PROJECT

Transboundary water management adaptation in the Amudarya basin to climate change uncertainties

Report

2.2. Analysis of country development programs

2.2a. Analysis of long-term strategy (programs) and forecast indicators of agricultural development until 2050 in the planning zones in the Amudarya basin

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The analysis of long-term strategy (programs) and forecast indicators of agricultural development by 2050 in the planning zones in the Amudarya basin

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I. BASIC CONCEPTS

Research objective and tasks

The objective is conducting the analysis of long-term country agricultural development strategies in the Amudarya basin and, thus forecasting changes in crop production, irrigated areas and yield taking into account implementation of innovative irrigation technologies, as well as calculating livestock population and animal production. The research also aims at determining the level of population provision with basic items of foodstuff.

Given that, the following **tasks** were set:

– To analyze the long-term country agricultural development strategy in the Amudarya basin.

– To calculate population growth for 2020-2050 in the Amudarya basin.

– To forecast agricultural development (changes in crop and animal production, irrigated areas and yield) for the period 2020-2050 in the Amudarya basin.

– To forecast the level of population provision with basic items foodstuff for 2020-2050 in the Amudarya basin.

Research methodology

The methodology is based on systematic approach and dialectical method, which in dynamics allow considering patterns and processes related to state regulation, as well as to the long-term country agricultural development strategy.

In the research, various methods were applied: abstract-logical one, systematization and classification, expert evaluation, analysis and synthesis, statistical analysis, comparison, plotting time series, and plotting trend lines (approximation and smoothing).

The sequence of forecast calculations

The forecast indicators of agricultural development in the Amudarya basin until 2050 were developed on the basis of the three scenarios – BAU, FSD and ESA. Here, the BAU scenario refers to maintaining the current tendencies in agriculture, the FSD scenario refers to ensuring food security and the ESA scenario refers to export oriented sustainable adaptation of agriculture in the Amudarya basin.

The sequence of forecast calculations is as follows:

– the forecast population in the Amudarya basin is calculated;

– targets for optimization of cropping patterns for the main crops are identified;

– indicators of crop yields are identified for particular crop types through econometric calculations and taking into account implementation of innovative irrigation systems;

– gross output for particular crop types is calculated;

– livestock population and animal production are calculated;

– provision of population with basic items of foodstuff is calculated based on coefficients of conversion of raw materials into foodstuff, on agricultural output and the population size.

Major criteria of forecast calculation:

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It should be noted that in all three scenarios – BAU, FSD and ESA, the forecast irrigated area is equal to the total irrigated area for the recent years and it is assumed that it is unchanged in the Uzbek part, whereas the development of new lands is considered in the Tajik part.

FSD scenario:

- maximum production for food self-sufficiency;

- increased crop and animal production according to population growth;

- increased livestock population contributing to livestock production (meat, milk and eggs), thereby increasing self-sufficiency with livestock products;

- growing total crop production export, earnings of which facilitates development of other agricultural spheres (mainly, livestock);

- intensive adoption of innovative water and other resource saving technologies according to food security strategy.

ESA scenario:

- maximum food export;

- keeping food self-sufficiency of population at 80%;

- increasing agricultural production rates based on currency earnings from export;

- adoption, as maximum as possible, of innovative water and other resource saving technologies through export earnings.

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II. ANALYSIS OF LONG-TERM COUNTRY AGRICULTURAL DEVELOPMENT STRATEGY (PROGRAMS) IN THE AMUDARYA BASIN

In **Uzbekistan**, long-term development programs are adopted and being implemented in all economic sectors, including agriculture. Proceeding from the research tasks, we will try to analyze the main aims and forecast parameters of agricultural development strategies by 2020.

1.   In order to further implement economic reforms in agriculture, ensure effective and rational use of valueless land and water resources through the optimization of cropping patterns, introduction of advanced agronomic practices, as well as enhancement of economic efficiency and financial sustainability of farms, and increase export potential of the sector in Uzbekistan, a Program for agricultural reformation and development was adopted for 2016-2020[1].

The Program stipulates the optimization of irrigated areas under cotton and cereal in provinces in Uzbekistan by 2020. Based on the optimization, the target parameters of cropping patterns by 2020 were adopted for the land areas that were previously used for cotton and grain. These target parameters broken down into provinces in the Amudarya basin are shown in Tables 1 and 2.

Table 1

Target parameters of cropping patterns by 2020 for the land areas that were previously used for cotton, broken down into provinces in the Amudarya basin

Territory	Areas that were previously used for cotton, thousand ha	Cropping pattern by 2020, thousand ha					
		Potato	Vegetables	Intensive orchards	Fodder crops	Oil-bearing crops	Other crops
Republic of Karakalpakstan	7.0	1.5	2.2	0.5	0.7	0.9	1.2
Bukhara province	10.0	2.4	5.1	0.6	0.7	0.8	0.4
Kashkadarya province	18.4	2.3	8.2	1.5	3.3	1.6	1.5
Navoiy province	3.4	0.5	1.4		1.0	0.5	
Surkhandarya province	14.3	3.0	6.5	1.3	2.0	1.0	0.5
Khorezm province	8.8	0.4	4.8	0.3	1.5	0.9	0.9
Total in the Amudarya basin	**61.9**	**10.1**	**28.2**	**4.2**	**9.2**	**5.7**	**4.5**

Table 2

Target parameters of cropping patterns by 2020 for the land areas that were previously used for grain and cereals, broken down into provinces in the Amudarya basin

Territory	Areas that were previously used for grain and cereal, thousand ha	Cropping pattern distribution by 2020, thousand ha				
		Vegetables	Intensive orchards	Fodder crops	Oil-bearing crops	Other crops
Republic of Karakalpakstan	-	-	-	-	-	-
Bukhara province	5.0	2.0	0.6	2.4	-	-

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[1] The Decree of the President of the Republic of Uzbekistan of 29.12.2015 №PD-2460 "On measures for further reforms and development of agriculture for 2016-2020".

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Territory						
Kashkadarya province	4.0	1.5	0.3	1.8	0.2	0.2
Navoiy province	-	-	-	-	-	-
Surkhandarya province	5.0	2.2	0.5	2.0	0.2	0.1
Khorezm province	-	-	-	-	-	-
Total in the Amudarya basin	**14.0**	**5.7**	**1.4**	**6.2**	**0.4**	**0.3**

At the same time, the Program defines the forecast parameters of livestock population growth for 2016-2020 (Table 3).

Table 3

Forecast parameters of livestock population growth for the period 2016-2020 broken down into provinces in the Amudarya basin

Territory	2015 (actual)	2016	2017	2018	2019	2020	Difference 2020 compared to 2015 (+:-)
Cattle, thousand of heads							
Republic of Karakalpakstan	955	1,032	1,090	1,165	1,255	1,351	396
Bukhara province	1,132	1,170	1,223	1,280	1,340	1,407	275
Kashkadarya province	1,405	1,470	1,540	1,615	1,693	1,772	367
Navoiy province	415	435	457	482	507	536	121
Surkhandarya province	850	890	930	970	1,015	1,065	215
Khorezm province	824	863	890	930	1,005	1,081	257
Total in the Amudarya basin	**5,581**	**5,860**	**6,130**	**6,442**	**6,815**	**7,212**	**1,631**
Small ruminants, thousand of heads							
Republic of Karakalpakstan	900	930	968	1,013	1,065	1,127	227
Bukhara province	1,886	1,950	2,015	2,085	2,165	2,255	369
Kashkadarya province	4,268	4,443	4,616	4,815	5,022	5,242	974
Navoiy province	1,801	1,850	1,913	1,991	2,075	2,175	374
Surkhandarya province	2,024	2,110	2,205	2,300	2,400	2,502	478
Khorezm province	390	400	412	430	455	490	100
Total in the Amudarya basin	**11,269**	**11,683**	**12,129**	**12,634**	**13,182**	**13,791**	**2,522**

2. To extend the range of products, increase production volume and export of high-quality competitive foodstuff with high added value through accelerated development of raw material base, construct new and improve existing production facilities for agricultural processing with involvement of foreign investments, create modern trade and logistic centers and refrigerating chambers for keeping and processing of fruits and vegetables, a Program for development of raw material base, processing of fruits and vegetables and meat and dairy products, increase of food production and export in 2016-2020 was adopted[2].

3. To further reclaim land, develop a network of drainage and irrigation systems, ensure rational and wise use of water resources, achieve sustainable agricultural production, improve soil fertility and increase crop

[2] The Decree of the President of the Republic of Uzbekistan of 05.03.2016 № PD-2505 " On measures for further development of raw materials base, recycling of fruit and vegetables and meat and dairy products, increase of food production and export in 2016-2020".

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yields, a Program for improvement of land reclamation and rational use of water resources for 2013-2017 was adopted[3]. Relevant Government Decree was issued in addition to the Program[4].

The Program defines the target figures of implementation of drip irrigation in 2013-2017, as well as of portable flexible hose irrigation and furrow irrigation under polyethylene film for 2014-2017. The monitoring results of the Program show that the target figures (or forecast parameters) were fulfilled by 2015[5]. Below are the forecast parameters of implementation of drip irrigation (Table 4), portable flexible hose irrigation (Table 5) and furrow irrigation under polyethylene film for the period 2016-2017 (Table 6).

Table 4

Forecast parameters (target figures) of implementation of drip irrigation for 2016-2017 broken down into provinces in the Amudarya basin

Territory	Forecast for 2016-2017, ha	Of which, ha:	
		2016	2017
Republic of Karakalpakstan	90	40	50
Bukhara province	360	180	180
Kashkadarya province	1,800	880	920
Navoiy province	540	260	280
Surkhandarya province	1,250	620	630
Khorezm province	90	40	50
Total in the Amudarya basin	**4,130**	**2,020**	**2,110**

Table 5

Forecast parameters (target figures) of implementation of portable flexible hose irrigation for 2016-2017 broken down into provinces in the Amudarya province

Territory	Forecast for 2016-2017, ha	Of which, ha:	
		2016	2017
Republic of Karakalpakstan	200	100	100
Bukhara province	1,800	900	900
Kashkadarya province	4,000	2,000	2,000
Navoiy province	800	400	400
Surkhandarya province	1,800	900	900
Khorezm province	200	100	100
Total in the Amudarya basin	**8,800**	**4,400**	**4,400**

Table 6

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[3] The Decree of the President of the Republic of Uzbekistan of 19.04.2013 № PD-1958 "On measures for further reclamation of land and rational use of water resources in 2013-2017".

[4] The Decree of the Cabinet of Ministers of the Republic of Uzbekistan of 24.02.2014 № 39 "On additional measures for implicit implementation of the State Program for reclamation of land and rational use of water resources in 2013-2017".

[5] Materials of the Ministry of Agriculture and Water Resources of the Republic of Uzbekistan on monitoring of implementation of water-saving irrigation technologies in agriculture.

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Forecast parameters (target figures) of implementation of furrow irrigation under polyethylene film for 2016-2017 broken down into provinces in the Amudarya province

Territory	Forecast for 2016-2017, ha	Of which, ha:	
		2016	2017
Republic of Karakalpakstan	350	150	200
Bukhara province	2,100	1,000	1,100
Kashkadarya province	4,900	2,000	2,900
Navoiy province	1,300	500	800
Surkhandarya province	2,200	1,000	1,200
Khorezm province	350	150	200
Total in the Amudarya basin	**11,200**	**4,800**	**6,400**

4. To implement the set of measures for preservation and strengthening of population health, prevention of diseases, as well as creation of necessary conditions for meeting the needs of various population groups for healthy nutrition, the Concept and Set of measures ensuring healthy nutrition of the population in the Republic of Uzbekistan was adopted for 2015-2020[6].

5. The forecast indicators (target figures) of the Uzbekistan Development Strategy until 2030 were also analyzed.

Since independence, comprehensive agricultural reforms have been undertaken in **the Republic of Tajikistan**. However, there are some problems and shortcomings in country agricultural development. As a result, a Program on development and further reformation of agriculture was adopted by 2020. We will analyze the basic agricultural strategies by 2020.

1. To increase the profitability and cost-effectiveness of agricultural production through rational use and sustainable management of natural resources and ensure food security, a Program of agricultural reforms was adopted in the Republic of Tajikistan by 2012-2020[7].

This Program is focused on the improvement of profitability of dekhkan (peasant) farms through free choice of crops and cropping patterns, selling of products in the chosen places, according to the market principles of demand and supply and without any interference from outside, as well as equal access to land and water. These imply ensuring food security and healthy nutrition for the population (in particular, for vulnerable groups).

2. To rehabilitate non-used lands in agriculture and expand irrigated areas, improve the efficiency of country agricultural production, create jobs in rural area and, based on this, improve the lives of population, a State Program for the development of new irrigated area and rehabilitation of non-used land in agriculture was adopted in the Republic of Tajikistan for 2012-2020[8].

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[6] The Decree of the Cabinet of Ministers of the Republic of Uzbekistan of 29.08.2015 № 251 "On approval of the Concept and Set of measures ensuring healthy nutrition of population in the Republic of Uzbekistan for 2015-2020."

[7] The Decree of the President of the Republic of Tajikistan of 01.08.2012 № 383 "On approval of the Program for agricultural reforms in the Republic of Tajikistan for 2012-2020."

[8] The Decree of the Government of the Republic of Tajikistan of 31.08.2012 № 450 "On approval of the State Program for the development of new irrigated area and rehabilitation of non-used lands in agriculture in 2012-2020."

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The program set the plan for development of new irrigated land for 2012-2020 in the Republic of Tajikistan. The target for development of new irrigated land for 2015 was fulfilled. Below is the plan for development of new irrigated land for 2016-2020 in Tajikistan (Table 5).

Table 5

Plan for development of new irrigated land for 2016-2020, particularly through the state investment projetcs in the Republic of Tajikistan, ha

Territory	2016	2017	2018	2019	2020	Total for 5 years
Gorno-Badakhshan Autonomous Region	100	100	120	100	170	590
Districts of Republican Subordination	380	250	320	260	310	1,520
Khatlon province	-	1,750	2,167	2,167	2,167	8,251
Total in the Amudarya basin	**480**	**2,100**	**2,607**	**2,527**	**2,647**	**10,361**

3.   To further develop horticulture and viticulture, supply internal market with fruits and grapes, increase export, ensure food security of the country, increase the well-being of population and reduce the poverty, a Program for development of horticulture and viticulture for 2016-2020 was adopted in the Republic of Tajikistan[9].

The Program includes forecast indicators (target figures) on development of new orchards, particularly intensive fruit production and vineyards for 2016-2020 in the Republic of Tajikistan. The forecast indicators broken down into provinces in the Amudarya basin are given in Tables 5, 6 and 7.

Table 5

Indicator on new orchards for 2016-2020 broken down into provinces in the Amudarya basin, ha

Territory	2016	2017	2018	2019	2020	Total for 5 years
Gorno-Badakhshan Autonomous Region	54	60	65	70	76	325
Districts of Republican Subordination	1,470	1,475	1,489	1,484	1,493	7,411
Khatlon province	1,050	1,061	1,069	1,010	1,020	5,210
Total in the Amudarya basin	**2,574**	**2,596**	**2,623**	**2,564**	**2,589**	**12,946**

Table 6

Indicator on new vineyards for 2016-2020 broken down into provinces in the Amudarya basin, ha

Territory	2016	2017	2018	2019	2020	Total for 5 years
Gorno-Badakhshan Autonomous Region	-	-	-	-	-	-
Districts of Republican Subordination	322	323	321	319	320	1,605
Khatlon province	96	109	102	97	106	510
Total in the Amudarya	**418**	**432**	**423**	**416**	**426**	**2,115**

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[9] The Decree of the President of the Republic of Tajikistan of 30.12.2015 № 793 "On the Program for development of horticulture and viticulture in the Republic of Tajikistan in 2016-2020".

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Table 7

Indicator on intensive orchards for 2016-2020 broken down into provinces in the Amudarya basin, ha

Territory	2016	2017	2018	2019	2020	Total for 5 years
Gorno-Badakhshan Autonomous Region	2.0	2.0	2.0	2.0	3.0	11.0
Districts of Republican Subordination	39.0	51.0	62.0	80.0	85.0	317.0
Khatlon province	5.0	10.0	20.0	22.5	22.5	80.0
Total in the Amudarya basin	**46.0**	**63.0**	**84.0**	**104.5**	**110.5**	**408.0**

4. As well as forecast indicators of other internal and local authorities in the Republic of Tajikistan.

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III. ANALYSIS OF FORECAST INDICATORS OF AGRICULTURAL DEVELOPMENT AND FOOD PROVISION IN THE PLANNING ZONES IN THE AMUDARYA BASIN

Please, refer to the Russian version of the Report for detailed analysis.

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IV. CONCLUSIONS ON ALL PLANNING ZONES IN THE REPUBLIC OF UZBEKISTAN

1. Growth of population, changes in demographic pattern and significant increase of income in the future will result in substantial increase in food demand, as well as in the change of the nutrition patterns as a result of changed lifestyles and behavior. Thus, an increase in the share of fish, meat, eggs and vegetable oil and a decrease in the share of grain and sugar in the total food consumption are projected.

2. The forecast indicators of changes in irrigated area are calculated proceeding from the scenario tasks. On the one hand, it is necessary to reduce the areas under grain and use these lands for fodder crops, vegetables and potato. According to FSD scenario, the areas under fodder crops and maize will significantly increase to produce enough feedstuff for animals, especially for dairy production.

On the other hand, it is necessary to reduce unprofitable cotton areas and use these lands for fruits, vegetables, and cucurbits as their production is more profitable on these land areas. When optimizing cropping patterns in the future, the cotton areas will not be reduced significantly as secondary products as a result of cotton processing (meal, husks, etc.) provide with feedstuff for animals.

3. Crop yields may be increased through the change in irrigation technologies and transition to advanced technologies (drip irrigation and others), as well as because of quality, quantity and content of applied fertilizers; quality and schedule of field work; quality of seeds; change in crop varieties; control over plant diseases and pests; crop rotation, etc.

According to ESA scenario, export earnings will contribute to increased yields. Such earnings will allow implementing new irrigation technologies and using seeds, seedlings and fertilizers of higher quality, etc.

4. According to FSD and ESA scenarios, the production of main crops will increase and, accordingly, through sustainable growth of cotton and wheat yield, there will be insignificant decrease in production rate of these crops. The decrease in production will not affect agricultural development in this area as self-sufficiency with these crops is rather high.

5. According to FSD and ESA scenarios, the forecast indicators of increased livestock population and livestock products are calculated on the assumption of sufficient fodder supplies, increased fodder yields and sufficient volumes of secondary products (meal, husks, etc.) of raw cotton processing. However, the increase in meat, egg and dairy production does not provide the population with enough food according to the recommended rates almost in all planning zones of the Amudarya Basin until 2020. The total provision will be achieved by 2050.

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V. CONCLUSIONS ON ALL PLANNING ZONES IN THE REPUBLIC OF TAJIKISTAN

1. Growth of population, changes in demographic pattern and significant increase of income in the future will result in substantial increase in food demand, as well as in the change of the nutrition patterns as a result of changed lifestyles and behavior. Thus, an increase in the share of fish, meat, eggs and vegetable oil and a decrease in the share of grain and sugar in the total food consumption are projected.

2. The forecast indicators of changes in irrigated area are calculated proceeding from the scenario tasks. In order to ensure grain security in the future, the areas under wheat will not be reduced significantly. In particular, the areas that were previously used for wheat will be used for fodder crops, vegetables and potato. According to FSD scenario, the areas under fodder crops and maize will significantly increase to produce enough feedstuff for animals, especially for dairy production.

3. It is necessary to reduce unprofitable areas under cotton and use these lands for fruits, vegetables, cucurbits as their production is more profitable in these land areas. When optimizing cropping patterns in the future, the areas under cotton will not be reduced significantly as secondary products of cotton processing (meal, husks, etc.) provide with feedstuff for animals, especially for meat production.

In the mid-term, it is planned to develop new irrigated areas, in which new intensive orchards and vineyards will be created by applying water and other resource technologies.

4. Crop yields may be increased through the change in irrigation technologies and transition to advanced technologies (drip irrigation and others), as well as because of quality, quantity and content of applied fertilizers; quality and schedule of field work; quality of seeds; change in crop varieties; control over plant diseases and pests; crop rotation, etc.

According to ESA scenario, export earnings will contribute to increased yields. Such earnings will allow implementing new irrigation technologies and using seeds, seedlings and fertilizers of higher quality, etc.

5. According to FSD and ESA scenarios, the forecast indicators of increased livestock population and livestock products are calculated on the assumption of sufficient fodder supplies, increased fodder yields and sufficient volumes of secondary products (meal, husks, etc.) of raw cotton processing. However, the increase in meat, egg and dairy production does not provide the population with enough food according to the recommended rates almost in all planning zones of the Amudarya Basin until 2050.

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