Implementation stages, results and recommendations of the PEER-5 Project “Interstate Water Resource Risk Management: Towards A Sustainable Future for the Pyanj River Basin"

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What is the urgency of the problem and what is the reason for the study of climatic conditions, the state of water resources and glaciation of the Pyanj river basin?

- The Pyanj River is a main upstream tributary of the Amu Darya River.

  - Length: 921 km
  - Basin: 114000 km²
  - Discharge (aver): 1032 m³/sec
  - Glaciation Basin: 3767 km²

- The Pyanj River contributes approximately 50% to the Amu Darya’s water flow and is largely unregulated.
Amu Darya

Length: 2580 km
Basin area: 309000 km²

The area of irrigated land in the river basin of Central Asia:
3.5-4.0 Mln. ha

Cost-effective hydropotential of the river basin:
37.5 Bln. kW

Number of active reservoirs:
35

Total volume of water accumulation in reservoirs:
29.8 km³

Population of Central Asian countries in the river basin:
> 2 Mln. per
An in-depth analysis of the state of the Pyanj River Basin disclosed the following urgent problems:

- Transboundarity
- Demography
- Food security
I. Transboundarity

- After the stabilization of the political situation in Afghanistan, the problem of distribution of water resources in Central Asia will become urgent. According to world Bank estimates about 100 Th. ha of land in Northern Afghanistan are currently irrigated directly from the Pyanj transboundary river.

- According to various estimates, the potential growth of irrigated land in the Afghan territory in the basin about 500 Th. ha and by the use of pumping stations — up to 1.0 Mln. ha.
II. Demography

- 2015
- 2050

Mln. pers.

Kazakhstan
Kyrgyzstan
Tajikistan
Turkmenistan
Uzbekistan

22.4
17.6
8.2
14.2
5.9
8.4
5.3
6.5

by 2050 - more than 88 million people in comparison with 2015 it will increase by more than 90%
It is necessary to organize continuous monitoring of the hydrological characteristics of the Pyanj river and its tributaries.

Expand the network of hydrological observations of the Pyanj river and its tributaries both in Tajikistan and in neighboring Afghanistan.

Creation of a long term hydrological data Bank to create scenarios and forecasts based on real hydrological measurements.
## Dynamics of area changes of agricultural land and population of the Republic of Tajikistan

<table>
<thead>
<tr>
<th></th>
<th>1990</th>
<th>2015</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Area irrigated land, ha</td>
<td>710,000</td>
<td>594,000</td>
<td>-16.3%</td>
</tr>
<tr>
<td>Population, Mln. person</td>
<td>5.36</td>
<td>8.20</td>
<td>+53%</td>
</tr>
<tr>
<td></td>
<td>0.13 ha/per</td>
<td>0.07 ha/per</td>
<td></td>
</tr>
</tbody>
</table>

**0.26 ha/pers. - Global**

Therefore, the main strategy of the Republic of Tajikistan is the development of hydropower.
## Hydropower potential of the Pyanj river basin

<table>
<thead>
<tr>
<th>№</th>
<th>Name</th>
<th>Capacity, MWt</th>
<th>Output, TWt·h/years</th>
<th>Head, m</th>
<th>Useful volume of reservoir, km³</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Namangutskaya*</td>
<td>2.5</td>
<td>0.018</td>
<td>36</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Barsharskaya</td>
<td>300</td>
<td>1.6</td>
<td>100</td>
<td>1.25</td>
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<tr>
<td>3</td>
<td>Anderobskaya</td>
<td>650</td>
<td>3.3</td>
<td>185</td>
<td>0.1</td>
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<tr>
<td>4</td>
<td>Pishskaya</td>
<td>320</td>
<td>1.7</td>
<td>90</td>
<td>0.03</td>
</tr>
<tr>
<td>5</td>
<td>Khorogskaya</td>
<td>250</td>
<td>1.3</td>
<td>70</td>
<td>0.01</td>
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<tr>
<td>6</td>
<td>Rushanskaya</td>
<td>3000</td>
<td>14.8</td>
<td>395</td>
<td>4.1</td>
</tr>
<tr>
<td>7</td>
<td>Yazgulemskaya</td>
<td>850</td>
<td>4.2</td>
<td>95</td>
<td>0.02</td>
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<tr>
<td>8</td>
<td>Granites gate</td>
<td>2100</td>
<td>10.5</td>
<td>215</td>
<td>0.03</td>
</tr>
<tr>
<td>9</td>
<td>Shirgovetskaya</td>
<td>1900</td>
<td>9.7</td>
<td>185</td>
<td>0.04</td>
</tr>
<tr>
<td>10</td>
<td>Khostovskaya</td>
<td>1200</td>
<td>6.1</td>
<td>115</td>
<td>0.04</td>
</tr>
<tr>
<td>11</td>
<td>Dastidzumskaya</td>
<td>4000</td>
<td>15.6</td>
<td>300</td>
<td>10.2</td>
</tr>
<tr>
<td>12</td>
<td>Dzumarskaya</td>
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<td>8.2</td>
<td>155</td>
<td>1.3</td>
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<tr>
<td>13</td>
<td>Moscovskaya</td>
<td>800</td>
<td>3.4</td>
<td>55</td>
<td>0.04</td>
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<tr>
<td>14</td>
<td>Kokchinskaya</td>
<td>350</td>
<td>1.5</td>
<td>20</td>
<td>0.2</td>
</tr>
<tr>
<td>15</td>
<td>Nijni-Pyanjskaya</td>
<td>600</td>
<td>3.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>18322.5</strong></td>
<td><strong>84.918</strong></td>
<td></td>
<td><strong>17.36</strong></td>
</tr>
</tbody>
</table>
Conclusion and recommendations

Taking into account the huge hydropower potential of the Pyanj river basin and the possibility of their development in the future it is necessary:

- To foresee and take measures for the development of works for the organization of observational networks of meteorological parameters necessary to establish the influence of large and medium reservoirs on the formation of the microclimate

- Develop recommendations to the Ministry of melioration and the Ministry of Agriculture for the selection of agricultural varieties and the development of irrigation standards in accordance with the meteorological conditions formed under the influence of reservoirs
The Gorno-Badakhshan Autonomous Region (GBAO) of the Republic of Tajikistan covers Pamir Mountain and is a formation zone of the Transboundary Pyanj River is characterized by three climatic conditions (zone).

The object of research is the climatic zones of the Pamir Mountain including the Gunt and Vanch river basins – tributaries of the Pyanj River.

The data from meteorological stations:
- Darvaz
- Khorog
- Rushan
- Irkht
- Bulunkul
- Shaimak

were used for monitoring of the temperature and precipitation trends in the climatic zones of the Pamir
Vanch River Basin

Length 103 km
Basin area 2070 km²

Mean annual temperature change for the period 1956-2018 is low and 0.0032 °C/ year
Runoff dynamics and Hydrograph of the Vanch River

\[ y = 0.0705x - 139.49 \]

\[ R^2 = 0.0387 \]
Length
246 km

Basin area
14840 km²

The western part
Meteostation Khorog

\[ y = -0.1348x + 8.7059 \]
\[ R^2 = 0.0008 \]

The eastern part
Meteostation Bulunkul

\[ y = -0.4593x + 13.784 \]
\[ R^2 = 0.0677 \]
The **western** part

Meteostation Khorog

\[ y = 0.013x - 25.604 \]

\[ R^2 = 0.1177 \]

The **eastern** part

Meteostation Bulunkul

\[ y = -0.0005x + 0.8431 \]

\[ R^2 = 4E-05 \]

\[ \Delta T, \, ^\circ C \]

\[ \Delta W, \, m^3/sec \]

The western part

Meteostation Khorog

\[ y = 0.013x - 25.604 \]

\[ R^2 = 0.1177 \]

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Precipitation and Snow depth in the climatic zones of the Mountain Pamirs
CONCLUSION

- Orography rather than the altitude of the terrain above sea level dominate the distribution of atmospheric precipitation and snow depth in the climatic zones of the Mountain Pamir

- Penetration of air masses from the Mediterranean and Caspian Sea to the Gunt River Basin kept the atmospheric precipitation almost constant for more than 70 years in the western climatic zone of the Mountain Pamir

- The impact of climate change on the Pamir mountain rivers Runoff is manifested in a change in the state of glaciation of river basins
Water sampling points from the Pyanj River and its tributaries
CONCLUSION

- Content of anions and cations in the waters of the Pyanj River and its tributaries does not exceed the MPC and is formed as a result of leaching of rocks.

- The glacial runoff makes a significant contribution to the water discharge of the Pyanj River tributaries.

- Groundwater also makes a significant contribution to the runoff formation of the Vanch River.
RECOMMENDATIONS

- Taking into account the prospect of expanding the area of irrigated land in Afghanistan and Central Asia in the Pyanj river basin and the possibility of pollution of the river to create an Interstate Coordination Commission on Water Quality in the basin.

- To comply with the principle of transparency and strict accounting for the water balance of the Pyanj River Basin, develop continuous monitoring of meteo- and hydrological conditions on Afghanistan.

- Given the significant impact of mountain orography on the promotion of air masses and thus the formation of precipitation to expand the observation network of meteorological and hydrological conditions of the basin.

- Strengthen research and applied work on the study, monitoring of glacial lakes and for timely response to the rupture of glacial lakes and prevention of emergencies to expand observation networks.

- Stimulate the development of modern methods of irrigation and efficient use of water and land resources of the basin.
Thank You for Yours Attention