

ウズベキスタン国ブハラ地域における塩害の現状分析及び対策案について  
 Analysis of current condition and counter measures on saline issues regarding  
 irrigation and drainage in Bukhara, Uzbekistan

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**1. Introduction**

Central Asia was one of the first Irrigated farming centers in ancient times. The largest water resources in Central Asia are Trans Boundary Rivers, Syr Darya and Amu Darya rivers are the major rivers which are flow to the Aral Sea Lake (Fig.1).

The water resources of Central Asia are importance to five countries (Uzbekistan, Kazakhstan, Tajikistan, Turkmenistan, and Kyrgyzstan) in economic activities. Now, inappropriate irrigation practices, accompanied by inadequate drainage, have often damaged soils through over-saturation and salt accumulation. Salinization is an important factor in land degradation and is largely brought about by the over-use of irrigation water and affects up to 50.1% of the total irrigated area. (Table.1.MAWR, 2011).

Research objectives are to spatially analyze current conditions of irrigated lands in Jandor district, Bukhara Province, Uzbekistan by GIS (Fig. 2.). GIS analysis on saline land, water use, and land use change and also scenario analysis will be conducted.

**2. Study area and Methodology**

**2-1. Study area: Jandor district in Bukhara province**

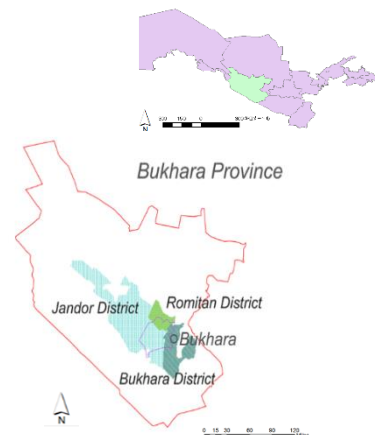
In this area, saline issues are coming from: (1) large amount loss of irrigation water from irrigation network led to the rise in level of ground water and deterioration of condition of irrigated lands, (2) irrigation supply was



**Fig.1** Map of Uzbekistan

**Table.1.** Saline land in Uzbekistan

Countries	Irrigated area (ha)	Saline irrigated land by (ha)	Saline irrigated land by (%)
Uzbekistan	4, 280, 600	2, 140, 550	50.1
Kyrgyzstan	1, 077, 100	124, 300	11.5
Tajikistan	719, 200	115, 000	16.0
Kazakhstan	2, 313, 000	>763, 290	>33.0
Turkmenistan	1, 744, 100	1, 672, 592	95.9
Total of Central Asia	10, 134, 000	4, 815, 732	47.5



**Fig.2.** Map of Bukhara

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not corresponding to the actual requirements of crops.

## 2-2. Database development and field survey

To develop GIS database, data was collected from different sources; weather data, social data, data of ADB of salinization of the project area, DEM data, field data, Amu-Bukhara

Irrigation System (ABIS) data, agricultural production data of current condition of the study area, water consumer associations (WCA) and farmers' data (Table.2). In field survey was conducted in Bukhara province on August-September 2014. The current condition of the rural areas was also observed.

## 2-3. Analysis methods

In this research spatial information on soil salinity is important. To explore spatial variability of soil salinity in the study area, grid sampling consisting of 36 sample points EC, pH, and level of ground water (h) of 10 wells on the study area(Fig.3).

## 3. Results and discussion

Geostatistics is a group of interpolation methods for statistical analysis of data which is measured with limited of sample points to continuous spatial variation. And, also provides a set of statistical tools for incorporating spatial and temporal coordinates of observations in data processing. Geostatistical methods can be powerful tools for characterizing large-scale spatial distributions of soil properties for precision agriculture. The results indicate that Geostatistical mapping can be used to generate soil salinity map (strong, moderate, slight and non-saline area), ground water levels and map of harvest. Nowadays, Geostatistical maps can be made (by using ArcGIS, SGeMS) (Fig.4.). Later, social analysis and recommendation for decision making will also be done.

This research aims to strengthen preventive measures in order to decrease the level of salinity, establishing of a system of incentives for the efficient use of water resources in this area.

Table. 2. Database of this research

Data	Uzbekistan	Bukhara province	Jandor district
Agriculture data	Land and water resources (annual)	cotton, wheat, other crops (annual)	cotton, wheat, others (annual)
Social data	GDP, population (only county)	population, Gross production	population, Gross production
Whether data	monthly high temperature-°C monthly low temperature-°C monthly rainy (mm)	monthly rainy (mm)	monthly rainy (mm)
Field data	vegetation map, soil map, salinization map (2003y) DEM	irrigation area, salinization (2008y-2012y), Amu Bukhara project area	EC, pH, soil chemical, soil texture, ground water level (m)

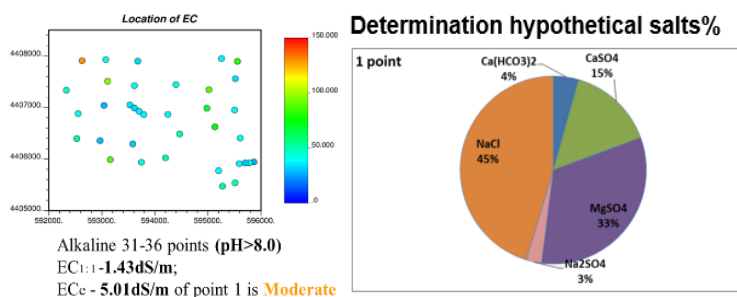
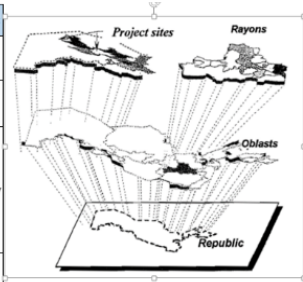


Fig.3. Location of EC and pH of the study area

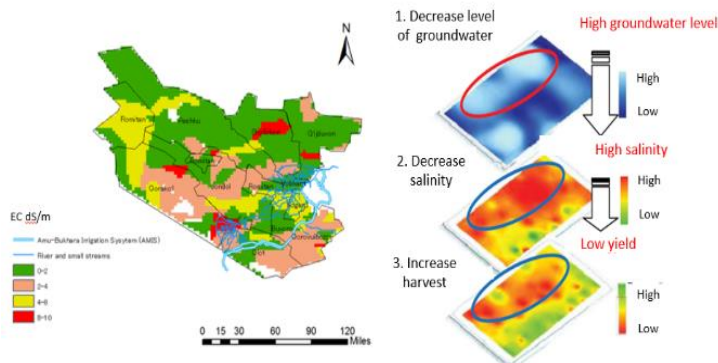


Fig.4. Soil salinity map of Bukhara province.