Institute of Sanitary, Hygiene and Professional Diseases

Sogd Water Authority, Tajikistan

Reducing water pollution and carbon emissions from irrigated areas by improving irrigation management and rural livelihoods

Case studies from energy intensive pump irrigated areas of Sogd Province, Tajikistan and Kashkadarya Province, Uzbekistan

Principal Investigator : Oyture Anarbekov

Principal Investigator from USA: James Ayars USDA

Principal Investigator from USA: Kate Berry, UNR

Budget : 299,734 USD

Duration : 2018 – 2021

1. INTERNATIONAL WATER MANAGEMENT INSTITUTE

IWMI is a non-profit, scientific research organization with focus on the sustainable use of water and land resources in developing countries

Vision: A Water-Secure World

Mission: Provide evidence-based solutions to sustainably manage water and land resources for food security, people's livelihoods and the environment

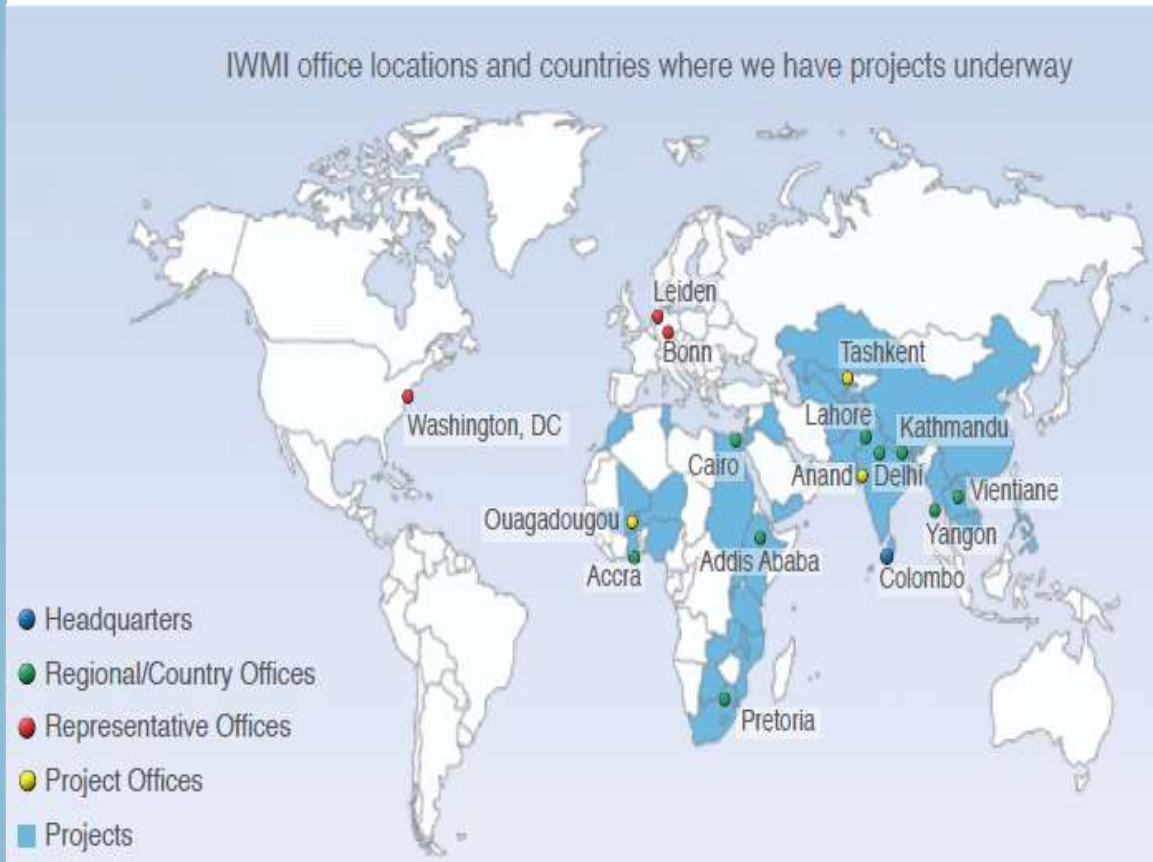
To feed **9 billion** people by **2050**,

farmers will have to produce

60% more food,

requiring a **19%** increase in agricultural water use,

which today accounts for **70%** of all water withdrawals in competition with energy, urban and environmental uses.

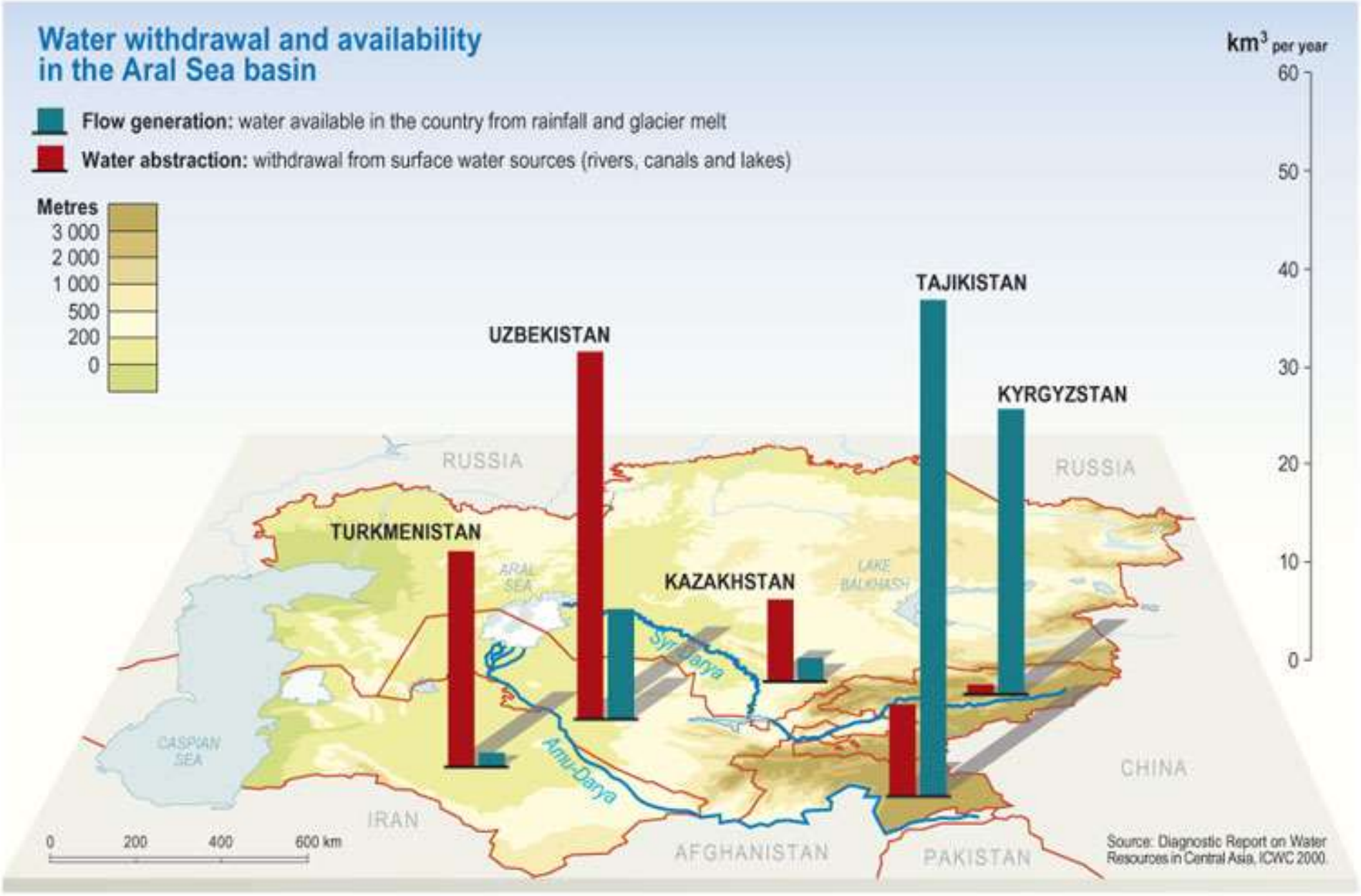


www.iwmi.org

Water withdrawal and availability in the Aral Sea basin

Flow generation: water available in the country from rainfall and glacier melt

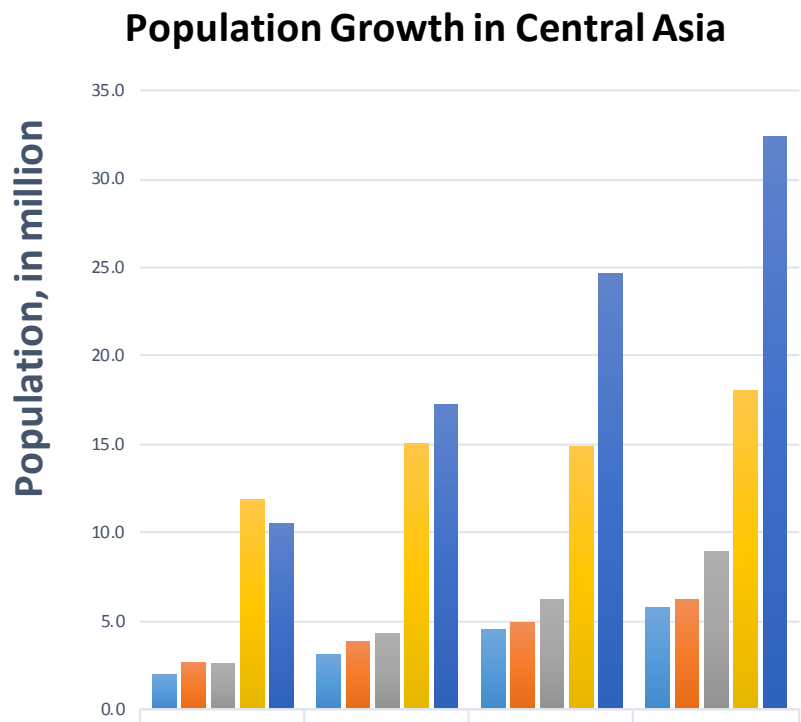
Water abstraction: withdrawal from surface water sources (rivers, canals and lakes)



MAP BY VIKTOR NOVIKOV AND PHILIPPE REKACEWICZ - UNEP/GRID-ARENDAL - APRIL 2005

CHALLENGES IN CENTRAL ASIAN REGION

- Population growth remains high in all countries within the region.
- **Water-Energy-Food-Environment Nexus**
- Salinization and waterlogging of the irrigated land
- Climate change - supply concerns and extreme events (water scarcity- GDP6%↓2050)
- Poor water use efficiencies practices
- Poor water mgt & governance
- Deteriorated irrigation and drainage infrastructure



	1966	1983	2000	2017
Turkmenistan	2.0	3.1	4.5	5.8
Kyrgyz Republic	2.7	3.8	4.9	6.2
Tajikistan	2.6	4.3	6.2	8.9
Kazakhstan	11.9	15.0	14.9	18.0
Uzbekistan	10.5	17.2	24.7	32.4

Data Source: World Development Indicators 9/21/2018

PROJECT PARTNERS

James E. Ayars- United States Department of Agriculture, USA

Kate A. Berry- University of Nevada, Reno, USA

Abdulkhakim T. Salokhiddinov - Tashkent Institute of Irrigation and Agricultural Mechanization Engineers, Uzbekistan

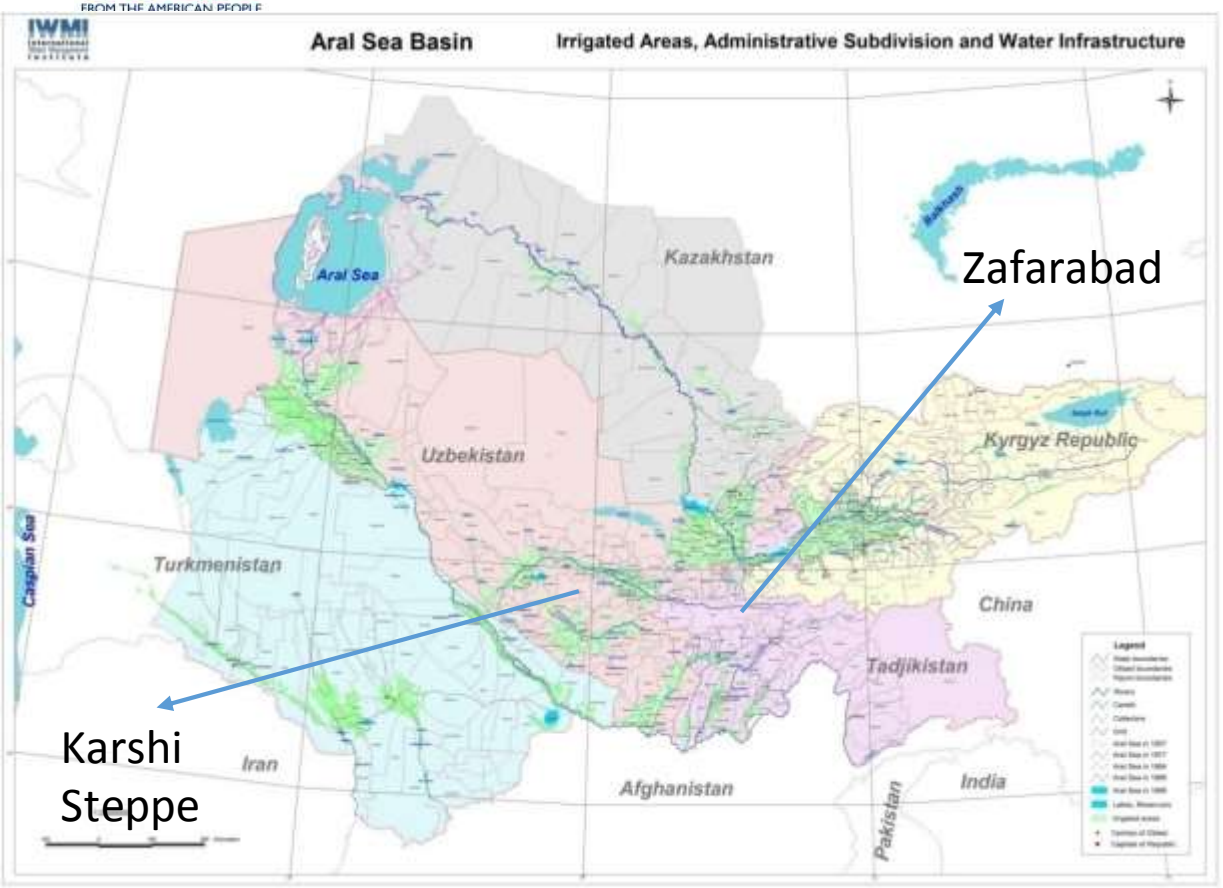
Institute of Sanitary, Hygiene and Professional Diseases

Elena N. Ginatullina - Institute of Sanitary, Hygiene and Professional Diseases, Uzbekistan

Sogd Water Authority, Tajikistan

Khalim R. Khodjiev - Sogd Water Authority, Tajikistan

PROJECT STUDY AREAS & OBJECTIVE



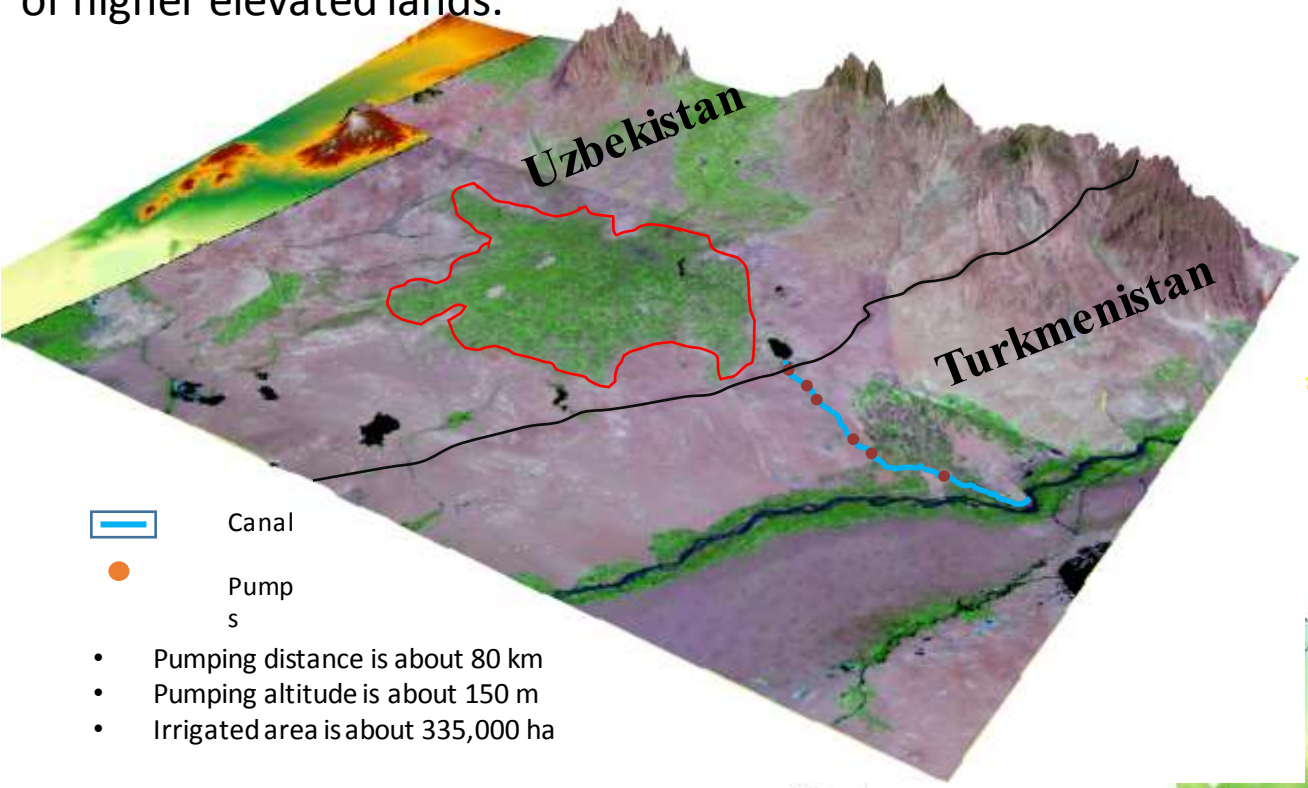
Project objective is to **assess whether improved irrigation management can make rural livelihoods more 'sustainable' and reduce health issues by decreasing water pollution and carbon emissions**

The research is the first major attempt to analyze relationships between the **pump irrigation practices, rural livelihoods, and health** in Central Asia through transboundary partnerships

Project design: This research project attempts to ***integrate, quantify and analyze linkages between water, energy, food, climate and health*** while accounting for stakeholder perceptions and social challenges in rural settings through bottom-up, transboundary cooperation.

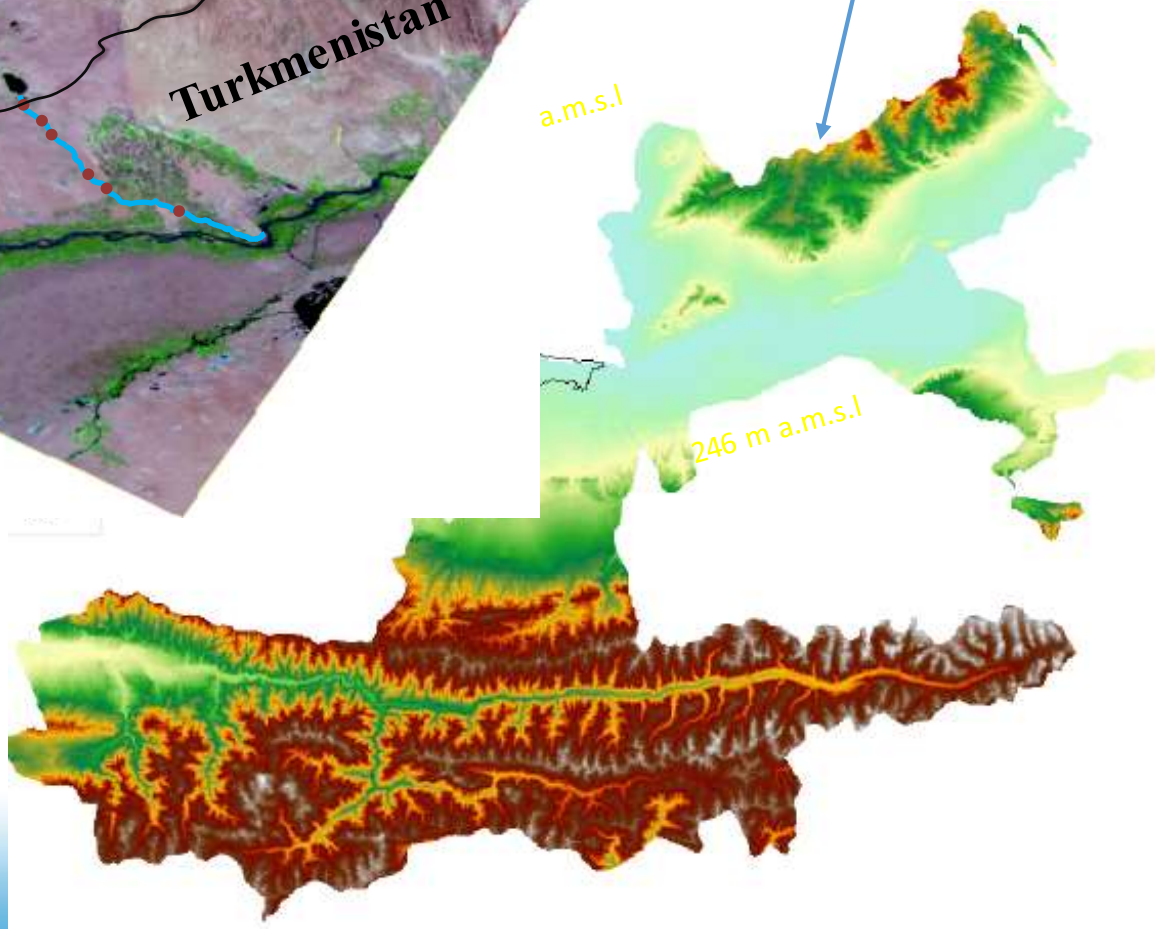
PEER CYCLE 6 PROJECT SITES AND ITS DIGITAL ELEVATION MODEL

In the two study areas of Kashkadarya province in Uzbekistan and Sogd province in Tajikistan, currently 80-85 percent of the land is supplied by irrigation pumps in response to the obstacle of higher elevated lands.



- Pumping distance is about 80 km
- Pumping altitude is about 150 m
- Irrigated area is about 335,000 ha

Sogd Province, North of Tajikistan



EXPECTED PROJECT OUTCOMES

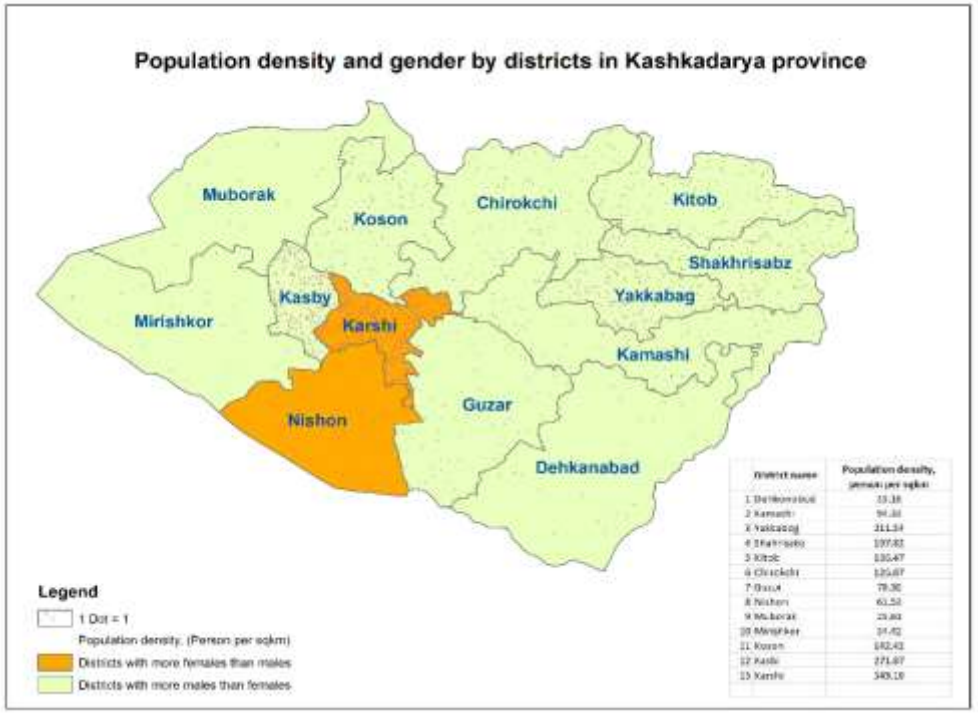
- **Improved data availability on water pollution and carbon emissions** resulting from traditional irrigation practices in the region
- Improved **data exchange systems and networks** between participating institutions
- **Improved knowledge and awareness of the extent of water pollution and carbon emissions in lift irrigated areas** due to traditional and outdated practices and their impact on population health and rural livelihoods to enable better decision making
- More **initiatives and policies** at local, national and regional levels to improve irrigation management practices that aim to reduce water pollution and carbon emissions

PROJECT ACTIVITIES

- Identification **water pollution** attributed to the lift irrigated agricultural zones: **contaminant fluxes** and exposure routes
- Potential impacts of **improving water use efficiency on energy savings, reducing CO_2 emissions, and runoff** from lift irrigated areas
- **Water use efficiency improvement** = utilizing **data** generated from ongoing PEER project (i.e. **geodatabases)**
- Assessment of the current **environmental, socio-economic and health impact of irrigation** and identify possible interventions to improve the rural livelihoods (e.g., restoring ecosystems and their services)
- Preparation of **policy documents**

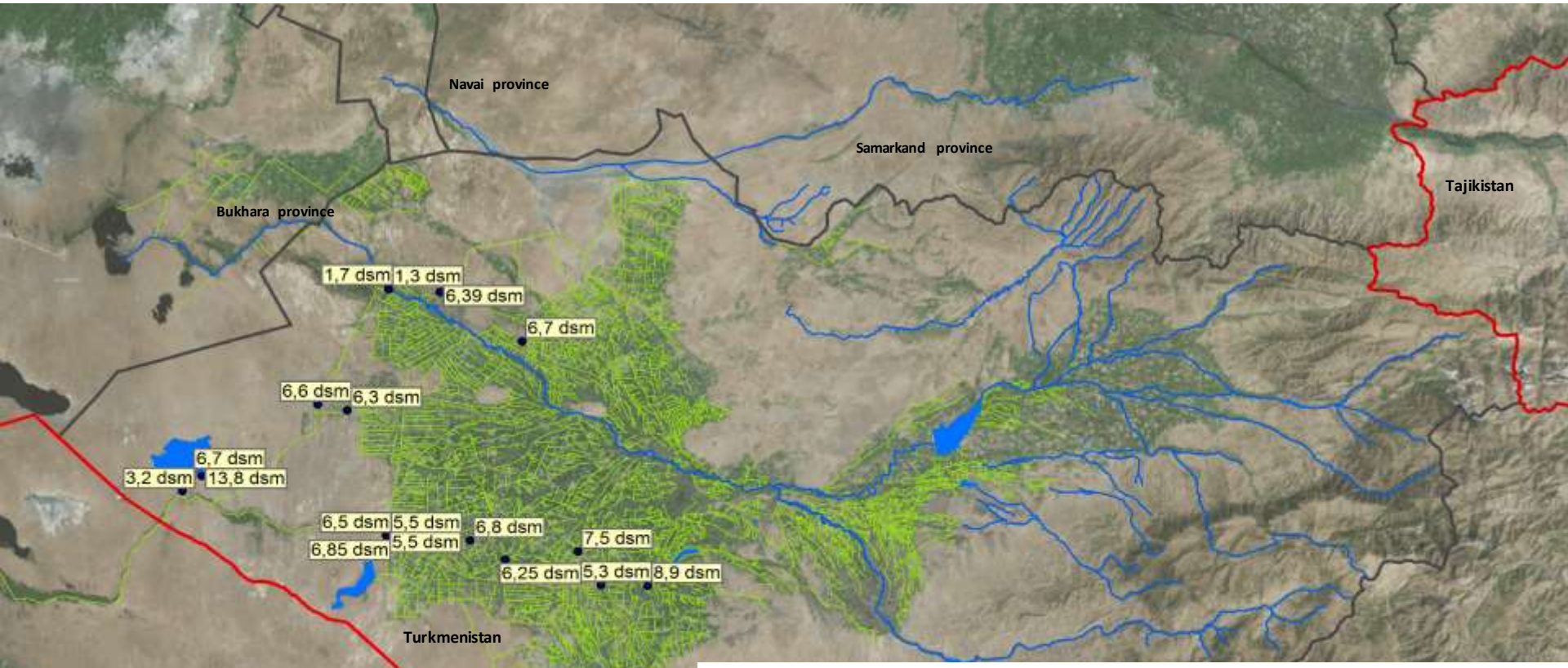
FIELD WORK: COLLECTION OF GEOREFERENCED WATER QUALITY DATA

INITIAL DATA COLLECTION & SYSTEMATIC LITERATURE REVIEW



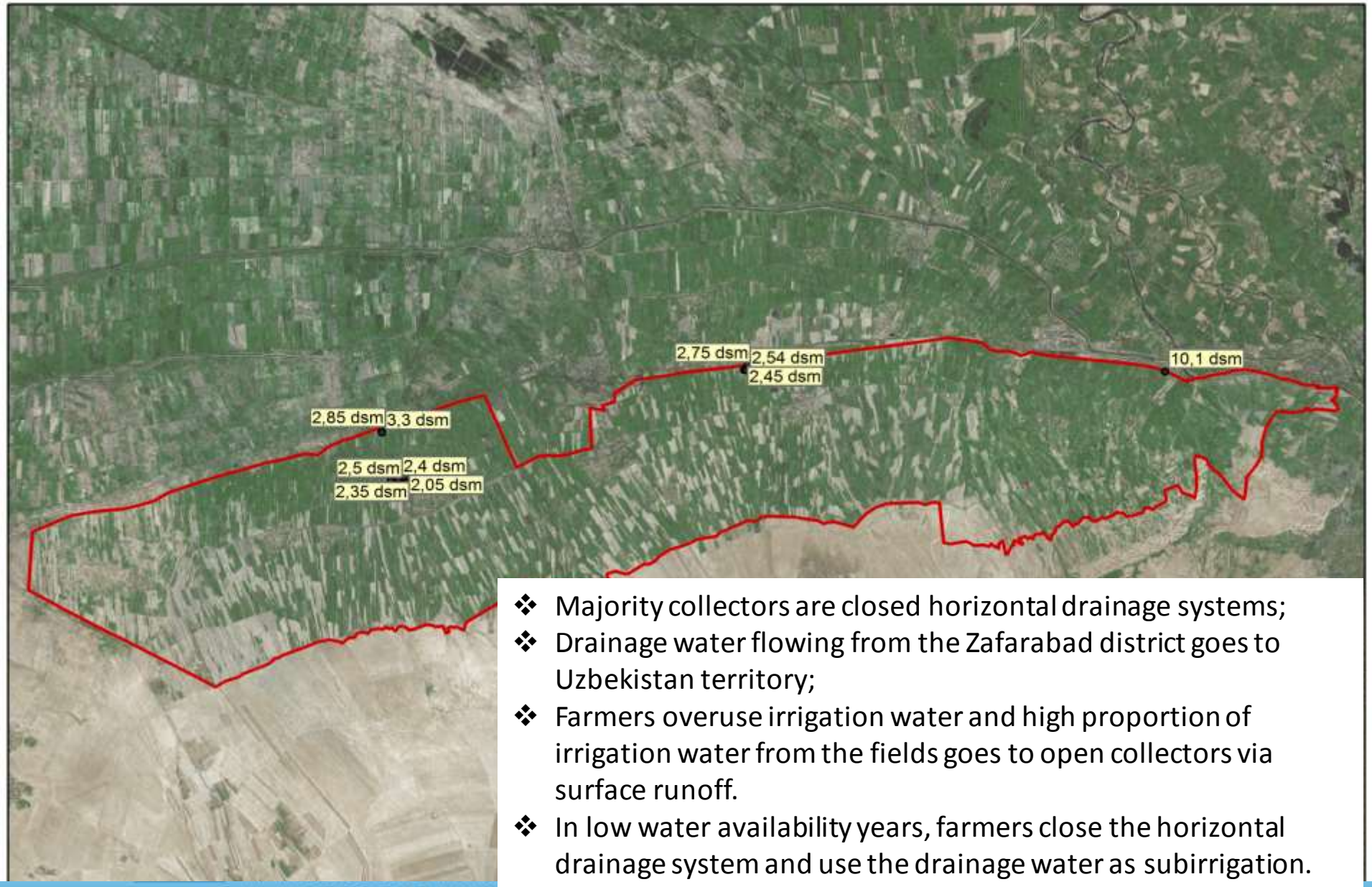
WCA boundaries, irrigation regimes	Climate zones
Population	Ecosystems
Main canal	Soil grounds and types
Main rivers	Digital elevation model
Main drainage systems	Residential areas
Pump stations	Railway lines
Water reservoirs	Road lines
Lakes	Basin boundary&intake

EC VALUES OF MAIN COLLECTORS IN KARSHI STEPPE



- Majority collectors are open drainage systems.
- Sechankkul and Achinkul are main water catchment areas in Karshi steppe.
- 80% of area use water pumped from Amudraya river though cascade of pump stations.
- Farmers overuse irrigation water and more than 30% water goes to collector system deteriorating the environment.

EC VALUES OF MAIN COLLECTORS IN ZAFARABAD DISTRICT



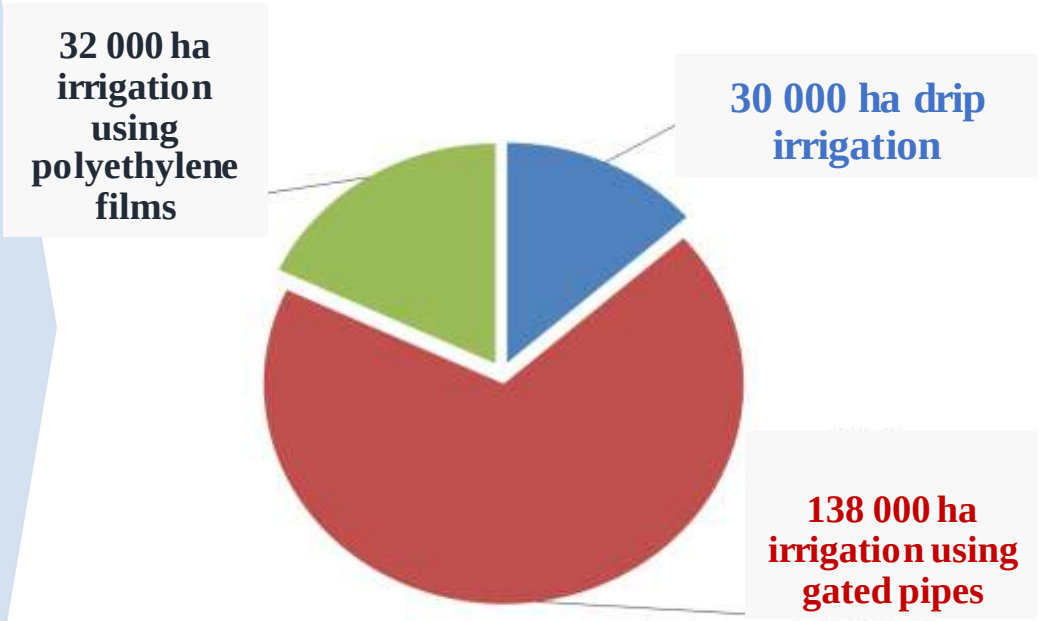
- Majority collectors are closed horizontal drainage systems;
- Drainage water flowing from the Zafarabad district goes to Uzbekistan territory;
- Farmers overuse irrigation water and high proportion of irrigation water from the fields goes to open collectors via surface runoff.
- In low water availability years, farmers close the horizontal drainage system and use the drainage water as subirrigation.

FIELD WORK: COLLECTION OF LONG-TERM WATER QUALITY DATA

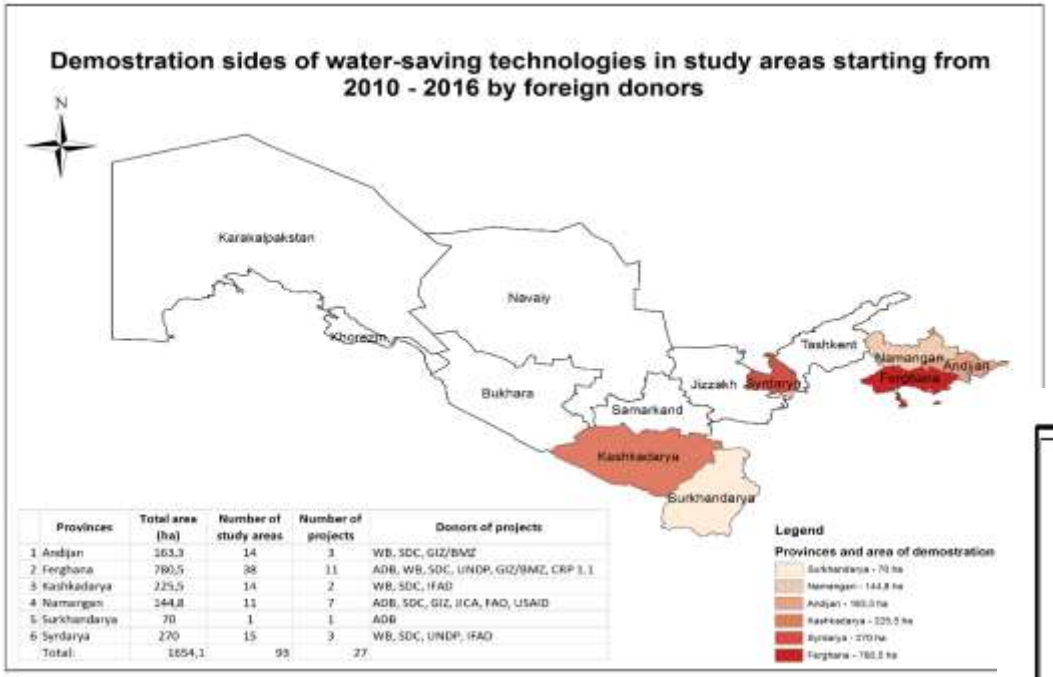
INTRODUCTION OF WATER SAVING TECHNOLOGIES IN UZBEKISTAN DATA FROM 2017 (SOURCE: MAWR OF UZBEKISTAN)

Over the past 5 years, a water-saving irrigation technology has been introduced in the republic on 200,000 hectares of the area (2-3 % of total irrigated land.

Annually such technologies are introduced on the area of 50-100 thousand hectares.

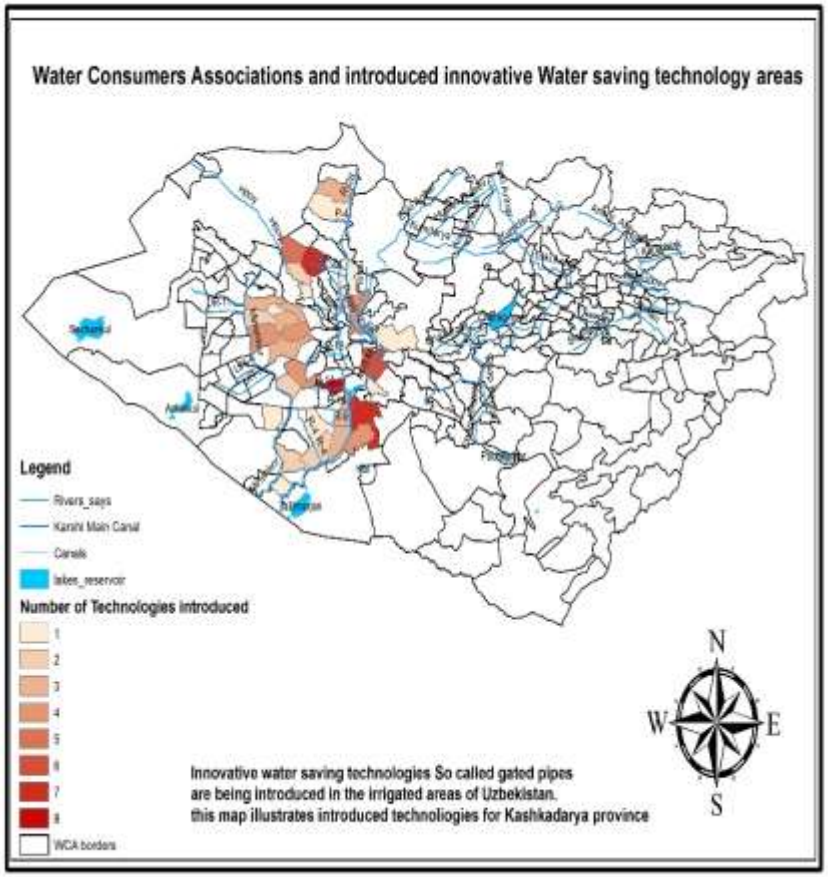


OVERVIEW OF WATER-ENERGY SAVING TECHNOLOGIES



Provinces	Total area (ha)	Number of study areas	Number of projects	Donors of projects
1 Andijan	163,3	14	3	WB, SDC, GIZ/BMZ
2 Ferghana	780,5	38	11	ADB, WB, SDC, UNDP, GIZ/BMZ, CRP 1.1
3 Kashkadarya	225,5	14	2	WB, SDC, IFAD
4 Namangan	144,8	11	7	ADB, SDC, GIZ, JICA, FAO, USAID
5 Surkhandarya	70	1	1	ADB
6 Syrdarya	270	15	3	WB, SDC, UNDP, IFAD
Total:	1654,1	93	27	

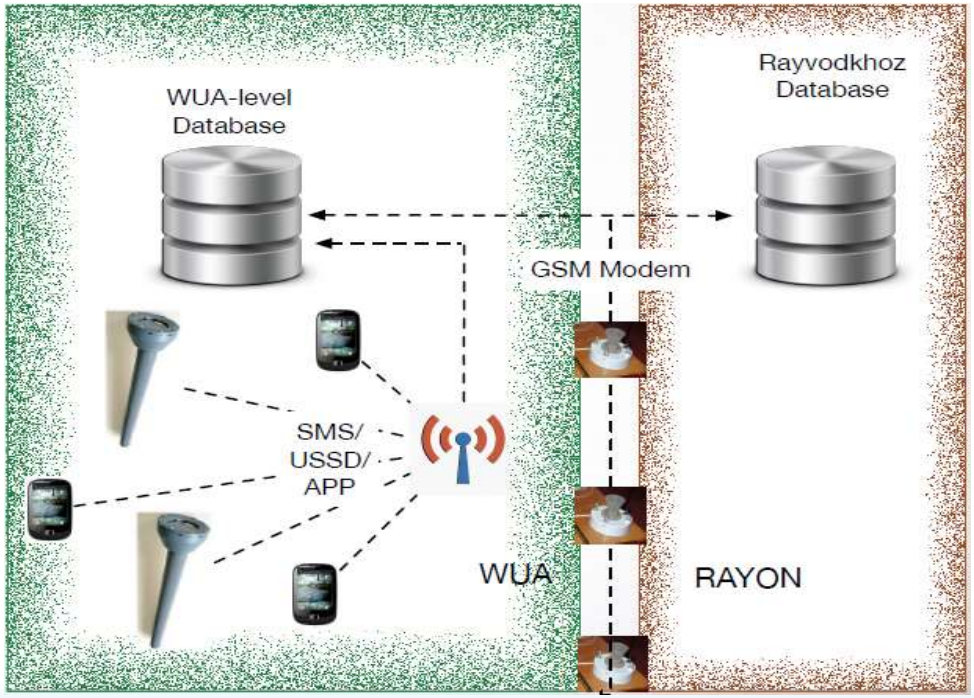
Database of all water related active projects and introduced water & energy saving technologies.



- Before introduction technologies – pay attention to quality as well as natural conditions of water sources;
- Introduce drip irrigation, where pumping via tube well irrigation exists for orchard farmers;
- Improvement of water accounting at the farm-WCA borders to demonstration actual water delivery to each farm;
- Gated-pipes shall be considered the source of water.

IMOMO: IMPROVEMENT OF WATER ACCOUNTING, DATA TRANSMISSION AND EFFECTIVENESS

- Improvement of water accounting using modern technologies;
- Work out financial and economic incentives for water saving and water productivity in rural areas as well as irrigation service fee pricing;
- Promotion of Water Information System from on-farm up to basin level (IMoMo project experience);



COMPLETED AND ONGOING TASKS (2018)

- Collected long-term water quality parameters, specifically nutrient fertilizers (phosphorous, nitrogen and potassium), heavy metals (arsenic and mercury), pesticide (chloro-organic, phosphorus organic) concentration in the water column (river and groundwater) at project sites **[ISPHD]**
- Collected geo-referenced water quality data for both study areas **[IWMI, TIIAME, SWA]**
- Combined geo-referenced water quality data with site thematic maps for the relevant time period (i.e., elevation, soil type, crop, etc.) **[IWMI]**
- Comprehensive analysis of contaminant fluxes and exposure routes and identification of factors responsible for specific chemical or heavy metal accumulation in the soil or water column in lift irrigated agricultural zones for the period of 2000-2016 **[IWMI]**
- Primary satellite data collected. Identification of geographic conditions of the study area **[IWMI]**
- Estimation of water quality parameters by using RS tools and ground based datasets **[IWMI]**
- Kickoff workshop conducted **[IWMI & Partners]**

PROJECT OUTPUTS

Publications:

1. Kakhramon Djumaboev, Tulkun Yuldashev, Bunyod Holmatov and Zafar Gafurov (2018). Assessing Water Use, Energy Use, and Carbon Emissions in Lift Irrigated Areas: A case Study from Karshi Steppe in Uzbekistan. Paper accepted for publication. Irrigation and drainage journal of International Commission on Irrigation and Drainage. https://onlinelibrary.wiley.com/journal/15310361

2. Kakhramon Djumaboev, Bunyod Holmatov and Oyture Anarbekov (2019). Effects of agriculture related water pollution on the environment and on public health in Uzbekistan. Under review for publication

3. Collected data and draft geodatabase is under preparation

4. Project Poster is prepared
5. Training materials are developed on improved water use efficiencies

Capacity building:

1. 2 PhD and 1 Master Students are involved into project
2. 4 local Institutions capacities are built

Outreach activities (next slides)

OUTREACH ACTIVITIES

- On 14-15 February 2018, In the framework of preparation for the 8th World Water Forum, IWMI-CA participated in the Central Asian Citizens Forum on water-related issues. The event was organized by the Government of the Republic of Tajikistan and the Kazakh-German University.
- IWMI-CA representatives presented results of USAID PEER Cycle projects and planed works under USAID Peer Cycle 6

OUTREACH ACTIVITIES

- On 19-22 June, 2018, IWMI Project team participated in the High Level International Conference on International Decade for Action “Water for Sustainable Development”, 2018-2028 in Dushanbe, Tajikistan.

- IWMI-CA staff holded two booth exhibitions where the team was disseminating research and project findings in the form of posters, brochures, maps and other publications.

CONSTANT CONTACT WITH USAID REGIONAL AND NATIONAL OFFICE IN UZBEKISTAN, TAJIKISTAN AND KAZAKHSTAN AS WELL AS WITH OTHER PEER GRANTEES

- On 24 July, 2018, IWMI CA office together with representatives of the Regional Environmental Centre for Central Asia (#CAREC) had a meeting with #USAID Regional Mission Director for Central Asia Mr. Christopher Edwards, Director of Office of South and Central Asian Affairs Ms. Kyung Choe, USAID Central Asia Office Director in Uzbekistan Mr. Gary Robbins and Project Management Specialist in Uzbekistan office Mr. Bahtiyor Mirzabaev. The high-level meeting was organized within framework of USAID funded IWMI projects (PEER 4, PEER 5 and PEER 6 Cycles) and CAREC projects (PEER 5 and Smart Waters project) at the Innovations and Scientific Research Cluster of CAREC-TIIAME (Tashkent Institute of Irrigation and Agricultural Mechanization Engineers), Tashkent, Uzbekistan.

THANK YOU FOR YOUR ATTENTION
WE LOOK FORWARD FOR COOPERATION!

- http://www.iwmi.cgiar.org/resources/apps/

IWMI-CENTRAL ASIA Office: E-mail: iwmi-ca@cgiar.org