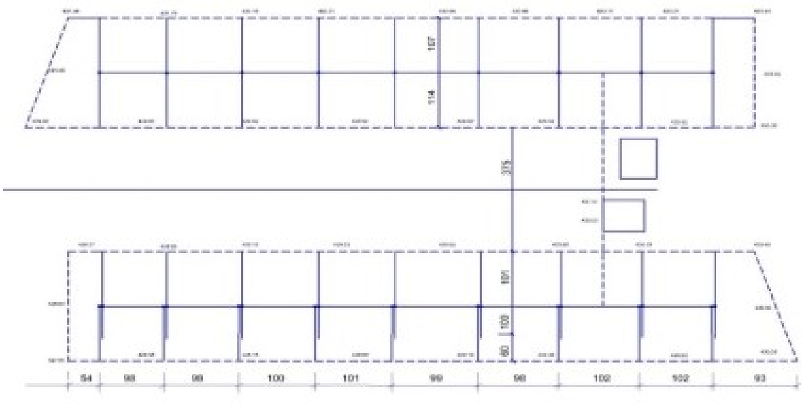

Figure 1. Depicts a ground-based scheme of applying the drip irrigation system.

The effectiveness of internal land management for the farm is reflected in the environmental, economic, and social spheres. Irrigated lands in the Kashkadarya region fall from 5 cadastral zones to 4 cadastral zones. Due to its physical limitations and the difficulty of restoration, its economical and efficient use of land is the most important and topical issue. There are 24.4 thousand hectares of irrigated arable land in the region, all of which is in the agricultural sector. According to a 1999 survey, the average quality score of soil in the province is 51 points. This is a decrease of 3.5 points compared to 1991. Crop rotation, increased attention to seed and selection, irrigation technologies, improved land reclamation efficiency, and mechanization in cadastral zones are all necessary to overcome the aforementioned drawbacks.

Table 4. Comparative data for estimating the location of fields and irrigation plots by the example of Z. Farmonov farm*.

No.	Indicators	I per year of land formation	II according to the project
1	2	3	4
1	Land use coefficients (LUK)	95.37	98.32
2	Crop rotation area, hectares	90.9	93.75
3	Area under roads, hectares	0.9	0.3
4	Net area of arable land, hectares	90.0	93.45
5	Number of working plots	4	4
6	Average area of the working plot, hectares	22.73	23.44
7	Distance between the longest sections, km	1050	1050
8	Average processing distance, m	740	860
9	Slope in the working direction, %	13.3	9.1
10	Total area of the rotation lanes, hectares	15.2	8.21

*Calculations of 2020 year.

4. Conclusion

The above analysis leads to the following conclusions:

1. The quality of land is taken into account according to the characteristics that determine its value as a natural resource and a means of production. Such characteristics include the description of soils in terms of soil, vegetation, and relief structure, the degree of water and wind erosion of the soil, information on waterlogging, salinity, nutrient availability, and so on. These factors should be taken into account when drawing up plans for the efficient use of land resources.
2. Areas with erosion should have their own specialization and concentration of production. Therefore, it is necessary to develop a set of measures for land management to create regional conditions for land use in the territory of erosion zones rather than on farms, where the organization of the production of raw cotton is carried out.
3. In irrigated eroded lands, the area of irrigation plots depends on the slope of the land plot and should be calculated as 6.3-26.7.
4. In saline soils, the size of the irrigated area is affected by the level of salinity of the soil and the level of groundwater. The results of our research showed that they should be calculated for 16.0–36.0 in non-saline soils, 16.3–23.4 in low-salinity soils, and 7.2–10.4 in moderately saline soils.
5. As a result of the use of “water-saving” technologies on the area of 42 hectares in the territory of the farm Z. Farmonov in the massif, water consumption per hectare decreased by 30–40% and production costs by 20–25%. The efficiency rate increased by 22%.

As a result of the effective implementation of the above measures, farms using agricultural lands will have the opportunity for sustainable development, and their level of profitability will increase.

References

[1] Avezbaev S and Volkov S N 2004 *Design of Land Management* (Tashkent: Generation of the new century)
[2] Avezbaev S and Volkov S N 2002 *Economy of Land use* (Tashkent: Generation of the new century)

[3] Muller T G, Peirce F S and Ernke D D 2001 Map quality for site-specific fertility management *Soil Sci. Soc. Am. J.* **65** 1547–1558
[4] Khakberdiev A E 2008 *Erosion-Prone Irrigated Lands of the Samarkand Oasis and Ways to Increase Their Anti-Erosion Resistance* (Tashkent)
[5] Pronin V V 2002 Agrolandscape approach to the organization of the land use area in areas of manifestation of water soil erosion *Agrarian science* **4** 16–18
[6] Konokotin I G 1996 *Ecological and Economic Substantiation of the Anti-Erosion Organization of the Territory* (Moscow: GUZ)
[7] Kuznetsov M S 1996 *Erosion and Soil Conservation* (Moscow: MGU)
[8] Ji Zhou, Bojie Fu, Dongchun Yan, Yihe Lü, Shuai Wang and Guangyao Gao 2019 Assessing the integrity of soil erosion in different patch covers in semi-arid environment *Journal of Hydrology* **571** 71–86
[9] Blinkov I, Kostadinov S and Marinov I T 2013 Comparison of erosion and erosion control works in Macedonia, Serbia and Bulgaria *International Soil and Water Conservation Research* **1 (3)** 15–28
[10] Aafaf El Jazouli, Ahmed Barakat, Rida Khellouk, Jamila Rais, Mohamed El Baghdadi Remote sensing and GIS techniques for prediction of land use land cover change effects on soil erosion in the high basin of the Oum Er Rbia River (Morocco) *Remote Sensing Applications Society and Environment* **13** doi: 10.1016/j.rsase.2018.12.004
[11] Shuai Yang, Zhao-liang Gao, Yong-hong Li, Yao-bin Niu, Yuan Su and Kai Wang 2019 Erosion control of hedgerows under soils affected by disturbed soil accumulation in the slopes of loess plateau *CATENA* **181**
[12] Samosa C, Altiev A, Khafizova Z and Mukumov A 2021 Methodology for determining the costs of environmental protection measures in land management *European Journal of Life Safety and Stability* **2660**
[13] Mukumov A, Xujakeldiev K, Xamidov F, Narbaev Sh and Abdivaitov Kh 2021 Features of the organization of agroclusters in the structure of land management projects *E3S Web of Conferences* **227** 01003
[14] Adizov Sh B and Karimov E Q 2020 Ways to increase the effective use of lands of personalities and dekhan economies in the bukhara region *Agroprotsessing* **2** 29
[15] Shuhrat A, Behzod A, Mironshoh M and Azizbek A 2021 Further development of the lemon industry in Uzbekistan and further improvement of the introduction of innovative technologies in this area *E-Conference Globe* **7** 261–263
[16] Adizov S B, Obidovich A B and Maxmudov M M 2021 Rights and responsibilities of the spouses *Academic Journal of Digital Economics and Stability* **7** 10
[17] Khudoyberdiyev F Sh, Bobojonov S U and Mukhamadov K M 2021 Innovative approach to pasture management and productivity improvement *Academicia Globe: Inderscience Research* **2.05** 491–494
[18] Egamova D A, Shukurova N O and Ahmadov B O 2020 Efficient and rational use of land resources is a requirement of the time *Efficiency of application of innovative technologies and equipment in agriculture and water management* **3** 327–328
[19] Egamova D A, Bobojonov S and Muhamadov Q M 2021 Improvement of measures to improve soil reclamation in bukhara region *Student Gazette* **18** 92
[20] Karimov E K 2021 Change in the properties of desert-sandy soils of the Vabkent district under the influence of irrigation *Actual Problems of Modern Science* **4** 101–103