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Rotational Pasture Management for Ameliorating Productivity and Feed Value of Vegetation, Soil Quality, and Sustainability in Dry Steppe Zone

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Abstract: Over the past years, a farming system in the Akmola region of Kazakhstan has undergone significant changes: The average number of animals per farm and the use of external inputs have significantly enhanced while the diversity of farming practices has decreased, becoming similar to intensive farming. In this research, we evaluated the rotational pastures for increasing the productivity and feed value of vegetation, soil quality, and sustainability of pastures for the development of livestock farming in Northern Kazakhstan. Statistical data analysis indicated that in the grazing period, in the phytocenosis of the farm's pastures, the main dominant plants were fescue Welsh (Fescue) (Festuca Valesiaca) and wormwood (Artemisia vulgaris). The projective cover by season of the grazing period varied from 53% with an intensive method of use to 67% with the use of rotation, the height of the grass stand was from 9-22 cm, respectively. The yield of green mass varied from 6.1-12.6 c/ha^{-1}. Green mass collection averaged from 7.0-10.9 c/ha^{-1}, the yield of dry mass from 2.2-4.1 c/ha^{-1}, feed units from 1.1-2.1 c/ha^{-1}, digestible protein from 0.09-0.18 c/ha^{-1}, provision of feed units with digestible protein from 80 to 85 g, metabolic energy from 1.6-3.0 GJ/ha^{-1}. The obtained results will allow agricultural producers to effectively use pasture resources and increase the competitiveness of domestic livestock products.

Keywords: Rotational Pasture, Forage Grasses, Productivity, Feed Value, Soil, Degradation Stage

Introduction

Sustainable land and soil management approaches are central to ameliorating food systems, maintaining a healthy environment, and ensuring rural development (Recanati *et al.*, 2019; Baronti *et al.*, 2022). It is crucial for nature, farming systems, and all human beings as the foundation of our health and our wealth (Adhikari and Hartemink, 2016). Pasturelands account for 67% of all agricultural lands worldwide (FAO, 2023). Currently, overgrazing occurs on pastures located near villages and watering places. Common pastures where the number of livestock grazing exceeded the threshold are especially affected (Grossman and Reinsh, 2018; Derner *et al.,* 2018). If grazing is done throughout the year without migration to seasonal pastures and even without local changes in the grazing site, the reduction of nutritious plant species, damage to vegetation and topsoil and as a result, wind erosion will occur (Bilotta *et al.,* 2007; Drewry *et al.,* 2008). Drewry *et al.,* (2008) in a study revealed that if grazing pressure is excessive, muddy conditions and soil compaction can occur, along with the reduction of desirable grazing species. It helps the spread of weeds that tolerate such conditions. As grazing distance increases, the level of degradation decreases, but most livestock rarely graze more than five km from waterholes. In this regard, it is necessary to examine the methods of rational use of pastures. The area of natural fodder lands in Kazakhstan is 183.9 million hectares. The potential productivity of pasture lands in our country reaches about 25 million tons of feed units (Kurbanbayev *et al.,* 2023). Additionally, our state is believed to have the largest supply of forage land per capita (Pan *et al.,* 2017; Van Oijen *et al.,* 2018).

Kazakhstan's pastures vary greatly in terms of relief: 77% of pastures are located on plains, including 25% in sand, 18% in mountains and uplands, and 5% in valleys and lowlands. Natural pastures are an important source of cheap feed. Their products account for 40% of the feed balance, including 80% of the need for green feed. In the Akmola, there are about 6.475 thousand hectares of pastures, of which 1.265 thousand hectares, or 19.5% are improved, 918.5 thousand hectares or 14.2% are distant pastures, 2.567 are watered pastures, 3 thousand hectares, or 39.6%."

Unsystematic exploitation of pastures has caused the productivity of pastures and fodder to decrease almost everywhere and the area of degraded lands has increased (Stampa *et al.,* 2020; Gultekin *et al.,* 2021). As a result, the productivity of fodder farms and pastures is significantly lower than their potential. Therefore, in order to reduce further destruction and rational use of pasture lands, the Law on Pastures of the Republic of Kazakhstan was adopted on February 20, 2017, which regulates public relations related to the rational use of pastures. Simultaneously, a law on the application of amendments and additions to some legal laws of Kazakhstan on the use of pastures was approved. Approximately 76.1% of the lands of Kazakhstan are considered to be areas sensitive to desertification with medium and high sensitivity (Kubenkulov *et al.,* 2019). In addition, according to data provided by FAO, the area of degraded land in Northern Kazakhstan is more than 50 million hectares, 38% of which is pasture (FAO, 2020) and, according to the Agency of Kazakhstan for the Use of Land Resources, 26.5 million hectares of pasture land have already been knocked down in this country. The current state of pastures in Kazakhstan is characterized by an increasing deterioration in pasture productivity and feed quality, on the one hand, the maximum concentration of livestock in the accessible territory, leads to the excessive use of the latter, while the far pastures are used the least (Caudillo *et al.,* 2023).

For the first time in the conditions of the Zhaksyn district of the Akmola region, a comprehensive survey of the vegetation and soil cover of pastures was carried out with the development of a pasture rotation scheme. The scientific and practical significance of the study is that the obtained results will allow agricultural producers to effectively use pasture resources and increase the competitiveness of domestic livestock products. The objective of this study was to evaluate rotational pastures to increase the productivity and feed value of vegetation, soil quality, and sustainability of pastures for the development of livestock farming in Northern Kazakhstan.

Materials and Methods

Site Description

The study was conducted in the growing seasons of 2022-2023 to evaluate the rotational pastures to increase the productivity and feed value of vegetation, soil quality, and sustainability of pasture lands of Zaporozhye-Agro LLP in the Zhaksyn district of Akmola region, Kazakhstan (51°40′26.5″N 67°23′49.9). The site has an average slope of 7% and the soil series are mapped as Enders silt loam (fine, mixed, thermic Typic Fragiudults) at the top and Leadvale loam (fine-silty, siliceous, thermic Typic Fragiudults) at the bottom of the slope. The unsystematic grazing method has been performed at the site of the study previously.

Experimental Design and Treatment Implementation

Based on the results of a geobotanical survey of the total pasture area of the farm, an experimental area of 50 hectares was selected, which was divided into five experimental fields (Table 1).

Geobotany studies were performed to determine the species composition, projective cover, height, and yield for the seasons spring, summer, and autumn, quality indicators with an investigation of the nutritional and energy-protein value of pasture vegetation in the conditions of 2022-2023 years.

Table 1: Experimental scheme, simplified five-field ten-year pasture rotation on fescue-wormwood-forb pastures

Year of use	Pasture rotation fields				
	1st Seasons	2nd	3rd	4th	5th
1 year	Spring	Summer	Autumn	Spring	Rest
2 year	Rest	Spring	Summer	Autumn	Spring
3 year	Spring	Rest	Spring	Summer	Autumn
4 year	Autumn	Spring	Rest	Spring	Summer
5 year	Summer	Autumn	Spring	Rest	Spring
6 year	Spring	Summer	Autumn	Spring	Rest
7 year	Rest	Spring	Summer	Autumn	Spring
8 year	Spring	Rest	Spring	Summer	Autumn
9 year	Autumn	Spring	Rest	Spring	Summer
10 year	Summer	Autumn	Spring	Rest	Spring

A geobotanical survey of the identified economically significant contours of seasonal pastures was laid out regarding the methodology of experimental work on hayfields and pastures (Konyushkov *et al.*, 1961). On an area of 100-200 m^2, several patches of plant communities were identified, each of which differed significantly in species composition, soil, and microrelief. The most typical area, well delimited from others, was described in the following order: Determination of the type of pasture, a list of dominant vegetation cover, evenness or complexity of the grass stand on a particular pasture, seasonal yield, projective cover, and other indicators.

Soil Sampling and Analysis

The calculation of bioclimatic potential was analyzed using the method of takes into account the influence of heat resources and the ratio of heat and moisture on biological productivity. Determination of the volumetric mass of soil using the cylinder method and was assessed according to the scale for assessing soil compaction by volumetric mass (g/cm^3) by Dolgov (1966). Moreover, soil density was also determined with a Wile penetrometer soil compaction - a device for measuring density through soil resistance when inserted into the soil. Determination of nutrients in the soil was performed in layers of 0-10, 10-20, and 20-30 cm before the beginning of grazing in the spring. Soil samples were randomly taken from each replicate, they were dried at 65°C, ground, and analyzed through the standard methods (Clemson University Agricultural Service Laboratory, Clemson, USA).

Climate Condition of the Area

During the study, at the Zhaksy weather station (https://www.meteoblue.com), average daily air temperatures in the winter months (January, and February) were warmer compared to the long-term average. Thus, the average monthly temperature in January was -14.0°C, while the norm was -15.7°C (1.7°C above normal). The average temperature for the month of March was -4.0°C, which was 4.0°C higher than the long-term average. The average monthly temperature in April 2023 was 5.1°C, which is 1.4°C higher than normal (3.7°C). An excessive increase in total temperature will cause the regrowth of perennial weeds. At the beginning of the grazing period in May, the average monthly temperature reached 15.1°C, which was 1.6°C higher than the long-term average (13.5°C) Table (2).

June was associated with moderate temperatures and a lack of precipitation. The temperature regime was within the long-term data -19.4°C, with a deviation of -0.2°C. The average temperature for July was 23.2°C, which was 2.2°C higher than the long-term indicator (21.0°C). In August, average daily air temperatures over ten days were below the long-term average by -0.3°C.

Precipitation condition. During the experiment rainfall data was obtained from the nearby Zhaksy weather station (https://www.meteoblue.com). Precipitation during the study period of 2022-2023 decreased unevenly Table (3).

In January 2023, precipitation decreased by 0.8 mm and in February by 0.1 mm. In March, precipitation recorded 5.6 mm, which was -8.4 mm less than the long-term average. The amount of precipitation in April was 15.9 mm, which was -4.1 mm less than normal. The amount of rainfall in May was -8.7 mm, but its normal was 38.0 mm. In June, the amount of precipitation was also lower by -15.7 mm. This year, the amount of rainfall in July was low, the difference with the long-term indicators was -12.4 mm, which in turn had a strong negative effect on the regeneration of grass. Thus, the average monthly precipitation, with a norm of 40.0 mm, was 27.6 mm. However, during August, precipitation decreased by 69.3 mm, which was already 41.3 mm higher than the long-term index.

Table 2: Average daily air temperature in 2022-2023 in comparison with average long-term values of average daily temperatures (SMZST)°C

Indicators	Months									
	Jan.	Feb.	March	Apr.	May	June	July	August	Sep.	Oct.
2023	-14.0	-13.9	-4.0	5.1	15.1	19.4	23.2	18.6	12.1	5.2
SMZST	-15.7	-15.2	-8.0	3.7	13.5	19.6	21	18.9	12.1	4.2
-,+ SMZST	1.7	1.3	4	1.4	1.6	-0.2	2.2	-0.3	0	1

Table 3: Precipitation data in 2022-2023 in comparison with average long-term precipitation (SMKO), mm

Indicators	Months									
	January	Feb.	March	Apr.	May	June	July	August	Sep.	Oct.
2023	13.8	12.1	5.6	15.9	8.7	11.3	27.6	69.3	73.5	30.5
SMKO	13.0	12.0	14.0	20.0	28.0	27.0	40.0	28.0	23.0	20.0
-,+ from SMKO	0.8	0.1	-8.4	-4.1	-19.3	-15.7	-12.4	41.3	50.5	10.5

Data Analysis and Statistics

Before statistical analysis, all data were examined for normality and constant variance. Data analysis was laid out by the use of the GLIMMIX procedure of the SAS Institute (2014). One-way and two-way Analysis of Variance (ANOVA) was followed by the Least Significance Difference (LSD) test for the mean comparison to identify the statistical differences between the treatments at $p< 0.05$. Tukey's test for post hoc comparison of means was done for the comparison of more than two samples, e.g., soil parameters during the experimental years.

Results

Based on the results of a geobotanical survey of the entire pasture area of the farm, an experimental farm with an area of 50 hectares was selected, which was divided into five fields. In the spring, in the phytocenosis of pastures of Zaporozhye Agro LLP, the main dominant plants were Welsh fescue (*Festuca valesiaca*) and wormwood (*Artemisia vulgaris*). Also, Austrian wormwood (*Artemisia austriaca*), wheatgrass (*Agropirum pectiniforme*), Lessing's feather grass (*Stipa lessingiana*), milkweed (*Euphorbia esula*), spreading cornflower (*Centaurea diffusa*) and bedstraw (*Galium verum*) were found. Projective cover varied from 53 to 64%, grass height from 9-18 cm. Green mass yield from 6.1-9.6 c/ha^{-1} Tables (4-5).

In the control plot of intensive grazing, 6 plant species were found, the projective cover was 53%, with a grass stand height of 9 cm and a green mass yield of 6.1 c/ha^{-1}.

The first field of rotational grazing contained six plant species, such as Welsh fescue (Festuca Valesiaca), wormwood (Artemisia Vulgaris), Austrian wormwood (Artemisia Austriaca), wheatgrass (Agropirum Pectiniforme) and Lessing's feather grass (Stipa Lessingiana), the projective cover was 59%, with a grass stand height of 17 cm and a green mass yield of 9.4 c/ha^{-1}. In the second field of rotational grazing, four plant species were investigated, the projective cover was 58%, with a grass stand height of 16 cm and a green mass yield of 9.2 c/ha^{-1}. In the third field, seven plant species were identified, the projective cover was 64%, with a grass stand height of 18 cm and a green mass yield of 9.6 c/ha^{-1}. In field 4, four plant species were found, the projective cover was 59%, with a grass stand height of 17 cm and a green mass yield of 9.4 c/ha^{-1} and in the fifth field, six plant species were considered, the projective cover was 57%, with a grass stand height of 16 cm and a green mass yield of 9.3 c/ha^{-1}.

The phytocenosis of pasture lands was subject to change during the seasons depending on various factors including animal grazing. Therefore, the analysis of pastures in summer has significant differences in Table (6).

Data analysis indicated that in the summer, in the various pasture fields, there was a significant increase in projective cover, which varied from 56-67%, an increase in grass height with a value of 13-22 cm. The yield of green mass ranged from 7.8-12.6 c/ha^{-1} Table (6). However, until the end of summer, due to the high average daily temperature and lack of precipitation, burns and a decrease in farm productivity were observed. In the control plot of intensive grazing, six plant species were identified, and the projective cover was 56%, with a grass stand height of 13 cm and a green mass yield of 7.8 c/ha-1.

Table 4: Quantitative and qualitative indicators of the state of the vegetation cover of pasture lands of Zaporizhzhia-Agro LLP, Zhaksynsky district, Akmola region in the spring

Pasture use options and field numbers	Projective coverage, %	Quantity species	Grass height, cm	Productivity, (green mass) c/ha^{-1}
Intensively grazed pastures (control)	53	4	9	6.1
Rotational pastures-field 1	59	5	17	9.4
Rotational pastures-field 2	58	4	16	9.2
Rotational pastures-field 3	64	5	18	9.6
Rotational pastures-field 4	59	4	17	9.4
Rotational pastures-field 5	57	5	16	9.3
LSD $_{05}$	-	-	-	0.21

Table 5: Species composition of pastures depending on methods of use in the spring

Plant species	Pasture use options					
	Intensively grazed pastures (control)	Rotational pastures				
		Field 1	Field 2	Field 3	Field 4	Field 5
Fescue Welsh (fescue) (*Festuca valesiaca*)	+	+	+	+	+	+
Wormwood (*Artemisia vulgaris*)	+	+	+	+	+	+
Austrian wormwood (*Artemisia austriaca*)	+	+	-	+	+	+
Wheatgrass comb-shaped (*Agropirum pectiniforme*)	-	+	+	+	-	+
feather grass Lessing (*Stipa lessingiana*)	+	+	+	+	+	+
Bedstraw (*Galium verum*)	+	-	-	+	-	+
Euphorbia spurge (*Euphorbia esula*)	+	-	-	-	-	-
Spreading cornflower (*Centaurea diffusa*)	-	+	-	+	-	

Table 6: Quantitative and qualitative indicators of the state of the vegetation cover of pasture lands of Zaporozhye-Agro LLP, Zhaksynsky district, Akmola region

Pasture use options and field numbers	Projective coverage, %	Quantity species	Grass height, cm	Productivity, (green mass) c/ha^{-1}
Intensively grazed pastures (control)	56	4	13	7.8
Rotational pastures-field 1	63	5	22	12.4
Rotational pastures-field 2	64	4	21	12.2
Rotational pastures-field 3	67	5	22	12.6
Rotational pastures-field 4	65	4	21	12.4
Rotational pastures-field 5	63	5	21	12.3
LSD $_{05}$	-	-	-	0.32

Table 7: Quantitative and qualitative indicators of the state of the vegetation cover of pasture lands of Zaporizhzhia-Agro LLP, Zhaksynsky district, Akmola region in the autumn

Pasture use options and field numbers	Projective coverage, %	Quantity-species	Grass height, cm	Productivity, (green mass) c/ha^{-1}
Intensively grazed pastures (control)	55	4	10	7.10
Rotational pastures-field 1	62	5	21	10.30
Rotational pastures-field 2	63	4	20	10.20
Rotational pastures-field 3	65	5	21	10.50
Rotational pastures-field 4	64	4	20	10.40
Rotational pastures-field 5	62	5	20	10.30
LSD $_{05}$	-	-	-	0.28

In field 1 of rotational grazing, six plant species were found, and the projective cover was 63%, with a grass stand height of 22 cm and a green mass yield of 12.4 c/ha^{-1}. In field 2, four plant species were found, the projective cover was 64%, with a grass stand height of 21 cm and a green mass yield of 12.2 c/ha^{-1}. In the third field of rotational grazing, seven plant species were found, and the projective cover was 67%, with a grass stand height of 22 cm and a green mass yield of 12.6 c/ha^{-1}. In field 4, four plant species were identified, and the projective cover was 65%, with a grass stand height of 21 cm and a green mass yield of 12.4 c/ha^{-1}. In the fifth field, six plant species were found, and the projective cover was 63%, with a grass stand height of 21 cm and a green mass yield of 12.3 c/ha^{-1}.

In autumn, in different pasture fields, the image coverage varied from 55-65%, and the height of the grass stands from 10-21 cm. The yield of green mass ranged from 7.1-10.5 c/ha-1 (Table 7).

In control plots of intensive grazing, six plant species were found, and the projective cover was 55%, with a grass stand height of 10 cm and a green mass yield of 7.1 c/ha^{-1}. In field 1 of rotational grazing, six plant species were identified, and the projective cover was 62%, with a grass stand height of 21 cm and a green mass yield of 10.3 c/ha^{-1}. In field 2, four species were found, and the projective cover was 63%, with a grass stand height of 20 cm and a green mass yield of 10.2 c/ha^{-1}. In the 3rd field, seven plant species were found, and the projective cover was 65%, with a grass stand height of 21 cm and a green mass yield of 10.5 c/ha^{-1}. In field 4, four species were identified, the projective cover was 64%, with a grass stand height of 20 cm and a green mass yield of 10.4 c/ha^{-1}. In field 5, six species were found, and the projective cover was 62%, with a grass stand height of 20 cm and a green mass yield of 10.3 c/ha^{-1}.

When assessing the feed, energy and protein value of pasture phytocenoses in Zhaksynsky district, Akmola region, the collection of green mass varied from 7.0-10.9 c/ha^{-1}, the yield of dry mass varied from 2.2-4.1 c/ha^{-1}, the collection of feed units 1.1-2.1 c/ha^{-1}, the collection of digestible protein varied from 0.09-0.18 c/ha^{-1}, the provision of feed units with digestible protein 80-85 g and the yield of metabolizable energy varied from 1.6-3.0 GJ/ha^{-1} (Table 1).

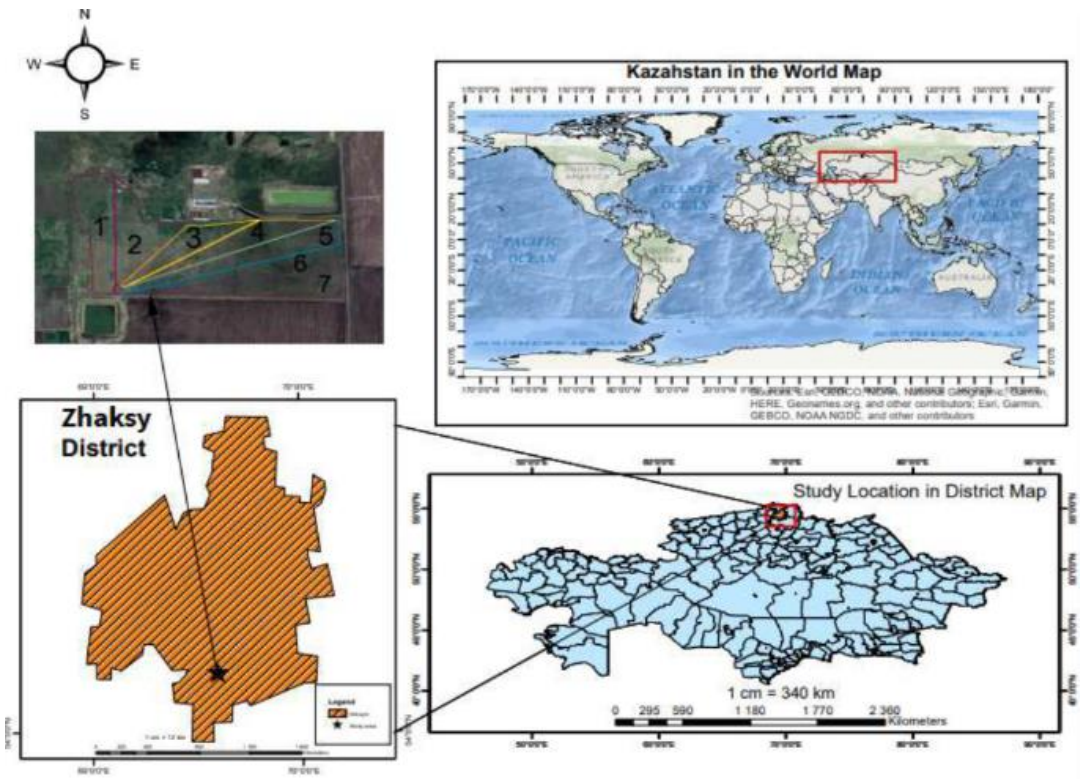
Field and laboratory evaluation were performed to study the soil cover of pastures (soil density (using Kaczynski cylinders), the content of agronomically valuable structural aggregates measuring 10-0.25 mm (by dry sieving of selected samples in laboratory conditions), nitrate nitrogen (Gost, 1986), mobile phosphorus (Gost, 1992), exchangeable bases (Gost, 2018) including exchangeable sodium (Gost, 2011), depending on the technology of their use in the conditions of the 2022-2023 farming years. When determining agrochemical and agrophysical indicators of the soil cover of natural forage lands of the considered pasture fields of Zaporozhye-Agro LLP, it was attained that the humus content varied from 3.11 with an intensive method of use and to 3.69% when using rotation, which is compared with the standard, lower by 12.54% (1 stage of degradation) and 0.92% (no degradation), respectively. Humus reserves were: Reference option 141.9 t/ha^{-1}; with intensive use 124.1 t/ha^{-1} and up to 140.6 t/ha^{-1} when using rotation (Table 2). Soil density varied from 1.27 g/cm^3 when using rotation and to 1.33 g/cm^3 when using intensively, which compared to the standard, is higher by 4.72% (1 stage of degradation) and by 9.03% (2nd stage of degradation).

When monitoring the changes in the structural composition of the pasture soil cover, it was found that in the soil layer of 0-30 cm, the content of valuable structural soil grains in the soil varies from 55.3-68.8% with a structural coefficient with the value of 1.26-1.9. It characterizes the soil condition of the fields as "Good" in terms of the content of structural aggregates with an agronomic value of 68.8% and a structure factor of 1.91 when rotation was applied. However, with intensive use, the soil of the fields deteriorated to "satisfactory" in terms of the content of structural aggregates with the agronomic value of 55.3% and the structural coefficient of 1.26.

Deterioration of soil agrophysical indicators and reduction of humus content with heavy use also had a negative effect on the amount of available phosphorus up to 1.57 mg/100 g. However, these conditions have led to a slight enhancement in the amount of exchangeable sodium in the soil, which indicates salinity and the increase in soil alkalinity and has not affected the soil salinity in the regions.

Discussion

Pastures cover about 26% of the Earth's surface and are the main source of feed for livestock, including all ruminants (Ellis *et al.*, 2010; Phelps and Kaplan, 2017). Feed is a key resource in livestock production and covers about 60-70% of the total production costs of meat, milk, and eggs, meaning sustainable livestock production is important for global food security (Wongnaa *et al.*, 2023). Insufficient supply of feed in terms of quality and quantity leads to a decrease in livestock productivity. Today, climate change, including decreased rainfall during important plant growing seasons and increased climate variability worldwide, poses serious questions to both scientists and growers. Developing a suitable livestock strategy with optimal use of available feed resources can enhance per capita production and consumption of livestock products. Livestock productivity can fluctuate due to many environmental factors, including climate variability, so pastures require constant monitoring of quantity and productivity as well as appropriate grazing practices. Taking climate extremes and climate variability into account, (Allred *et al.*, 2014) conducted a six-year study on the impact of spatial heterogeneity on livestock productivity in the tallgrass prairie of the southern Great Plains, USA. They analyzed the interaction of air temperature and livestock grazing in space and time at large scales across pastures ranging from 430-900 hectares and found that the effect of precipitation on livestock productivity was dependent on heterogeneity. When heterogeneity was absent, livestock productivity decreased with decreasing rainfall. In contrast, when heterogeneity was present, there was no relationship between rainfall and livestock productivity, with the result that heterogeneity stabilized livestock productivity over time, but the yield of individual grass groups varied without analyzing crop productivity in the study pastures.



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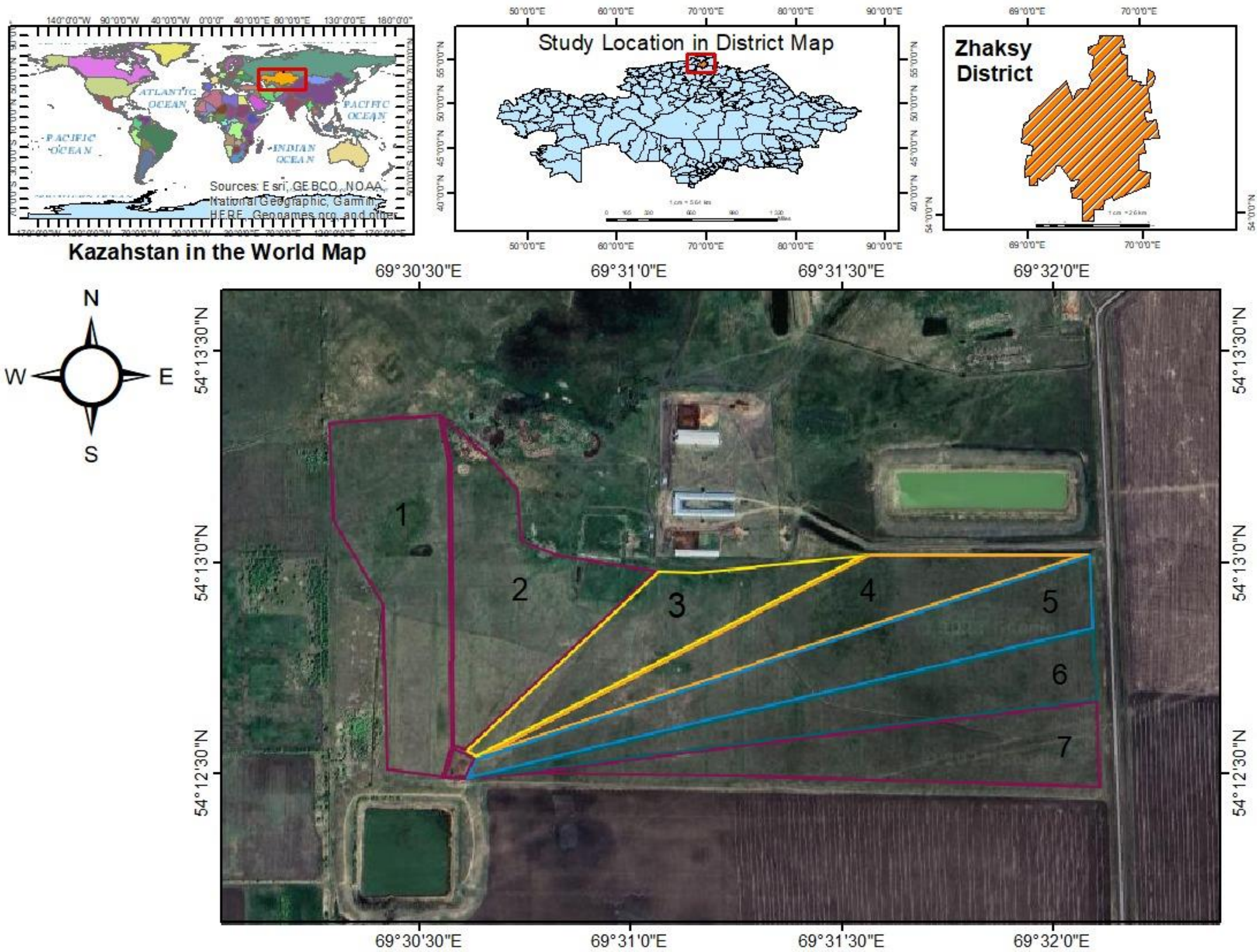

Fig. 1: The study area in Zaporozhye-Agro LLP in the Zhaksyn district of Akmola Region, Kazakhstan

Precipitation affects crop growth, but soil pH is important for the quality of growth and development, including plant roots. Research by He *et al*. (2024) indicated that dense vegetation cover and developed areas exhibit different factors that influence soil properties. To identify the sources of increased pasture productivity, hierarchical clustering analysis was conducted and the main driving factors were identified using random pasture regression and additive Shapley explanations. Overall, the results of this study demonstrated an effective method for using various open-source remote sensing datasets and GIS to understand spatial variability and soil respiration mechanisms. There is no one-size-fits-all approach to modeling carbon fluxes released through soil respiration and the study highlights the importance of further research and monitoring techniques to improve understanding of carbon dynamics and promote sustainable grassland management. Solascasas *et al*. (2024) have proven that the lack of transhumance has led to the degradation of natural corridors with unexplored consequences in terms of soil quality and functioning. The study determined the relationship between the conservation status of livestock routes and soil characteristics by selecting thirty sites in the Madrid road network in central Spain. Research results have shown that the safety of roadways has a significant impact on soil fertility. This study demonstrated pasture use options, vegetation changes, and the resulting assessment of green forage quality. Rotational pastures should be used to enhance various feed resources, livestock numbers, and livestock feed requirements and balance. The results of these studies and those of other scientists, once again highlight the need for rotational grazing, as presented in this article, to provide improved quality and quantity of pasture feed for animals.

There have also been studies using management schemes based on heterogeneity and feasting herbivores, which did not have a negative impact on the overall invertebrate community. In comparison, homogeneous landscapes, such as those created by traditional management, may benefit only those segments of the invertebrate community that have habitat associations with moderately disturbed or undisturbed areas. Thus, disturbance regimes involving fire and grazing interactions may be valuable for maintaining biodiversity and productivity in sand sage prairie ecosystems. Rangelands provide valuable habitat that is vulnerable to fragmentation and land use changes, which affect their suitability for grazing and their contribution to biodiversity. Research in this complex, transdisciplinary area is needed to figure out how to maximize food safety and ecosystem health while minimizing potential adverse impacts. In western North America, a large, regional, season-long field study over a single season on grasslands in Oregon and Idaho to reflect differences in ecological context and grazing intensity (Kimoto *et al.*, 2012). They analyzed the structure of annual grass, perennial grass, and shrub cover at regional and local scales and examined the extent to which site-level variation depended on pasture-level predictions of site favorability. Annual grasses were widespread across all sites; at the pasture site level, annual grass cover did not change, but perennial grass cover varied depending on grazing rates; perennial grasses, for example, had less cover closer to water sources but higher cover when there was more manure on the pasture, suggesting contrasting interpretations of these two grazing rates; perennial grasses had higher plot-level cover on cooler slopes and this the difference in topography was most dramatic in grasslands that were less favorable to perennial grasses regionally. Understanding the mechanisms underlying cross-scale interactions and stochastic responses of vegetation to grazing in these increasingly populated ecosystems will be critical for land management in a changing world. Jarque-Bascuñana *et al*. (2021) used near-infrared spectroscopy to determine several components of feed nutritional value, which they combined through ordination into a single feed composition index and weighed cows before and after the grazing season to assess cattle productivity for each grazing method. Thus, cows from burned pastures grew better during the grazing season. Burning sites can improve livestock production and productivity while creating the heterogeneity needed to achieve rangeland conservation goals.

Since the use of pastures, the assessment of its productivity is a very important issue everywhere and is the basis of the country's food security Scientists use various approaches to determine the most effective method of increasing pasture productivity, while rotational pastures are the most accurate and efficient. But so far, only the method of selecting different crops and analyzing the changes in plant species depending on the use of pasture were investigated.

Conclusion

During the grazing period, the dominant plants in the phytocenosis of field pastures were Welsh fescue (fescue) (*Festuca valesiaca*) and wormwood (*Artemisia vulgaris*). The projective coverage varied from 53% with intensive use to 67% with rotation based on grazing season, the height of the grass mass was from 9-22 cm, respectively. The yield of green mass ranged from 6.1-12.6 c/ha^{-1}. Green mass boron averaged from 7.0-10.9 c/ha^{-1}, dry mass yield 2.2-4.1 c/ha^{-1}, collection of feed units 1.1-2.1 c/ha^{-1}, collection of digestible protein 0.09-0.18 c/ha^{-1}, provision of feed units with digestible protein 80-85 g and metabolic energy from 1.6-3.0 GJ/ha^{-1}. The humus content ranged from 3.11 with intensive use to 3.69% with rotation, which is 12.54% (1-stage degradation) and 0.92% (no degradation) lower, respectively, compared to the standard. Humus reserves were: Reference option-141.9 t/ha^{-1}; with intensive use -124.1 t/ha^{-1} and up to 140.6 t/ha^{-1} when using rotation. Soil density varied from 1.27 g/cm^3 when using rotation and to 1.33 g/cm^3 when using intensively, which, compared to the standard, was higher by 4.72% (1 stage of degradation) and 9.03% (2nd stage of degradation). The soil condition of the plots when applying rotation was evaluated as "good" in terms of the content of structural aggregates with agricultural value (68.8%) and the structure factor of 1.91. However, with intensive use, the soil of the plots deteriorated to "satisfactory" in terms of the content of structural aggregates with agronomic value (55.3%) and a structural coefficient of 1.26.

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Author's Contributions

Gani Stybayev: Methodology, supervision.
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All authors read and approved the final manuscript.

Ethics

This article is original and contains unpublished material. The corresponding author confirms that all of the other authors have read and approved the manuscript and no ethical issues involved.

Conflicts of Interest

The authors declare that there are no conflicts of interest related to this article.

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