UDC 58.01/.07

A.S. Seilkhan[1], V.B. Saibulatova[2], R.N. Atraybaeva[3], M.E. Beisenbaeva[1], M.Zh. Zhumagul[4]

[1]Kazakh National Agrarian University, Almaty, Kazakhstan;
[2]«Department of agrochemical and soil research and integrated research-a branch of the non-profit joint stock companies»; Public Corporation of the government for citizens», Almaty, Kazakhstan;
[3]Abay Kazakh National Pedagogical University, Almaty, Kazakhstan;
[4]Al-Farabi Kazakh National University, Almaty, Kazakhstan
(E-mail: ainura_seilkhan@mail.ru)

Ecological monitoring of pastures of Kurti rural district of Almaty region

In the article the main indicators of the environmental monitoring system carried out in the territory of Kurti rural district, the main indicators of soil and chemical composition in the territory of Kurti rural district, their hydrological functions, climatic factors, as well as the biotic sequence and interaction of the unified system are studied. Integrated ecological monitoring of soil cover and vegetation features of the special rural district on the basis of dynamic changes in the territory and soil features of the relationship of a number of indicators, including one or more ecosystems. In the conditions of the local territory, agrochemical, ecological, climatic, soil and floristic compositions are studied, as well as productivity of pastures and the results of the number of livestock. Based on possible changes in the future, the relevance of the effective environmental monitoring increases in order to preserve the biodiversity of pasture lands and county territory in the future.

Keywords: ecological monitoring, soil fertility, flora composition, pasture mass.

The total area is 188 mln Ha or 70 % of all territory [1]. The pasture area of Kurti territory is 33348 ha net pasture 83205 ha (33.3 %), shrub land 65646 ha (26.2 %), sagebrush and another vegetative cover 434 ha (0.2 %), slightly ribbed and unchecked of Association are 8439 ha [2].

Environmental monitoring is a system covering many branches of research, which allows to determine the intensive load of pastures and to present a scientific concept and the possibility of further use of pastures, implementing them at the local, district, national and global levels, as well as to create conditions for controlling the causes of changes, including the dynamics of plant growth, effective and understandable methods [3–6].

In General, the processes of restoration of any vegetation cover a long time [7]. Quantitative studies obtained from point objects designated in the study area are carried out in order to obtain the characteristics of the soil composition and cover [8].

After analyzing the statistical data on environmental monitoring, the level of soil fertility depends on the productivity of hay fodder and at the same time has a high value of expeditionary research [9–12]. Before processing plants in the study area should be determined by the vegetable coating and feed thickness and Botanical composition of each site [13, 14]. Nutrients contained in the soil have a direct impact on pasture productivity and feed adequacy [15, 16]. The composition of the soil in which it is placed hayfields, approved by order No. 22/14 from 27.03.2020, confirming the suitability to 27.03.2020. Research soil nature protection, chemical, bacteriological, methods of preparation of samples and conclusions for helminthological analyses are carried out on the basis of the state standard 17.4.02–84 [17–23]. The principle of distribution of mobile elements in the General soil composition of Astana was carried out in accordance with the proposed method of Chernenko.

Among the factors affecting the spatial and temporal changes in pastures, the role of the grazing process is particularly relevant due to the fact that the calculation of the grazing index, not covering large areas, conducting studies at a minimized level leads to an effective result [24, 25]. Environmental monitoring determination of the relationship between quantitative and qualitative indicators of climate and soil and plant fertility, since most of the research is a source of nutrition of livestock vegetation cover, will allow in the future to make a qualitative forecast [26–28].

The greatest growth of adraspan, which is a toxic plant with gray wormwood growing in dry and semi-dry areas of excessive grazing, in the presence of the first signs of the degradation process, allows to conduct research at a minimized level without studying the large areas in which they grow, maximally adapted to the dry environment [29–31].

Materials and methods of the object of study

The relevance of carrying out environmental monitoring of the grasslands areas of the region due to overgrazing in areas in the period of 2015–2018 Kurti rural district has conducted studies of grasslands at the local level.

Due to the the spread of degraded pastures on the area of 145182 hectares, it is recommended to carry out the necessary measures to maintain the grazing regime and the optimal strength of pastures. In the course of the assessment, the study area was previously planned and marked with the help of Google earth-map program, the boundaries of which were numbered, in the laboratory state, indicators of humus and heavy substances in the soil were determined, geobotanical characteristics, density and humidity were established, floristic composition and indicators of the number of livestock belonging to the rural district were identified. Geobotanical characteristics and soil composition of pasture hayfields were determined, complex ecological monitoring studies of pastures were carried out.

In the Kurti rural district of Almaty region with the help of Google earth-map, shown in Figure 1, separated from the territory of the village of Akshi Kurti rural district in Almaty region, the coordinates of the contours and productivity of vegetation, and observed with a fixed territory coordinates: 44.00.00 76.18.56 East, parcel No. 2: 44.00 North East 76.19.28, lot No 3: North East 43.59.45 76.20.10. Environmental monitoring was carried out in expeditionary conditions. The data obtained from each plot in determining the mass of land ownership in the study area, in a 5-fold rate of repeatability of 1 m^2 of the established area and in a 5-fold radius of 5 square meters from each other, including hayfields from the rural border.

To obtain a qualitative chemical analysis of soils obtained in our territory, a number of special state standards were established. In particular, via special methods, elements of 100 g/dm^3 50 g separately with the addition of nitric acid in a flask with a capacity of 500 cm^3 are planned in a pre-prepared solution of the CV brand. Most of the elements come to the analysis as a grain.

When determining the content of lead in the soil, 0,01 % of the mass is taken, and for cadmium and iron samples this figure should be obtained below 0,005 % of the ointment, only for copper this figure should not be below 0,001 % of the mass, while the measuring weight used in the additional calculation should be equal to 2500 g. For other withdrawn samples, the mass of 1000 g is taken into account under the conditions established. In some cases, it is recommended to use other solutions for accurate analysis. Zinc is heated in a ratio of 30 cm^3 nitric acid (1:3) provided that when weighed with a special heat-resistant solution of 2.5 cm^3 with an acidic solution is 2500 g or 15 cm^3. Evaporating the wet salt, nitric acid is poured in a ratio (1:3), heated to dissolve the salt and cooled to 50 cm^3 flask. For analysis and results from spent reagents simultaneously for each measurement, including iron (Fe), copper (Cu), lead (Pb) and other elements 1000 and 2500 g. samples are taken in duplicate. As an example, solutions made on the basis of zinc, and sometimes on the basis of water, are used. When using atomic absorption spectrometers, results can be obtained automatically by special programs without operator assistance in the determination and measurement of the elements.

The second stage of our study was carried out using geobotanical methods, in particular, they cover three stages: 1. preparation, 2. departure to the field, and 3. office period.

Preparatory stage. At the preparatory stage, the purpose of the work and the scale of research is planned; the terms of work are planned and determined; planning and cartographic materials are collected, the boundaries of the territory on which the research is carried out are clarified and approved; the full literature about the object is acquainted with, information about the vegetation cover, natural and climatic conditions, the soil layer is summarized; cartographic materials of works on geobotanical and soil survey conducted in the previous stages are collected for analysis; selected topographic map, the photographic maps, drawings.

Field period. During this period, reconnaissance (preliminary studies) studies of the territory, geobotanical mapping of pastures, description of vegetation cover and soil, description of the cultural and technical condition of natural pastures, determination of measures for their effective use and improvement, determination of feed productivity and quality of feed, sampling of plants for chemical analysis and processing of collected materials in the field period.

The composition of the soil on the mobile compound of zinc, lead, cadmium, antimony, iron and copper, etc. were determined by atomic absorption and complex method Krupsky and Alexandrova listed in Tables 3–7.

Office period. Materials collected during the field period are processed. At finishing works the flora structure of the investigated territory is specified; the typological structure is formed, the classification of types of natural pastures is made; productivity of hayfields and pastures (on terms) is calculated; the geobotanical map of natural pastures is made, the offers on a cultural and technical condition and rational use is made.

Figure 1. Pasture points where environmental monitoring is carried out with the help of Google Earth-maps

Table 1

Research tools and results

№	Name of equipment	Serial number	Research certificate no.	Date of the study	Suitability of research analyses
1	Specord 210 PLUS	223F1426/1199	BA–11–19–430 22.05.2017	22.05.2018	27.03.2020
2	Ionomers laboratory type AND-160 MI	0451	BA–09–19–1514 22.05.2017	22.05.2018	27.03.2020
3	Photometer Type FLAPHO-4	779792/b/n	BA–11–19–433 22.05.2017.	22.05.2018	27.03.2020
4	Scales, electronic AR 2140	1227250240	BA–02–02–31112 17.07.2017	17.07.2018	27.03.2020
5	Scales, electronic Scout Pro SPS202 F	7132211951	BA–02–02–31116 17.07.2017	17.07.2018	27.03.2020

Table 2

According to the results of the study and analyzes are purely individual
Qualitative chemical analysis of soil (form) selection № 1

Indicators	Unit of measurement mg/kg	Necessary methodological documents for the study
Zinc	1.2	State standard R 50686–94
Iron (Fe)	34.0	State standard R 23957.1–2003
Copper (Cu)	1.5	State standard R 50683–94
Lead (Pb)	0.5	
Cadmium (Cd)	0.5	PNDF 16.1.9.–98
Nickel (Ni)	3.8	
Cobalt (Co)	4.1	State standard R 50683–94
Cobalt (Co)	31.0	State standard 50685–94

T a b l e 3

According to the results of the study and analyzes are purely individual
Qualitative chemical analysis of soil (form) plot № 2

Indicators	Unit of measurement mg/kg	Necessary methodological documents for the study
Zinc	1.8	State standard R 50686–94
Iron (Fe)	40.0	State standard R 23957.1–2003
Copper (Cu)	1.9	State standard R 50683–94
Lead (Pb)	0.7	
Cadmium (Cd)	0.8	PNDF 16.1.9.–98
Nickel (Ni)	4.7	
Cobalt (Co)	5.8	State standard P 50683–94
Cobalt (Co)	38.0	State standard 50685–94

T a b l e 4

According to the results of the study and analyzes are purely individual
Qualitative chemical analysis of soil (form) selection № 3

Indicators	Unit of measurement mg/kg	Necessary methodological documents for the study
Zinc	1.6	State standard R 50686–94
Iron (Fe)	36.0	State standard R 23957.1–2003
Copper (Cu)	1.6	State standard R 50683–94
Lead (Pb)	0.9	
Cadmium (Cd)	0.9	PNDF 16.1.9.–98
Nickel (Ni)	5.5	
Cobalt (Co)	6.2	State standard R 50683–94
Cobalt (Co)	49.9	

T a b l e 5

According to the results of the study and analyzes are purely individual
Qualitative chemical analysis of soil (form) indicators for the allocation № 3

Indicators, Unit of measurement	Site			Necessary methodological documents for the study
	1	2	3	
pH	5.3	6.2	7.8	State standard 26423–85
The rest density, %	0.2	0.03	0.04	State standard 2826889
Humus, %	0.30	0.36	0.33	Method of I.V. Tyurin
Humidity, %	4.7	6.8	7.1	State standard 28268–89

The results and means of studying the mobile elements identified in the composition of the soil are obtained on the basis of a set of methods specified in Table 1, for example: a high view of zinc on the plot No. 2 — 1.8 mg/kg, the lowest rate on site No. 1 — 1.2 mg/kg, also noted high levels of iron from the same sample.

But if the rate of copper at station No. 3 above 1.9 mg/kg at station No. 2 observed the similarities between these two indicators, the rate of lead above sample No. 3 — 0.9 mg/kg, the minimum rate of cadmium from sample No. 1 — 0.5 mg/kg, the high rate of cadmium from the site of No. 3 — 0.9 mg/kg, The lowest figure, plot No. 1 — 0.5 mg/kg. the Rate of Nickel at station No. 3 was 5.5 mg/kg, and its average was 4.7 mg/kg from site No. 2, minimum level of received 3.8 mg/kg from sample No. 1. The cobalt index is 6.2 mg/kg higher than the sample No. 3. When determining the manganese content in the soil above the sample No. 3 by 49.9 mg/kg, the low width index is determined from the sample No. 1 — 31.0 mg/kg.

The soil is sandy-clayey, light gray, humus content of 0.36 mg/kg showed that the humus content in the soil is low, in the presence of a neutral soil acidity index of 7.8, the solid soil residue was 0.04 % the

result of the study showed no salinity level. Analyzing in accordance with the rules of distribution of mobile elements in the total soil composition, the study area is extremely low soil fertility.

Semi-annual indicators of three-year weather observations received from Kurti station had a direct impact on the results of the data of this territory. For example, in Table 2, plant growth rates in Kurti rural district in different years indicate that vegetative propagation of plants affects the aridity of the climate. In wet years, a large number of cereals and ephemeral herbs. In dry years, the ephemeris is not well developed. The results of studies conducted in the period from 2015–2017 years, had a normal effect on the vegetative state of the plants, as during the study period the temperature was warm in autumn, winter was mild. The spring month was warm and humid. Compared to other years with hot summers, rainfall was significantly lower.

Table 6

Vegetation growth rates in Kurti rural district for different years

Years	Months												the average t
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
2015	–11.2	–6.4	+4.6	+10.5	+16.3	+21.7	+25.4	+22.6	+16.1	+7.6	–0.7	–3.8	8.6
2016	–6.9	–5.9	+1.9	+10.0	+17.4	+21.7	+26.3	+22.0	+16.8	+6.6	–0.7	–3.8	8.7
2017	–8.1	–2.8	+2.7	+8.6	+11.6	+25.8	+32.0	+27.9	+22.8	+9.7	+2.2	–4.2	10.7
Years	Months												rainfall (R)
	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	
2015	29	41	53	34	34	27	36	20	17	21	108	55	475
2016	24	41	37	80	114	86	68	28	20	20	19	43	580
2017	35	32	49	34	78	104	64	32	41	22	29	37	557

Table 7

Data on pasture areas Kurti rural district

Number of cattle grazing, pieces				
Four types of livestock, pets	2015 y.	2016 y.	2017 y.	Average index
Cattle	8811	8810	9518	9045
Sheep and goats	54188	56500	58450	56379
Horse	1990	2216	2840	2349
Camel	5313	5130	5570	5337
Type of bird	9200	8700	5800	5300
Total	79502	81356	85178	78410
The Botanical composition, number, m^2				
Name of plants	№ 1 site control	№ 2 site control	№ 3 site control	Average index
Wormwood pale (*Artemesia terra-albae)*	22	25	17	21.3
Bell *(Poa bulbosa)*	18	22	20	20
Cornea *(Eurotia ceratoides)*	25	27	30	27.3
Ears to bottles *(Alyssum desertorum)*	23	25	21	23
Soran *(Salsola)*	15	17	24	18.6
Tea wormwood *(Artemisia arenaria)*	19	21	23	20
Sand stage *(Ceratocarpus arenarius)*	11	13	18	21
Airspan (*Peganum harmala)*	31	28	30	29.6
Total	164	178	183	175

At the first stage of the study of plant resources in natural pastures was carried out counting the number of plants placed in a specially square cell. During the three-year control there were changes in the dynamics of plant composition. In this case, it is explained by the presence of all representatives of the four species of livestock falling in the area. On the territory of the study it was found that the number of sheep twice as much as in other species. The revealed results of quantitative growth and percentage of IDA vegetation over the last 3 years can be seen in Figures 2, 3.

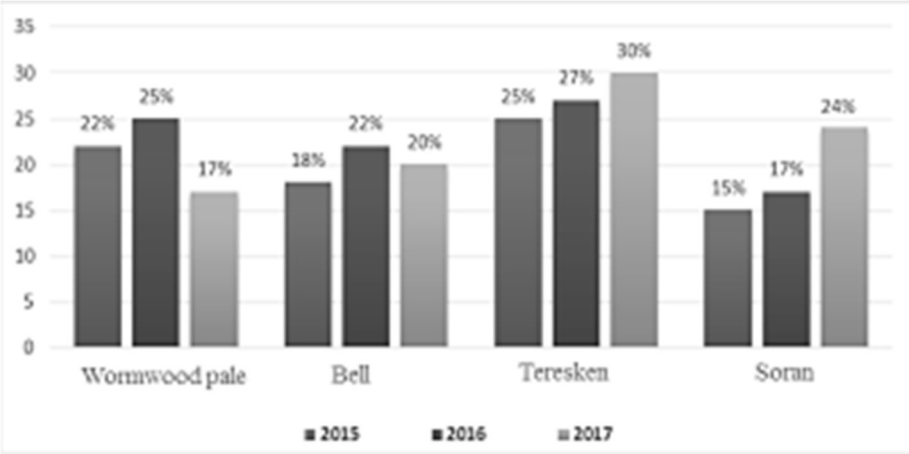

Figure 2. Percentages on the composition of plant growth for 3 years

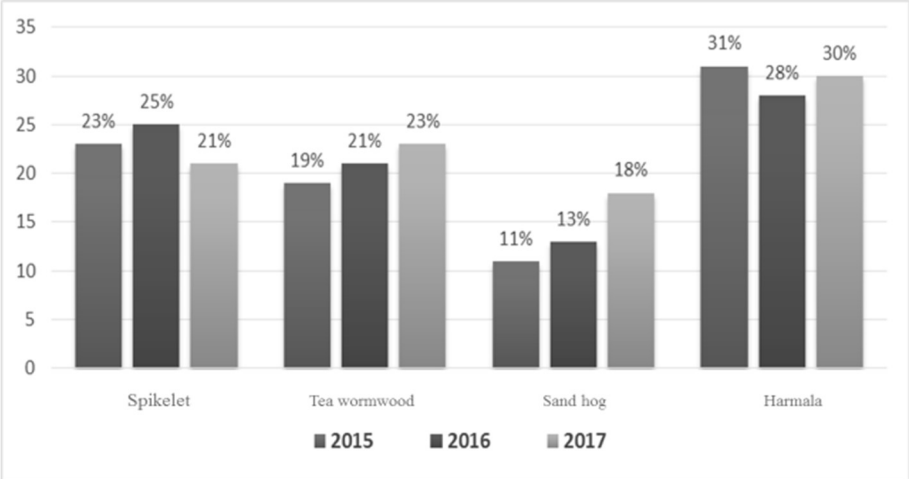

Figure 3. Percentages on the composition of plant growth for 3 years

Conclusion

The results of ecological monitoring of pastures of the village of Akshi of Kurti rural district for 2015–2017 are brought to the following data:

1. General provisions the Minimum soil content was determined at 0.5 mg/kg of lead in boiler No. 1, the maximum manganese content was set at site No. 3 at 49.9 mg/kg, humus % at all sites indicators with a similar difference of 0.30–0.36 these indicators led to different growth of vegetation in place, respectively.

2. The results of studies conducted in the period from 2015–2017 had a moderate impact on the vegetation state of the plants, as during the study period the weather during the warm autumn was wet, winter is mild, spring is warm and humid. Compared to other years, the hot summer, somewhere low, was the cause of different distribution of some plant species.

3. On the territory of the village of Akshi of Kurti rural district, the number of sheep is 58450 thousand heads, which is in 2017 at the site No. 3 85178 thousand heads, as well as at the site No. 3, it was revealed that sheep, especially damaging the surface of the vegetation cover, and its hooves negatively affect the reproduction of plants.

4. It was estimated that the predominant amount of adraspan *(Peganum harmala*) in the covered layer of forage grass in the studied pasture is 28–31 %, which is directly related to the production of livestock of this plant species.

5. The availability of livestock productive mass and large botanical composition in pastures directly depends on the amount and temperature index of soil fertility and precipitation, the type and number of animals falling on them.

In order to ensure that the results of environmental monitoring were qualitative, we concluded that it is mandatory to investigate the plant resource and soil composition in areas minimized at the local level, and not in large areas of the research area.

Kurti rural district from early historical periods is recognized as an area with developed animal husbandry and occupies a leading position in the agricultural sector in Almaty region, due to the fact that the district is actively developing the farm, in order to optimize the degradation and efficient use of pastures, preserving biodiversity, proposes to carry out the following activities.

Due to the continuous year-round use of rangelands, some rangelands of the territory are observed processes of deradation, in turn, caused by soil deflation. In the solution of the arisen problems there was a need of cultivation of long-term cultural pastures and pasture species of plants.

In particular, the number of reclamation forage, trees and shrubs, performing protective functions of rangelands: saxaul in the protection of rangeland has high utility. In the district known black and white type of saxaul *(Haloxylon persicum Bge), Haloxylon aphyllum* (Minkw.) of Elgin.) saxaul is a xerophytic plant. Anticonvulsant resistance is due to the strength of the root system and the specific anatomical structure of the assimilation organs. In the case of its absence the growth of saxaulnik living 10–12 years, increases to 3.0–3.5 meters. For landscaping and reclamation of feed recommended planting saxaul, isenovic, Tereshkovich plant communities.

Perennial plant, its dry weight is 10–15 ts/ha. It is suitable for eating in the early summer and winter months. The type of solid soil is followed by stone, and the type of loamy soils are in the form of loamy soils *(Kochia prostrata* (L.) Shrad. usage is submitted. For example, 100 kg of dry feed consists of 40–60 units of feed. Seeds of izena can be used as a concentrate feed, its yield is 1.0 to 1.5 kg/ha. Period of its economic use 10–12 years.

For the farmer, an indispensable useful crop, including when planting traces on an area of 150–200 hectares, it is able to give up to 15–20 tons of high quality feed in a timely manner. Teresken *(Eurotia ceratoides (L.) C.A. Mey.)* perennial plants suitable for use in autumn and winter.

On the territory of Kurti rural district in connection with the fact that rangelands are not in uneven use, it is necessary to conduct a comprehensive certification of the territory of the rural district with the aim of improving the ecological status of plant species, to review the current status and activities to the seasonal use of feed.

References

1 Закон Республики Казахстан «О пастбищах». Принят в 2017 г. [Электронный ресурс]. — Режим доступа https://online.zakon.kz

2 Природные кормовые угодья земель Куртинского сельского округа Илийского района Алматинской области: Отчет. — 2014. — 57 с.

3 Израэль Ю.А. Экология и контроль состояния природной среды /Ю.А. Израэль. — М.: Гидрометеоиздат, 1979. — 376 с.

4 Русанов А.М. Экологический мониторинг почв, как составная часть мониторинга земель Оренбургской области / А.М. Русанов, И.А. Новоженин, С.А. Юров // Вестн. Оренбург. гос. ун-та. — 2006. — № 12. — С. 78–81.

5 Elzinga C.L. Measuring and monitoring plant populations / C.L. Elzinga, D.L. Salzer, J.W. Willoughby. — U.S. Department of Interior, Bureau of Land Management, Denver, Colorado, 1998. — 154 p.

6 Brown J.R. Shrub invasion of grassland: Recruitment is continuous and not regulated by herbaceous biomass or density / J.R. Brown, & S. Archer // Ecology. — 1999. — Vol. 80. — P. 2385–2396.

7 Scheffer M.S. Catastrophic shifts in ecosystems / J.A. Carpenter Foley, C. Folke, & B. Walker // Nature. — 2001. — Vol. 413. — P. 591–596.

8 Bonham C.D. Measurements for terrestrial vegetation / C.D. Bonham. — Wiley, New York, 1998. — P. 57–66.

9 Google Earth [Электронный ресурс]. — Режим доступа https://earth.google.com/web/

10 Методическое руководство по проведению агрохимического обследования почв сельскохозяйственных угодий. — п. Научный: ГУ «РНМЦАС», 2006. — 49 с.

11 Friedel M.H. Range condition assessments and the concept of thresholds / M.H. Friedel // Journal of Range Management. — 1991. — Vol. 44. — P. 422–426.

12 Archer S. Woody plant encroachment into southwestern grasslands and savannas: Rates, patterns and proximate causes, in Vavra M, Laycock W.A., Pieper R.D., eds. // Ecological implications of livestock herbivory in the west. — Society for Range Management, Denver, Colorado. — 1994. — P. 13–68.

13 Davenport D.W. Viewpoint: Sustainability of pinon-juniper ecosystems — a unifying perspective of soil erosion thresholds / D.D. Breshears, B.P. Wilcox, C.D. Allen // Journal of Range Management. — 1998. — Vol. 5. — P. 231–240.

14 Фисюнов А.В. Сорные растения /А.В Фисюнов. — М.: Колос, 1984. — 320 с.

15 Черненок В.Г. Научные основы и практические приемы управления плодородием почв и продуктивностью культур в Северном Казахстане / В.Г. Черненок. — Астана: КАТУ им. С. Сейфуллина. — 2009. — С. 24–28.

16 Eldridge D.J. Assessment of erosion rates from microphyte-dominated calcareous soils under rain-impacted flow / D.J. Eldridge //Australian Journal of Soil Research. — 1997. — Vol. 35. — P. 475–489.

17 Belnap J. Vulnerability of desert biological soil crusts to wind erosion: The influences of crust development, soil texture, and disturbance / J. Belnap, D. Gillette // Journal of Arid Environments. — 1998. — Vol. 39. — P. 133–142.

18 Почвы. Определение подвижных соединений цинка по методу Крупского и Александровой в модификации ЦИНАО: ГОСТ Р 50686–94–1994 [Введен в действия от 1994–06–23]. — М.: Госстандарт России, 1994. — 16 с.

19 Цинк. Атомно-абсорбционный метод определения свинца, кадмия, сурьмы, железа и меди: ГОСТ Р 23957.1–2003 [Введен в действия от 2005–07–01]. — Астана: Госстандарт Республики Казахстана, 2003. — 16 с.

20 Количественный химический анализ почв. Методика выполнения измерений массовой концентрации ионов нитрита, нитрата, хлорида, фторида, сульфата и фосфата в пробах почв. ПНДФ 16.1.9.-98. — 1998 [Введен в действия от 1998–04–21]. — М.: Госстандарт России, 1998. — 25 с.

21 Определение подвижных соединений меди и кобальта по методу Крупского и Александровой в модификации ЦИНАО. ГОСТ Р 50683–94. — М.: Госстандарт России,1994.

22 Методы определения удельной электрической проводимости, pH и плотного остатка водной вытяжки ГОСТ 26423–85–1985 [Введен в действия от 1985–02–08]. — М.: Госстандарт СССР, 1985. — 10 с.

23 Методы определения влажности, максимальной гигроскопической влажности и влажности устойчивого завядания растений. ГОСТ 28268–89 [Введен в действия от 1989–09–27]. — М.: Стандартинформ, 1989. — 16 с.

24 Определение подвижных соединений марганца по методу Крупского и Александровой в модификации ЦИНАО. ГОСТ Р 50685–2008 [Введен в действия от 2008-11-26]. — Астана: Госстандарт Республики Казахстан, 2008. — 31 с.

25 Wallis De Vries M.F. From feeding station to patch: scaling up food intake measurements in grazing cattle / Wallis De Vries M, E.A. Laca, M.W. Demment // Applied Animal Behavior Science. — 1998. — Vol. 60. — P. 301–315.

26 Kellner K. Influence of patch formation in determining the stocking rate for southern African grasslands / K. Kellner, & O.J.H Bosch // Journal of Arid Environments. — 1992. — Vol. 22. — P. 99–105.

27 Whitford, W.J. Ants as Indicators of Exposure to Environmental Stressors in North American Desert Grasslands / W.J. Whitford, Van Zee, M.S. Nash, W.E. Smith, J.E. Herrick // Environmental Monitoring and Assessment. —1999. — Vol. 54. — P. 143–171.

28 Peters, D.P.C. Modelling vegetation change and land degradation in semiarid and arid ecosystems: An integrated hierarchical approach Advances in Environmental Monitoring and Modeling. — 2002.

29 Арыстангалиев С.А. Растения Казахстана. Народные научные названия /С.А. Арыстангалиев. — Алматы: Наука, 1977. — 57 с.

30 Northup B.K. Spatial distribution of soil carbon in grazed woodlands of dry tropical Australia: tussock and intertussock scales / B.K. Northup, J.R. Brown; D. Eldridge, D. Freudenberger (Eds.) // VI International Rangelands Congress Proceedings, VI International Rangelands Congress Proceedings Inc. Aitkenville, Queensland. — 1999. — P. 120–121.

31 Whitford W.G. Using resistance and resilience measurements for ‘fitness’ tests in ecosystem health / W.G. Whitford, D.J. Rapport, & A.G. deSoyza // Journal of Environmental Economics and Management. — 1999. — Vol. 57. — P. 21–29.

А.С. Сейлхан, В.Б. Сайбулатова, Р.Н. Атраубаева, М.Е. Бейсенбаева, М.Ж. Жұмағұл

Алматы облысы Күрті ауылдық округі жайылымының экологиялық мониторингі

Мақалада Күрті ауылдық округі территориясында жүргізілген экологиялық мониторинг жүйесінде негізгі көрсеткіштері топырақ және жергілікті территориядағы флоралық құрам сол жерде жайылатын мал басы түрлеріне, гидрологиялық қызметі, климаттық факторлары және біртұтас жүйенің биотикалық бірізділігі мен өзара тигізетін әсері мен байланысы зерттелген. Арнайы ауылдық округінің топырағы мен өсімдік жамылғысындағы ерекшеліктердің бірқатар индикаторларын, соның ішінде бір немесе бірнеше экожүйелердің өзара байланысын территория мен топырақ ерекшеліктері динамикалық өзгерістері негізінде кешенді экологиялық мониторингі зерттеу жұмыстары жүзеге асырылды. Жергілікті территория жағдайында агрохимиялық, экологиялық, климаттық, топырақ және флоралық құрамы, жайылымды жерлердің өнімділігі мен мал басы санының нәтижелері, шын мәнісінде, бұрын орын алған, ал болашақта болуы ықтимал өзгерістерді негізге ала отырып, экономикалық тұрғыдан үнемді және зерттеуге ыңғайлы экологиялық мониторингі әдісінің өзектілігін арта түсіп, болашақта жайылымды жерлердің биоалуантүрлілік қорын байытып, территорияның флоралық құрамы мен экологиялық жай-күйін қалыпты күйде сақтау міндеті туындап отыр.

Кілт сөздер: экологиялық мониторинг, топырақтың құнарлылығы, флоралық құрам, жайылымдық масса.

А.С. Сейлхан, В.Б. Сайбулатова, Р.Н. Атраубаева, М.Е. Бейсенбаева, М.Ж. Жумагул

Экологический мониторинг пастбищ Куртинского сельского округа Алматинской области

В статье изучены основные ключевые показатели системы экологического мониторинга, проведенные на территории Куртинского сельского округа, взаимосвязь целостной системы, климатические факторы, виды популяции почвенного и флористического состава. Проведены исследования по комплексному экологическому мониторингу сельского округа на основе динамических изменений территорий и почвенных особенностей взаимосвязи ряда индикаторов, в том числе одной или нескольких экосистем. В условиях локальной территории были изучены агрохимические, экологические, климатические, почвенные и флористические составы, а также продуктивность пастбищных угодий и результаты численности поголовья скота. Основываясь на возможных изменениях в будущем, повышается актуальность проведения эффективного экологического мониторинга в целях обогатить запасы пастбищных земель и сохранить биоразнообразие территории округа.

Ключевые слова: экологический мониторинг, плодородие почв, флористический состав, пастбищная масса.

References

1 Zakon Respubliki Kazakhstan. O pastbishchakh [Law of The Republic of Kazakhstan. The pastures]. (2017). *online.zakon.kz.* Retrieved from https://online.zakon.kz [in Russian].

2 *Prirodnye kormovye uhodia zemel Kurtinskoho selskoho okrupa Iliiskoho raiona Almatinskoi oblasti. Otchet [Natural forage lands of Kurti rural district of ili district of Almaty region. Report]*. (2014) [in Russian].

3 Izraehl', U.A. (1979). *Ekolohiia i kontrol sostoiania prirodnoi sredy [Ecology and environmental control].* Moscow: Hidrometeo [in Russian].

4 Rusanov, A.M., Novozhenin, I.A., & Yurov, S.A. (2006). Ekolohicheskii monitorinh pochv, kak sostavnaia chast monitorinha zemel Orenburhskoi oblasti [Ecological monitoring of soils as an integral part of monitoring of lands of the Orenburg region]. *Vestnik Orenburhskoho hosudarstvennoho universiteta — Bulletin of Orenburg State university, 12,* 78–81 [in Russian].

5 Elzinga, C.L., Salzer, D.L. & Willoughby, J.W. (1998). *Measuring and monitoring plant populations*. U.S. Department of Interior, Bureau of Land Management, Denver, Colorado, 154.

6 Brown, J.R., & Archer, S. (1999). Shrub invasion of grassland: Recruitment is continuous and not regulated by herbaceous biomass or density. *Ecology, 80*, 2385–2396.

7 Scheffer, M., Carpenter S., Foley, J.A., Folke C., & Walker, B. (2001). Catastrophic shifts in ecosystems. *Nature, 413,* 591–596.

8 Bonham, C.D. (1998). *Measurements for terrestrial vegetation*. Wiley, New York.

9 Google Earth. *earth.google.com.* Retrieved from https://earth.google.com/web/

10 Metodicheskoe rukovodstvo po provedeniiu ahrohimicheskoho obsledovaniia pochv selskohoziastvennykh uhodii [*Guidance on carrying out of agrochemical inspection of soils of agricultural land*]. (2006). p. Nauchnyi: GU «RNMCAS» [in Russian].

11 Friedel, M.H. (1991). Range condition assessments and the concept of threshold. *Journal of Range Management, 44,* 422–426.

12 Archer, S. (1994). Woody plant encroachment into southwestern grasslands and savannas: Rates, patterns and proximate causes in M. Vavra, W.A. Laycock, and R.D. Pieper, (eds). *Ecological implications of livestock herbivory in the west.* Society for Range Management, Denver, Colorado.

13 Davenport, D.W., Breshears, D.D., Wilcox, B.P. & Allen, C.D. (1998).Viewpoint: Sustainability of pinon-juniper ecosystems-a unifying perspective of soil erosion thresholds. *Journal of Range Management, 5,* 231–240.

14 Fisyunov, A.V. (1984). *Sornye rasteniia [Weed plants].* Moscow: Kolos [in Russian].

15 Chernenok, V.G. (2009). *Nauchnye osnovy i prakticheskie priemy upravleniia plodorodiem pochv i produktivnostiu kultur v Severnom Kazakhstane [Scientific basis and practical methods of soil fertility and crop productivity management in Northern Kazakhstan].* Astana: KATU imeni S. Sejfullina [in Russian].

16 Eldridge, D.J., & Kinnell, P.I.A. (1997). Assessment of erosion rates from microphyte-dominated calcareous soils under rain-impacted flow. *Australian Journal of Soil Research, 35,* 475–489.

17 Belnap, J., & Gillette, D.A. (1998). Vulnerability of desert biological soil crusts to wind erosion: The influences of crust development, soil texture, and disturbance. *Journal of Arid Environments, 39,* 133–142.

18 Pochvy. Opredelenie podvizhnykh soedinenii tsinka po metodu Krupskoho i Aleksandrovoi v modifikatscii CINAO [Soils. Determination of mobile compounds of zinc by the method of Krupsky and Alexandrova in the modification of TIN] (1994). *HOST R 50686–94- from 23 June 1994*. Moscow: Hosstandart Rossii [in Russian].

19 Tsink. Atomno-absorbcionnyi metod opredeleniia svintsa, kadmiia, surmy, zheleza i medi [Zinc. Atomic absorption method for determination of lead, cadmium, antimony, iron and copper]. (2003). *HOST R 23957.1–2003- from 1st July 2005*. *Standart Respubliki Kazakhstan* [in Russian].

20 Kolichestvennii himicheskij analiz pochv. Metodika vypolneniia izmerenii massovoi kontsentratsii ionov nitrita, nitrata, hlorida, ftorida, sulfata i fosfata v probakh pochv [Quantitative chemical analysis of soil. Methods for measuring the mass concentration

of nitrite, nitrate, chloride, fluoride, sulfate and phosphate ions in phosphoric acid samples]. *PNDF 16.1.9.-98 from 21 April 1998*. Moscow: Gosstandart Rossii [in Russian].

21 Opredelenie podvizhnykh soedinenii medi i kobalta po metodu Krupskoho i Aleksandrovoi v modifikatsii CINAO [Quantitative chemical analysis of soils. Method of measurement of mass concentration of ions of nitrite, nitrate, chloride, fluoride, sulfate and phosphate in soil samples]. *HOST R 50683–94*. Moscow: Gosstandart Rossii [in Russian].

22 Metody opredeleniia udelnoi ehlektricheskoi provodimosti, pH i plotnoho ostatka vodnoi vytiazhki [Methods for determination of specific electrical conductivity, pH and dense residue of aqueous extract]. HOST R 26423–85 from 8 February 1985. Moscow: Gosstandart SSSR [in Russian].

23 Metody opredeleniia vlazhnosti, maksimalnoi hihroskopicheskoi vlazhnosti i vlazhnosti ustoichivoho zaviadaniia rastenii [Methods for the determination of moisture, maximum hygroscopic moisture and humidity sustainable wilting plants]. *HOST R 28268–89 from 27 September 1989*. Moscow: Standartinform [in Russian].

24 Opredelenie podvizhnykh soedinenii marhantsa po metodu Krupskoho i Aleksandrovoi v modifikatsii CINAO Determination of mobile compounds of manganese by the method of Krupsky and Alexandrova in the modification of the TING]. *HOST R 50685–2008 from 26 November 2008. Standart Respubliki Kazakhstan* [in Russian].

25 Wallis De Vries, M.F., Laca E.A., & Demment, M.W. (1998). From feeding station to patch: scaling up food intake measurements in grazing cattle. *Applied Animal Behavior Science, 60,* 301–315.

26 Kellner, K., & Bosch, O.J.H. (1992). Influence of patch formation in determining the stocking rate for southern African grasslands. *Journal of Arid Environments, 22,* 99–105.

27 Whitford, W.G., Van Zee, J., & Nash, M.S. et al. (1999). Ants as Indicators of Exposure to Environmental Stressors in North American Desert Grasslands. *Environmental Monitoring and Assessment, 54,* 143–171.

28 Peters, D.P.C., & Herrick, J.E. (2002). *Modelling vegetation change and land degradation in semiarid and arid ecosystems: An integrated hierarchical approach. Advances in Environmental Monitoring and Modeling*.

29 Arystangaliev, S.A. (1977). *Rasteniia Kazakhstana. Narodnye nauchnye nazvaniia [Plants of Kazakhstan. The people's scientific name].* Almaty: Nauka [in Russian].

30 Northup, B.K. & Brown, J.R. (1999). Spatial distribution of soil carbon in grazed woodlands of dry tropical Australia: tussock and intertussock scales. In: Eldridge, D.Freudenberger, D. (Eds.). *VI International Rangelands Congress Proceedings, VI International Rangelands Congress Proceedings Inc. Aitkenville,* (pp. 120, 121). Queensland.

31 Whitford, W.G., Rapport, D.J., & deSoyza A.G. (1999). Using resistance and resilience measurements for 'Fitness' tests in ecosystem health. *Journal of Environmental Economics and Management, 57,* 21–29.