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ASSESSING THE IMPACT OF SOIL SALINITY ON THE YIELD GRAIN CROPS UNDER CLIMATE CHANGE

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Abstract

Climate change has been a problem recently in many aspects. The average temperature has been in increasing over years, comparing to preindustrial period. As climate change proceeds in water shortage areas, soil salinization is progressing dramatically. This paper analyzes impact of soil salinization on agricultural production in north part of Uzbekistan from 2010 and 2017. This study estimates district level fixed effect (FE) panel model for agricultural production using seasonal climate variables and other input variables. The results show that soil salinization significantly impacts on crop yield with negative correlation in the model.

Goal

On the ongoing condition, it is one of the main driver for soil salinity, which has great impact on crop growth and one of limiting factor for productivity. The study focuses on analysis of the impact of soil salinity on crop production in Uzbekistan, where exists the problem of Aral Sea water shortage over years.

Specific objective

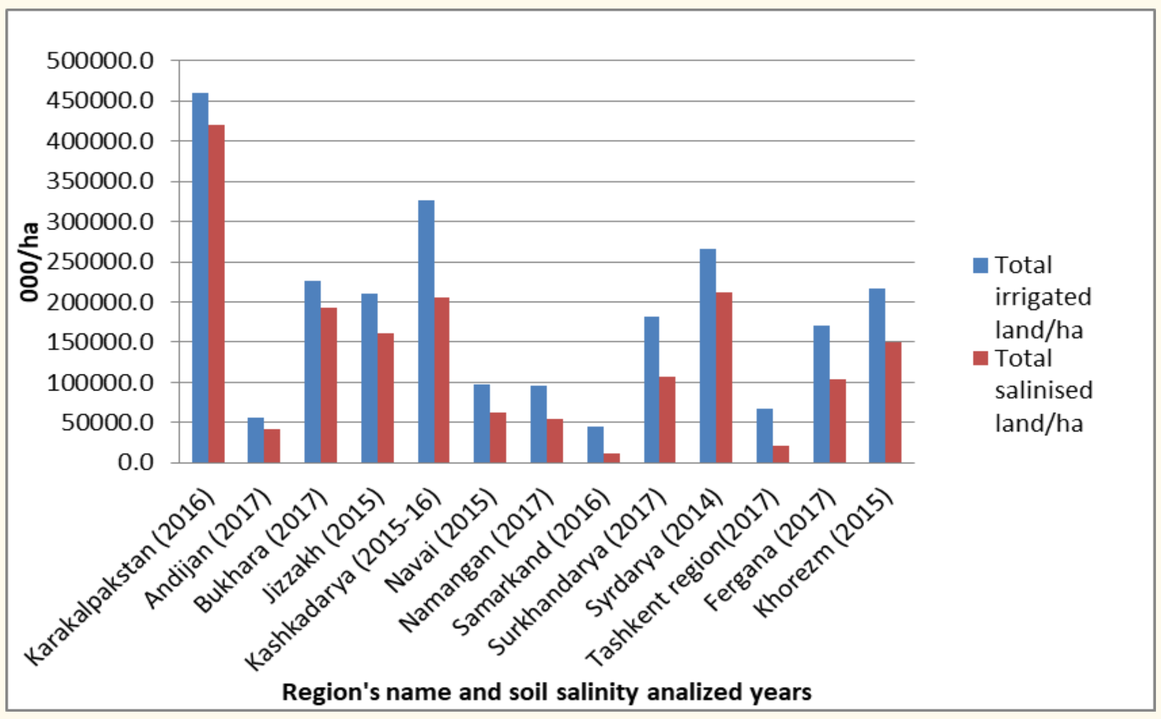
To check the impact of soil salinity on wheat crop yield .

Methodology

We use Panel data, output variable is total wheat yield. Land, labor and fertilizer variables are control variables which were collected from the state agency of Uzbekistan on statistics. The data covers five regions and 47 districts. Key independent variable is soil salinization. The data on soil salinization was obtained from regional departments of Ministry of Water resources of Uzbekistan. Temperature data was collected from hydrometeorological center of Uzbekistan. We use the Cobb–Douglas production function and our estimation approach incorporates Fixed Effect model.

Results

We applied Hausman test for the analysis to check model suitability on panel data. The test result show 99% significance level FE model, which is acceptable. Since almost every model has some endogeneity issues, the FE-Estimation is the appropriate choice and gives the best consistent estimates. However, the individual-specific parameters disappear. Our estimation approach incorporates Fixed Effect in our analysis.



Source: author based on statistical data

Figure 1. Comparison between irrigated agricultural land and its salinity.

In the resulting model, as we focused in the study, seasonal mean temperature and soil salinization variables show statistically significant impacts. The model also indicated that allocated land, labour, fertilizer and mean temperature of autumn season are positively associated with crop yield. Probably, at the beginning of vegetation that winter wheat requires warmer weather for to growth and starts tillering until cold winter.

Table 1. Estimation results for wheat crop yield as the dependent variable

	Ln total yield
Ln Land	0.676*** (21.64)
Ln labour	0.105*** (8.21)
Ln fertilizer	0.277*** (11.17)
Ln soil salinity	-0.076*** (-3.69)
Ln average Mai-June temperature	-0.570*** (-1.76)
Ln average autumn temperature	1.396*** (13.69)
cons	-0.335*** (-0.31)
N	376
R^2	0.972

Source: author's calculation

However, in generation period (Mai and June) crop is more sensitive for higher temperature. According to our results, soil salinization impacts negatively in all phase of crop growth. Other variables such as land, labor and fertilizer effect positively at 1% of significance level as p value shows.

Conclusion

In conclusion, there is still gap in studying wheat yield and climate change impacts. For instance, the relationships between inappropriate irrigation management and water salinization, which leads to land degradation (Hamidov at al, 2016). However, the research should include crop interaction and its growth in the saline soil. In the study, average soil salinity has taken per year; actually soil salinity changes in every irrigation and seasons, depending on crop vegetation. Researchers in future need to consider this issue while doing analysis.

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