Building a DSSAT Crop Growth and Development Model (2021-2023)

Customer: Ministry of Agriculture of th
Republic of Kazakhstan
Budget: 650 million tenge

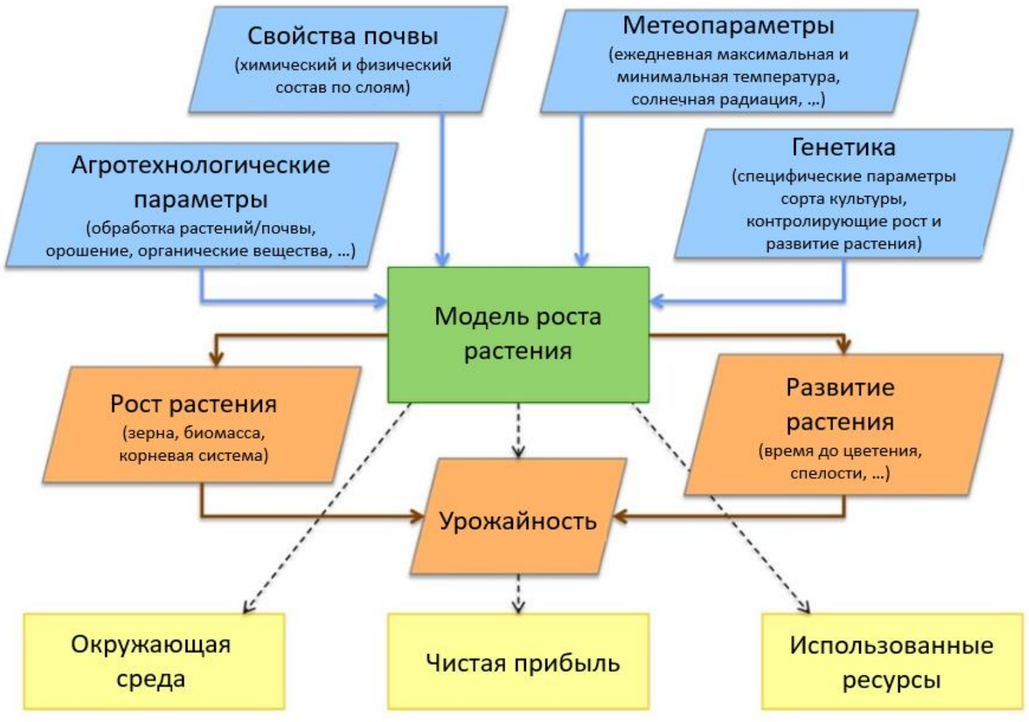
The main goal is to implement the concept of "Smart" agriculture, including high–tech types of crop and livestock products, including on the basis of new technical solutions.

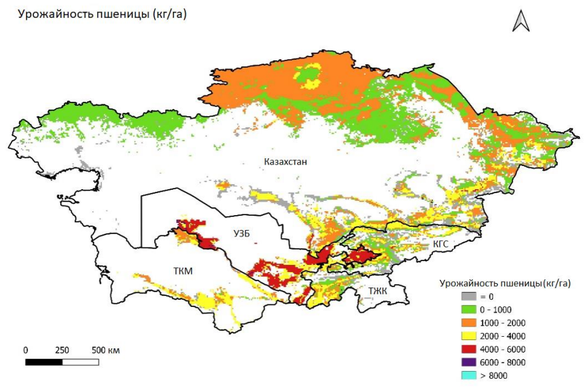
Tasks to be solved:

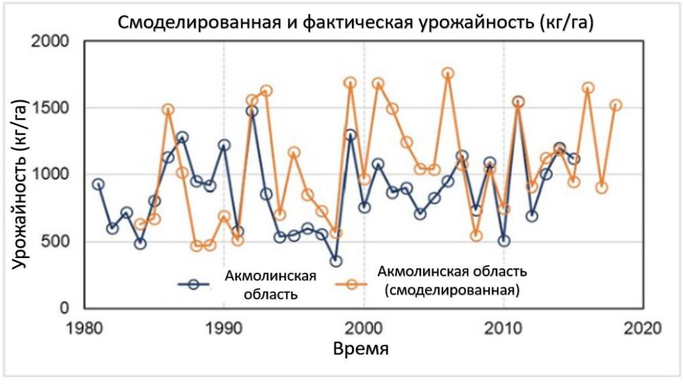
1. Creation of a decision-making system for the production of basic types of agricultural crops based on the DSSAT model - a decision support system for the transfer of agricultural technologies
2. Building a database of scientific and technical documentation for the production of livestock and crop products with open access (Open API);
3. A proven model of the growth and development of agricultural plants based on the SKO;
4. Formation of a system for transferring spent agricultural technologies to other regions of the Republic of Kazakhstan that differ in soil and climatic conditions;
5. Conducting drone flights and analyzing satellite images to build a system for determining and monitoring field data by remote methods.

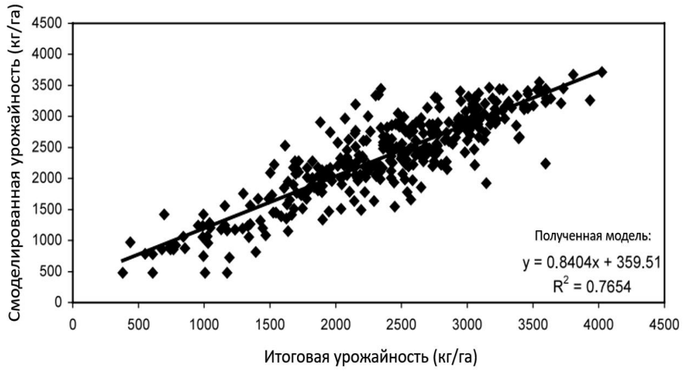
Seminar on August 15-19, 2022 (S. Seifullin KATU)

The algorithm of the DSS decision-making system









DSSAT FOUNDATION

UF UNIVERSITY of FLORIDA

Decoding of high-resolution satellite images of the territory of the green belt of Astana, tugai forests of the Syrdarya and Ili rivers, floodplain forests of the Ural River using GIS technologies and their correlation with the obtained ground survey data

Customer: ТОО КАЗНИИЛХА им. А.Букейхана

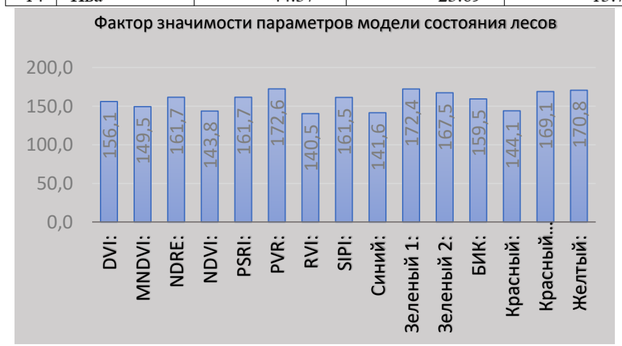
Budget: 60 million tenge

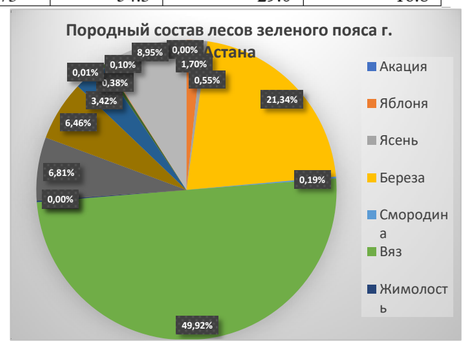
The main goal is to develop a technique for decoding satellite images of high spatial resolution to ensure the tasks of monitoring forest species.

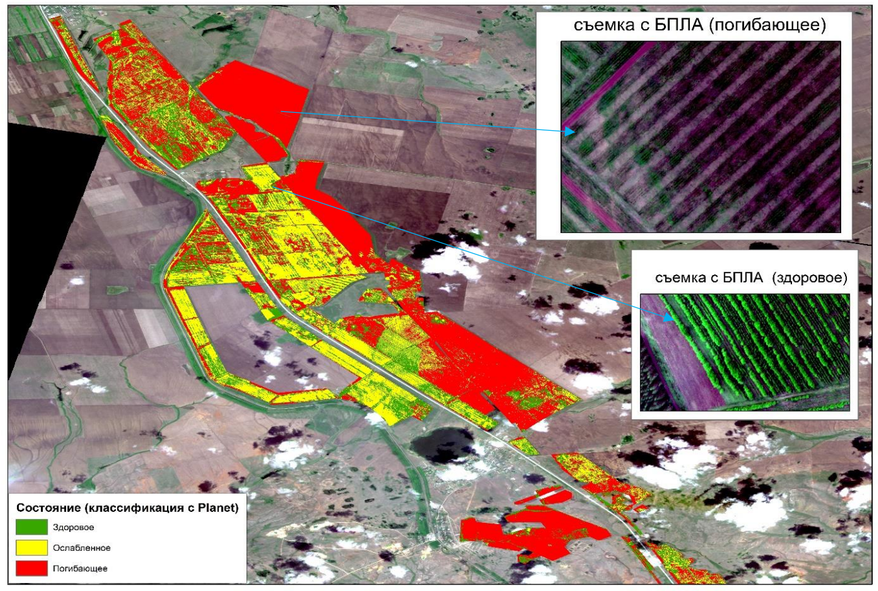
Research scheme

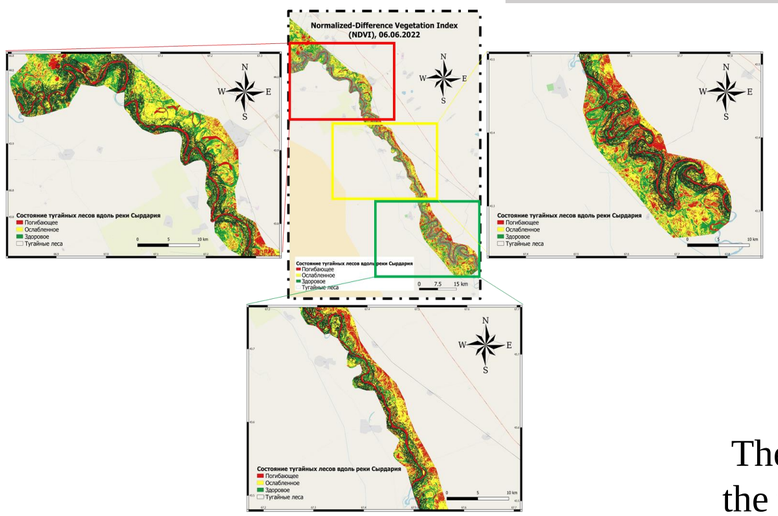
The state of forest species of the green belt of Astana

		Состояние (S, га)			Состояние (% от S)		
	Порода	здоровые	ослабленные	погибающие	здоровые	ослабленные	погибающие
1	Акация	2.35	0.46	0.06	81.9	16.2	1.9
2	Яблоня	730.84	532.03	126.05	52.6	38.3	9.1
3	Ясень	247.43	194.26	5.79	55.3	43.4	1.3
4	Береза	6 940.06	6 066.47	4 426.16	39.8	34.8	25.4
5	Смородина	56.70	84.59	10.47	37.4	55.7	6.9
6	Вяз	18 332.77	14 642.46	7 806.29	45.0	35.9	19.1
7	Жимолость	7.38	59.65	66.56	5.5	44.7	49.8
8	Сирень	0.39	-	-	100.0	0.0	0.0
9	Лох	559.64	2 803.37	2 201.29	10.1	50.4	39.6
10	Клен	2 207.44	1 921.96	1 145.36	41.8	36.4	21.7
11	Сосна	1 071.63	1 329.45	394.78	38.3	47.6	14.1
12	Тополь	90.72	208.56	12.36	29.1	66.9	4.0
13	Ирга	2.09	5.08	2.42	21.8	53.0	25.2
14	Ива	44.37	23.69	13.73	54.3	29.0	16.8

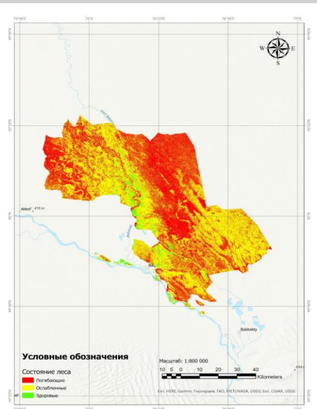




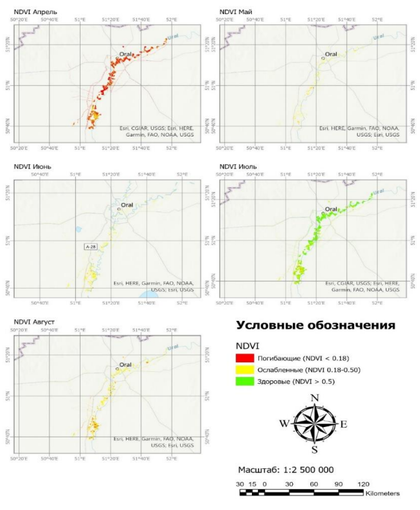




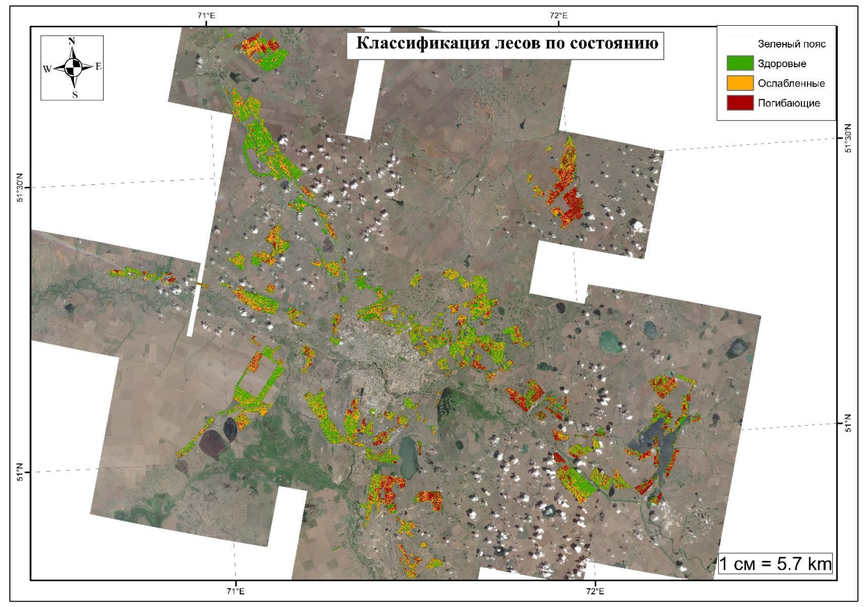
The general condition of the tugai forests of the Syrdarya River



The general conditionof the tugai forests of the Ili RiverAbakan Forestry



The general conditionof the floodplain forests of the Ural River



General condition of forest species of the green belt of Astana

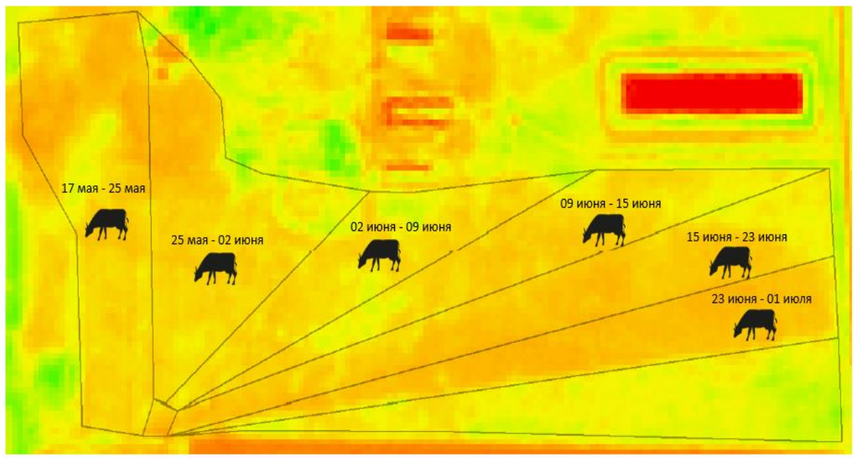
Development of a system for the rational use of pastures using remote sensing of the earth (2021-2023)

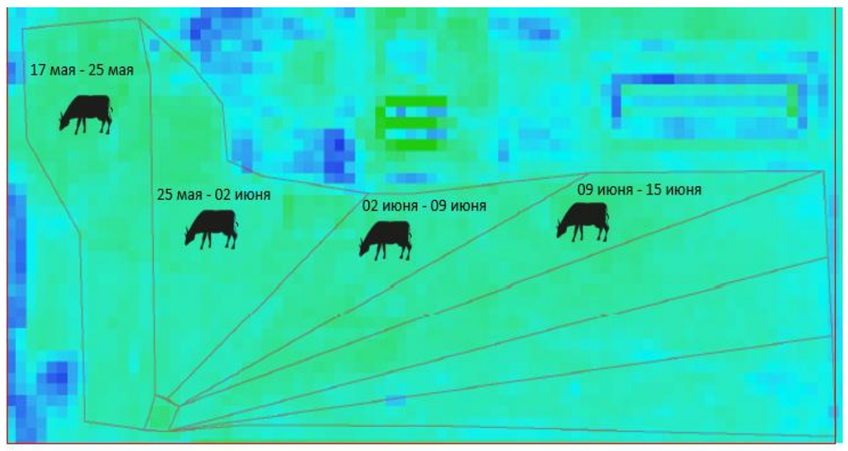
Customer: Ministry of Agriculture of the Republic of Kazakhstan
Budget: 141.1 million tenge

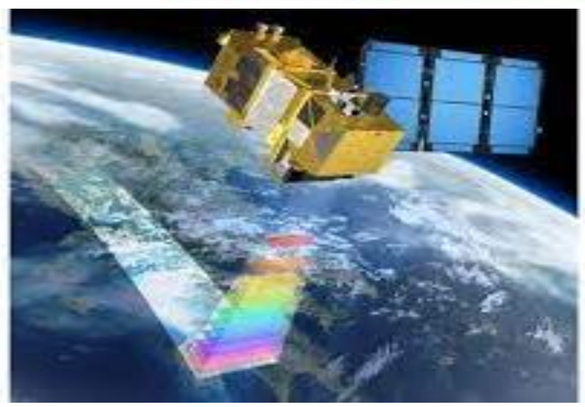
The main goal is the development and creation of scientifically–based Smart farms (horse breeding, beef cattle breeding) with the use of various at least 3 digital solutions.

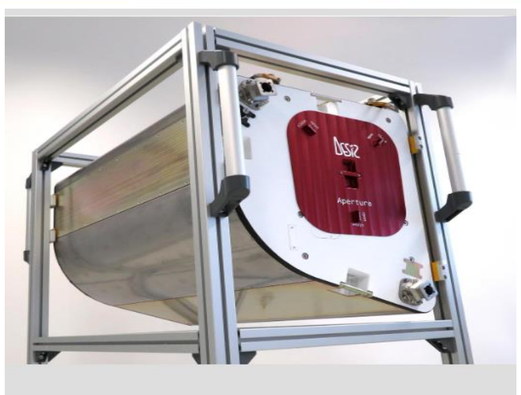
Tasks to be solved:

1. To analyze the availability and condition of pasture lands in farms;
2. To analyze the existing methods for determining and mapping pastures;
3. To monitor pasture lands in farms using remote sensing data;
4. Conduct ground-based geobotanical surveys (water-physical properties of soil, botanical composition) of pasture plots to determine seasonal productivity and nutritional value of pasture mass;
5. To conduct a comparative analysis of ground surveys with data obtained using GIS technologies;
6. Determine the capacity of pastures by paddocks and develop a pasture turnover scheme with an optimal grazing load of beef cattle;
7. Develop a geo-portal with digital maps with visualization of bioclimatic and soil characteristics, botanical composition of vegetation, load of farm animals on pastures with detailed legends;
8. Develop a methodological recommendation for the management of pasture resources using remote sensing data.









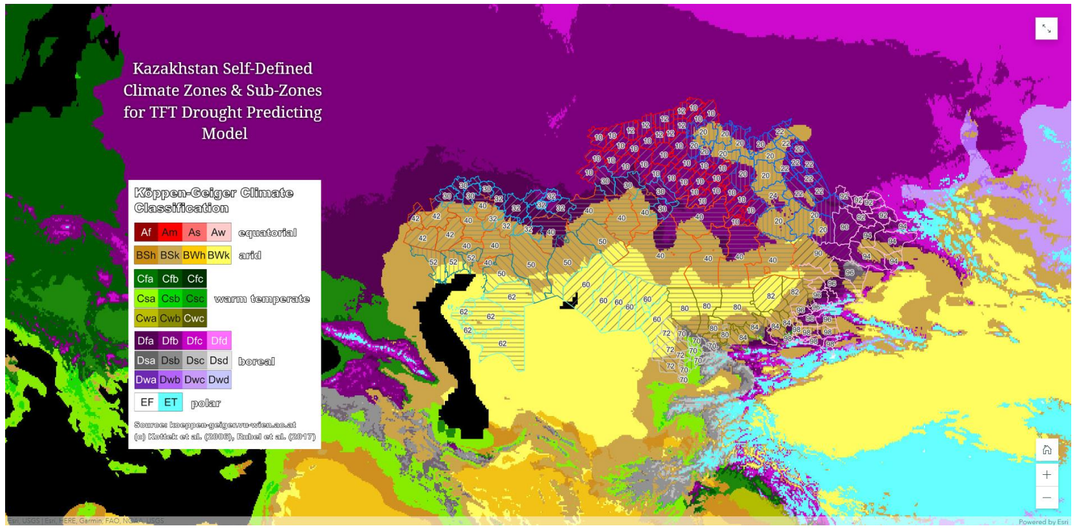
Integrated natural resources management in drought-prone and salt-affected agricultural production landscapes in Central Asia and Turkey (`CACILM-2`)

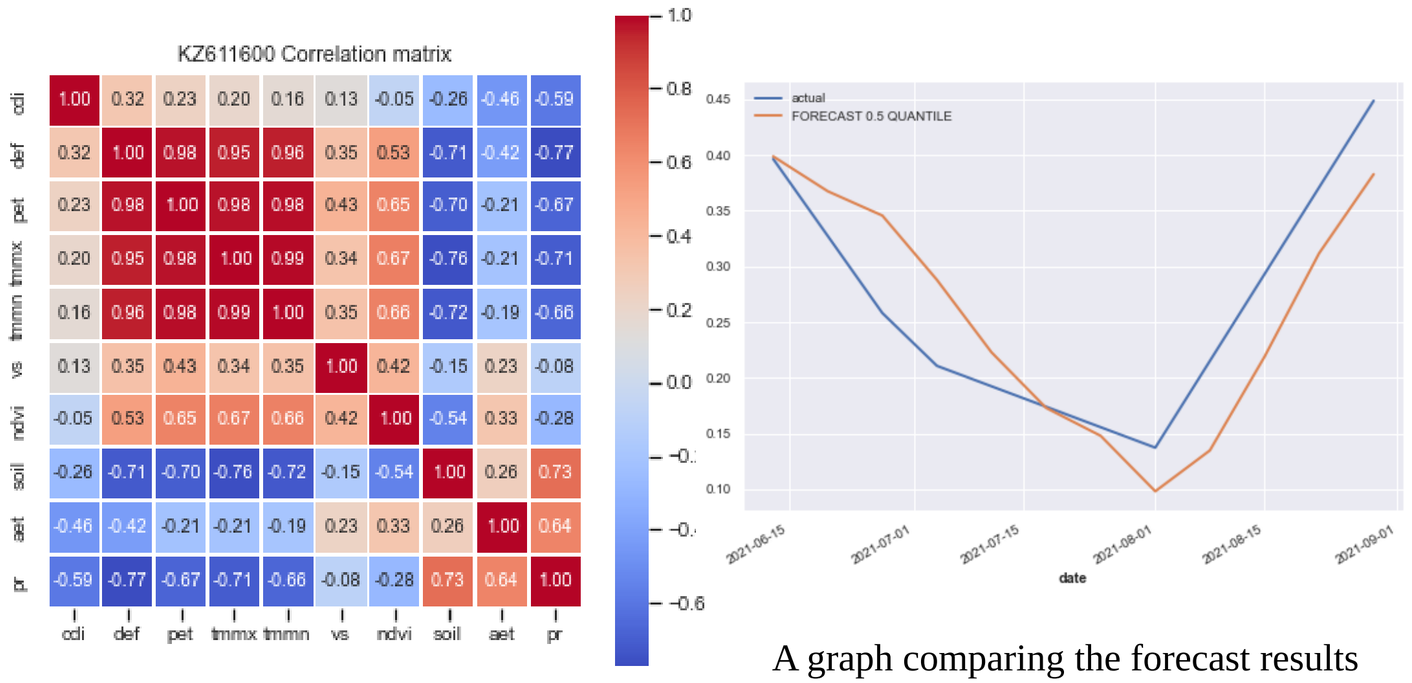
Customer: UN FAO

The main goal is to create an adapted model for predicting multidimensional time series using deep learning. Creation of a geoportal for drought forecasting in agriculture.

Tasks to be solved:

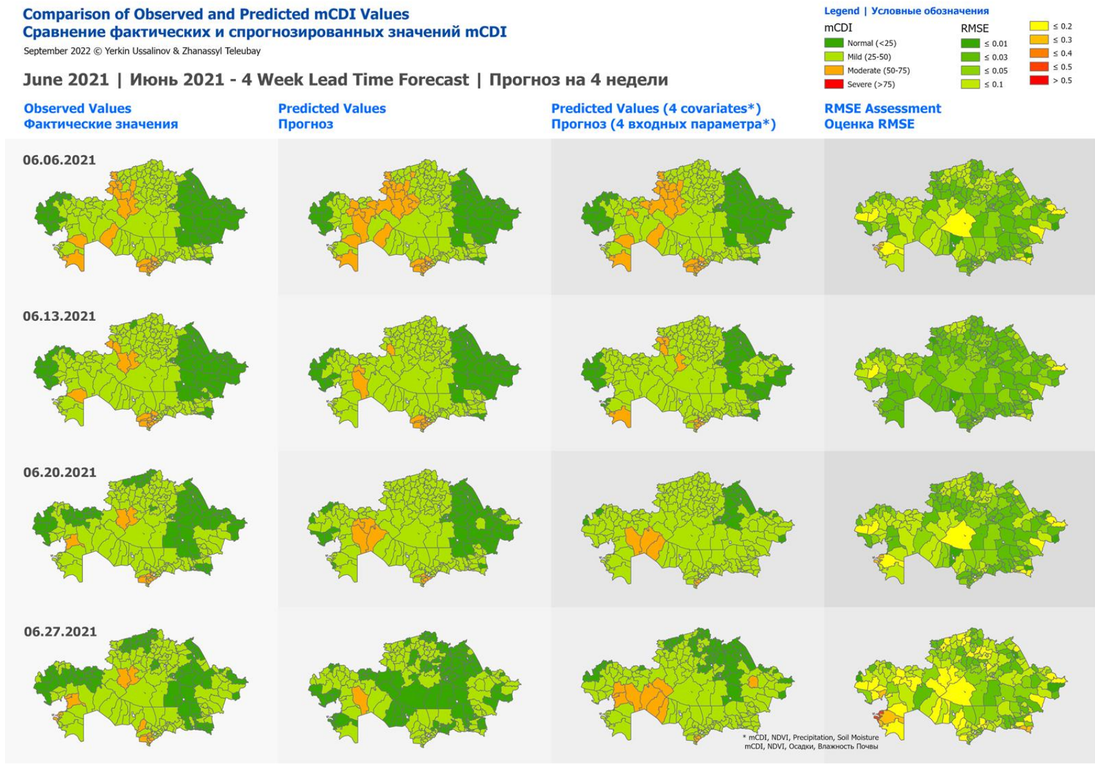
1. Drought monitoring support to strengthen drought planning processes at the national level;
2. Comparison and adaptation of existing time series forecasting models based on artificial neural networks (INS), machine learning (MO) and Deep Learning (GO);
3. Development of a geoportal with the results of agrometeorological monitoring of drought from 2000 to 2021 and integration of forecasted результатов засухи.





An example of a correlation matrix of various input parameters (meteorological indicators) used to create an agricultural drought forecasting model

A graph comparing the forecast results with the actual data of the mscdi index values for 12 weeks



Продовольственная и сельскохозяйственная организация Объединенных Наций

"Irrigation technologies and technical means for the introduction of new irrigation lands, reconstruction and modernization of existing irrigation systems" of the Ministry of Agriculture of the Republic of Kazakhstan for 2021-2023.

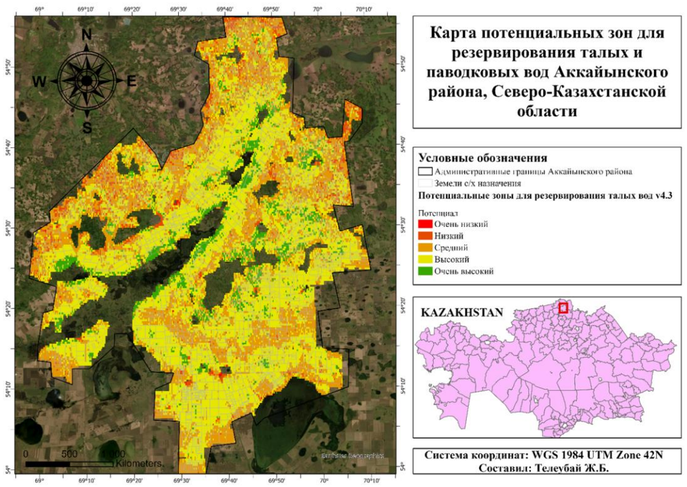
The main goal is to develop a methodology for selecting optimal locations for reserving melt and flood waters using GIS and remote sensing in Akkayyn district, North Kazakhstan region.

Customer: КазНИИВХ

Budget: 60 million tenge

Tasks to be solved:

1. Validation and calibration of previously developed snow cover monitoring technology using remote sensing data.
2. Calculation of the volume of thawed and flood waters using GIS and remote sensing.
3. Analysis of water quality at characteristic points.
4. Development of a methodology for selecting optimal locations for reserving meltwater and floodwaters and its implementation.
5. Recommendations on the design features of small reservoirs for reserving thawed and flood waters.



Карта потенциальных зон для резервирования талых и паводковых вод Аккайынского района, Северо-Казахстанской области

Условные обозначения

Административные границы Аккайынского района

Земли с/х назначения

Потенциальные зоны для резервирования талых вод v4.3

Потенциал

Очень низкий

Низкий

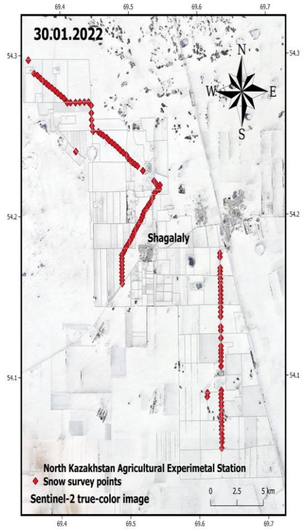
Средний

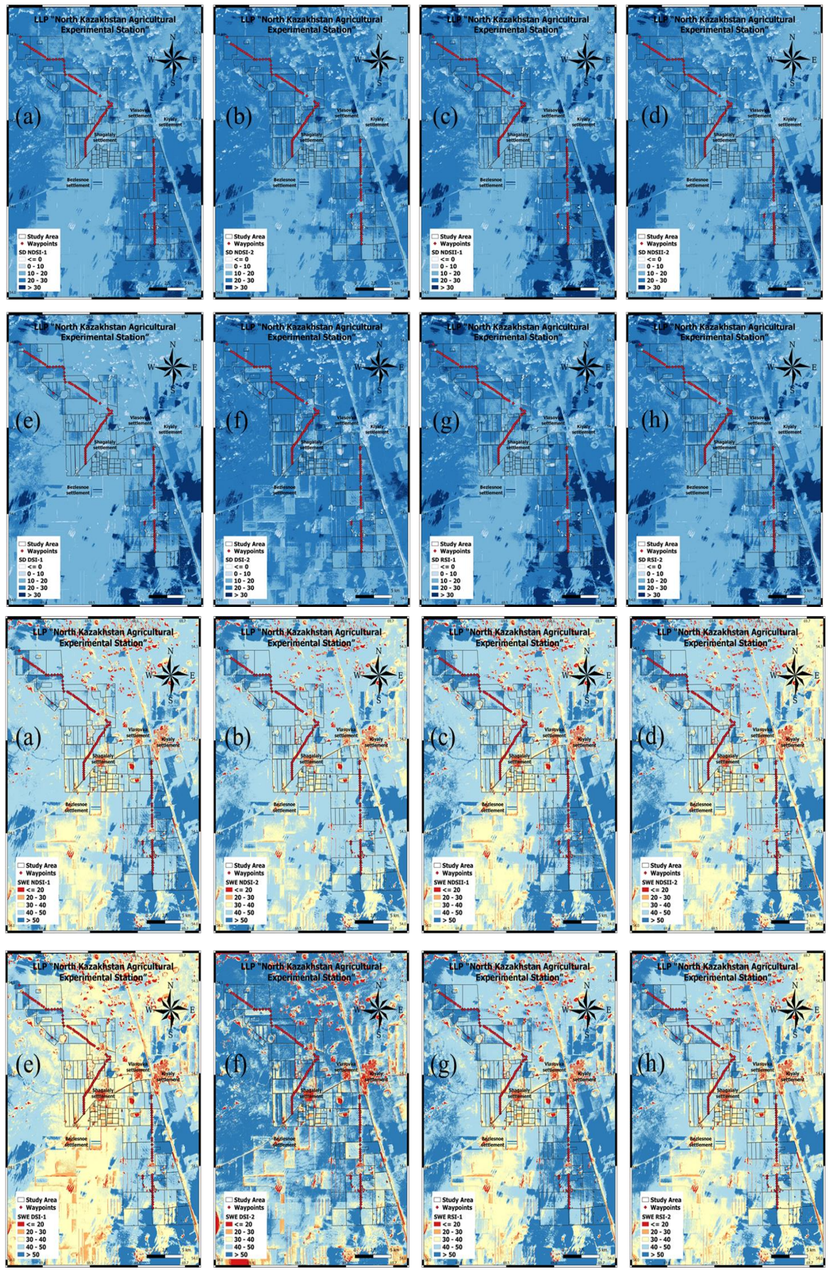
Высокий

Очень высокий

Система координат: WGS 1984 UTM Zone 42N
Составил: Телеубай Ж.Б.

Матрица		Осадки	Геология	Уклон	Плотность вобсбора	Вид землепользования	Гидрогеология	Почва	Рельеф	Нормализированный собственный вектор (W)
		1	2	3	4	5	6	7	8	
Осадки	1	1	4	3	2	5	1/2	7	2	19.71%
Геология	2	1/4	1	1/5	1/3	7	1/7	4	1/4	5.86%
Уклон	3	1/3	5	1	1/3	5	1/5	5	1	10.38%
Плотность вобосбора	4	1/2	4	3	1	8	1/2	7	3	18.69%
Вид землепользования	5	1/5	1/7	1/5	1/8	1	1/8	3	1/6	2.61%
Гидрогеология	6	2	7	5	2	8	1	9	2	29.14%
Почва	7	1/7	1/4	1/5	1/7	1/3	1/9	1	1/4	2.01%
Рельеф	8	1	3	1	1/3	6	1/2	4	1	11.59%





КазНИИВХ

"Development and improvement of integrated protection systems for fruit, vegetable, grain, fodder, legumes and plant quarantine" within the framework of program-targeted financingfor 2021-2023

Customer: КазНИИЗКР

The main goal is to adapt progressive agricultural technologies in the fight against quarantine and especially dangerous harmful organisms in order to ensure phytosanitary safety in the agro-industrial complex of the Republic of Kazakhstan.

Tasks to be solved:

1. Development of a methodology for predicting the spread of dangerous, especially dangerous quarantine pests on the territory of the Republic of Kazakhstan.
2. Conducting phytosanitary monitoring of diversified crops.
3. Improvement of methods of programming agricultural crops in various systems of protection measures against damage by harmful organisms.
4. Development of diversified and ecologized systems of protection of fruit and vegetable crops from harmful organisms depending on the growing area.