Brief Project Information

Title	**IRN AP25794147** **«GIS Modeling of Winter Cereal Crop Yields in Southern Regions of Kazakhstan Using Remote Sensing Data under Climate Change Conditions».**
Relevance	The project aims to model and forecast winter cereal crop yields in the southern regions of Kazakhstan, with a focus on the Turkestan Region. Under increasing climate change and growing weather instability, efficient agricultural resource management becomes essential for achieving stable high yields and ensuring national food security. Integrating key agrometeorological and climatic indicators (thermal resources, precipitation, hydrothermal conditions of the growing season), crop condition, and field weed infestation through GIS modeling creates a comprehensive system to support sustainable agricultural development in southern Kazakhstan.
Objective	To develop a GIS model for predicting winter cereal crop yields in the Turkestan Region, considering agrometeorological conditions, deviations from climatic norms, crop status, and weed infestation levels, based on satellite monitoring.
Tasks	• Develop and adapt a GIS model for yield forecasting of winter cereals, incorporating satellite and ground-based data (meteorological, climatic, biometric crop condition, and field infestation observations). • Compile a historical database of key meteorological and climate parameters that describe the hydrothermal conditions of cereal growing seasons, and identify trends over recent years. • Conduct integrated analysis of remote sensing, meteorological, climate data, and field observations to ensure model quality and accurate forecasting. • Test the model on field data from Turkestan Region to evaluate its effectiveness and accuracy. • Assess the sown areas and sowing dates of winter cereals using satellite indices, and prepare maps showing their spatial distribution. • Prepare maps showing crop condition during spring and summer growing periods and predicted yields based on satellite and ground data, which will help optimize agricultural operations in southern Kazakhstan.
Expected and Achieved Results	Expected results: • A tailored model for forecasting winter cereal yields will be developed, integrating remote sensing, climate data, crop condition, and weed infestation levels. The model will account for soil and weather specifics of the southern regions. • Key parameters (satellite, climate data, crop conditions, and weed infestation) will be analyzed and incorporated to enhance model reliability. • A prototype model will be developed for predicting yields and crop conditions at various growth stages, providing decision-making support for agricultural enterprises. Results will be published in two peer-reviewed international scientific journals indexed in Scopus (high percentile) or in the top three quartiles of Web of Science.

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Selected Publications	Karabkina N., Bekmukhamedov N., **Arystanov A.**, Aisarova A., Arystanova R. (2018). Operational Solution of Space Monitoring of Grain Crops in South Kazakhstan Based on Data of Sentinel-2, Landsat-8, PlanetScope, Information Technologies in Remote Sensing of the Earth, RORSE, pp. 321–328. https://doi.org/10.21046/rorse2018.321. **Arystanov, A.**, Karabkina, N., Sagin, J., Nurguzhin, M., King, R., & Bekseitova, R. (2024). Use of Indices Applied to Remote Sensing for Establishing Winter–Spring Cropping Areas in the Republic of Kazakhstan. Sustainability, 16(17), 7548. https://doi.org/10.3390/su16177548. Kabzhanova, G., Arystanova, R., Bissembayev, A., **Arystanov, A.**, Sagin, J., Nasiyev, B., Kurmasheva, A. (2025). Remote Sensing Applications for Pasture Assessment in Kazakhstan. Agronomy, 15, 526. https://doi.org/10.3390/agronomy15030526.