ウズベキスタン国シルダリア地域におけるリモートセンシングによる塩害の評価
Risk assessment by remote sensing of soil salinity in the Syrdarya region, Uzbekistan

Aziz Omonov*, Atiqotun Fitriyah**, Tasuku Kato***
○アジズ オモノフ*、フィトリヤ アティコツン **、加藤 亮***

1. Introduction

Soil salinity is one of the severe environmental and agricultural problems. Mainly in arid and semiarid areas, saline soils occur due to mismanagement of water resources, and inadequate irrigation and drainage systems in agricultural areas. Advanced technologies such as Geographic information system (GIS) and remote sensing (RS) data has become an economically and efficient tool for assessing, detecting, mapping, and monitoring saline areas along with its spatial and temporal variations. Therefore, the main objective of this study is to develop risk assessment of soil salinization using RS and GIS in the irrigated lands of Syrdarya province, Uzbekistan, where soil salinity has been considered as one of the biggest issues.

2. Study area and methods

The study area is Syrdarya province of Uzbekistan (Fig. **1**), and its located on the left bank of the Syrdarya River, bordered by Kazakhstan and Tajikistan. The province's average annual air temperature was 15°C in 2020 and, the average annual precipitation is 310 mm. The climate of the province is a semi-arid and continental climatic zone with hot and dry summers.

2.1 Satellite Imagery and statistical analysis

A preliminary analysis will be conducted of three parameters exposure, hazard/frequency, and vulnerability for generating of the salinity risk map (SRM) using this current methodology in (Fig. **2**). The existing data for our study are as follows: state soil salinity maps (SSSM); evapotranspiration (ET) – monthly; precipitation (P) – monthly (GPM); land surface temperature (LST); vegetation soil salinity index (VSSI); normalized difference vegetation index (NDVI); irrigation density (ID) and drainage density (DD).

All indexes and features will be tested for the October 2020. After finding the best correlation between SSSM and exposure (NDVI, ET, P, LST, ID and DI), hazard/frequency (SVVI), and vulnerability indexes (population density, pumping density,

Fig.1 The map of Syrdarya province, Uzbekistan

* 東京農工大学連合農学研究科， United Graduate school of Agriculture, Tokyo University of Agriculture and Technology. ** 東京農工大学GIR、*** 東京農工大学農学研究院

industries density and road density and et.,) will be generated the risk of salinity map of the study area. Analysis of the significance of each factor's effect on soil salinity will be used in R, GIS, and QGIS software.

2.2 Soil Salinity Map

The soil salinity data (October, 2020) of Syrdarya province was developed by the "Hydrological and Geological Reclamation Expedition (HGRE)" of Syrdarya province (local) provided as a soil salinity map (Fig. 3).
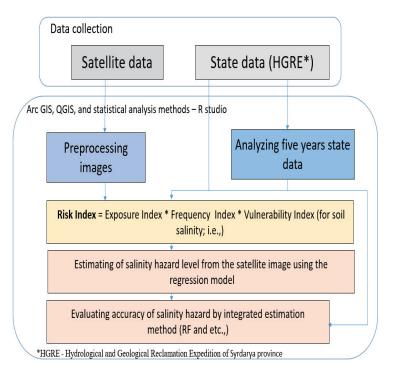

Fig.2 The methodology of this study

3.Ongoing Result and Discussion

The results of our previous study in this study area for comparison of several indices (SI2, SI3, SI4, NDSI, VSSI, NSI, NDVI) with Landsat 8 OLI images. VSSI (42%) and NDSI (38%) showed the highest accuracy with Landsat 8 OLI indices. In this study we will be use VSSI because it was suitable in the study area. At the same time, we will evaluate the changes in the salinity level of the study area for the last 5-6 years. The data shows that from 2016 to 2020 the level of low salinity (ha) was decreasing, a non-saline area slightly increasing, the moderate saline area was increasing, and a high saline area was decreasing.

This is because the province is still vulnerable to the salinity problem, therefore this current study will be very helpful and beneficial for identifying and estimating the hazardous agricultural lands in this area.

In addition, this soil SRM will be used for tillage, crop placement, fertilizer system improvement, composition, and standards of reclamation activities, which will be determined in the future. At the same time, based on SRM, auxiliary routes will be identified, and effective methods and technologies of land use will be designed.
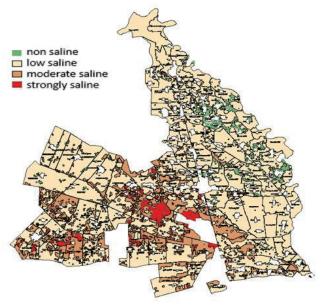

Fig.3 SSSM of Syrdarya province in 2020