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ISSUE ON LAND DEGRADATION IN KAZAKHSTAN

Makenova Saule Kazhapovna

PhD, Associated Professor

S. Seifullin Kazakh Agrotechnical Research University

Astana, Kazakhstan

E-mail: saule_makenova@mail.ru

Alipbeki Ongarbek Alipbekuly

PhD, Professor

S. Seifullin Kazakh Agrotechnical Research University

Astana, Kazakhstan

E-mail: oalipbeki@mail.ru

Tatarintsev Vladimir Leonidovich

Doctor of Agricultural Sciences, Professor

Altai State Agrarian University

Barnaul, Russian Federation E-mail: kafzem@bk.ru

Inkarov Dayan Sabyrovich

Doctoral student

S. Seifullin Kazakh Agrotechnical Research University

Astana, Kazakhstan

E-mail: inkarov96work@mail.ru

Asanova Gulnara Abdildinovna

PhD, Associate Professor

S. Seifullin Kazakh Agrotechnical Research University

Astana, Kazakhstan

E-mail: assanga@mail.ru

Muzyka Olesya Sergeevna

Master of Science

S. Seifullin Kazakh Agrotechnical Research University

Astana, Kazakhstan

E-mail: o.muzyka@kazatu.kz

Abstract

The scientific article is dedicated to the pressing issue of land degradation, which is observed and studied by the global scientific community, including Kazakhstani scientists. The classification and study of the state of degraded territories are of paramount importance as they are linked to further monitoring of the problem, determining the financial costs of implementing protective measures, and promoting sustainable development of these landscapes. It has been established that more than 90% of agricultural lands in Kazakhstan are subject to degradation processes, and this indicator varies depending on the type of land and their spatial distribution.

When monitoring pastures, data from the Terra and Aqua satellites were used to determine the degradation of pastures. Based on the results of comparing the degree of damage to pastures obtained by remote methods and on the basis of ground surveys, it was found that the reliability of the correct determination of a weak degree of damage corresponds to 75%, an average degree of damage - 85% and a severe degree of damage - 90%.

The authors of the article propose a classification of Kazakhstan's lands according to the Intergovernmental Panel on Climate Change and identify types of land degradation in Kazakhstan according to the «Wocat». The identified patterns of degradation processes in the territory of Kazakhstan are classified according to the Intergovernmental Panel on Climate Change levels. Directions for enhancing the sustainability of agricultural lands are determined based on classification criteria. The materials of this scientific research are recommended for use in land resource management and the development of agro-, phyto-, and agroforestry measures aimed at increasing the sustainability of desert agrolandscapes in Kazakhstan.

Key words: land degradation indicators; land productivity; soil organic carbon; land resource assessment; normalized vegetation index; Earth's remote sensing; land use.

Basic position and Introduction

Land degradation neutrality - one of the objectives of Sustainable Development Goals: by 2030, it is required to restore the degraded lands and soils, including the lands affected by desertification, drought and floods, and achieve a neutral balance in relation to degradation of lands [1].

Since the early of the 2000s, the global environmental changes have occurred on the Earth, the qualitative and quantitative indicators of land used in agricultural production have changed. Therefore, Land degradation neutrality is crucial in sustainability research.

According to the Food and Agriculture Organization of the United Nations, more than 66.0% of ploughland in Kazakhstan is vulnerable to erosion of varying degrees [2, 3, 4, 5].

In accordance with the Government order, in 2021, the Land Cadastre and Technical Inspection of Real Estate Departments performed work to

monitor agricultural land [6, 7]. It has been found from 2000 to 2021 there was a decrease in the humus level by 12.0-33.8% on chestnut, chernozem soils of Akmola, Kostanay, Aktobe, East Kazakhstan, West Kazakhstan regions. The physical and chemical soil characteristics of arable lands have deteriorated: granulometric and microaggregate composition, dispersion, hydrological constants, acidity. The density of the plough layer, mainly of medium density requires the measures aimed at loosening the subsurface layer of these soils. The farm areas in Atyrau, Mangystau, Kyzyl-Orda, Turkestan and Zhambyl regions are characterised by overgrazing and degradation of plant cover [6, 7].

The examination of regional characteristics of indicators caused by the climate change and intensive economic activity is very necessary to take measures to reduce land degradation.

Materials and Methods

The United Nations Convention to Combat Desertification [8] adopted three Sustainable Development Goals indicators (15.3.1) for land degradation monitoring and assessing:

1. Soil cover;
2. Land productivity;
3. Carbon stocks above and below the soil surface soil organic carbon parameter. [1]

To determine the level of land degradation, a period of 10–15 years is taken into account [1]. The unit of measurement for the indicator "soil cover" is the spatial extent (ha or km²), expressed as a share (as a percentage) of degraded land in the total land area.

With respect to the land productivity indicator, the data can be obtained and calculated from earth observations by (remote sensing of the earth) using the Normalized Difference Vegetation Index (Normalized difference vegetation index).

The soil organic carbon indicator is calculated based on soil depth and volume density data determined for each deep soil layer (depth 0–30 cm) and subsoil [1].

The interpretation of these indicators should include the regional ecological and socio-economic conditions of study areas.

The purpose of the research is to analyze indicators for monitoring and assessing of land degradation that affect (Land degradation neutrality), to clarify future (Land degradation neutrality) trends for (sustainable development goals) achievement 15.3.1.

To achieve the main goal of the research, we should do the following:

- to establish the relationship between (Land degradation neutrality) indicators, land rehabilitation and (sustainable development goals);

- analyze (Land degradation neutrality) indicators for monitoring and as-sessing land degradation in Kazakhstan.

Object of research

According to the "Consolidated analytical report on the condition and use of Kazakhstan land for 2021", agricultural land makes up 97.4% of the total area of agricultural land, including: ploughland 22.9%, perennial plantations - 0.05%, fallow - 1.7%, hayfields - 2.01%, pastures - 70.7%

[6]. They are located in 10 natural zones and pre-determine the development of a wide range of areas of agricultural production. The largest area of agricultural land (37.6%) is occupied by the desert zone with gray and graybrown soils. In the dry steppe zone on chestnut soils and semi-desert zone, they occupy 24.9% and 15.4%, respectively. The steppe zone on chernozem soils occupies 10.7% of all agricultural land in the country [7].

Results

Land cover and its qualitative changes are indicative of the important factor, since they contain the first signs of vegetation decrease or increase, ecosystem fragmentation and transformation of land resources. It is also used in the interpretation and consideration of the other two indicators.

Land classification Level 1 is based on the categories of (International Plant Protection Convention) Procedure Manual [1]. Land classification Level 2 is based on the land cover classification, which is used by Food and Agriculture Organization (Land Cover Meta Language) for a unified approach to defining the soil class. If the country's national land-use classification system is not consistent with levels 1 and 2 classes, the landuse classifications need to be combined or split to match the classes presented in the Manual (Table 1).

Table 1 - Hierarchical classification of land cover according to International Plant Protection Convention [1]

Level 1	Indicators
Forest area	Forest trees
Meadowland	Grassland and and native grasses
	Shrubs, heathland
	Sparse lands
	Climatic climax communities and mosaics
Ploughland	Medium and large-sized unirrigated grassy farm fields
	Medium and large-sized irrigated grassy farm fields
	Permanent crops, agricultural plantation
	Agricultural communities and mosaics
Moorland	Open moorland
Settlements	Urban areas and related economically developed areas
Other land	Barren land
	Permanent snow cover and glaciers
Water	Inland waters, coastal waters, seas

The nearest to the categories of (International Plant Protection Convention) Procedure Manual is the classification of lands into categories, which has the basis of their intended purpose [5, 6]. Table 2 shows the classification of land in Kazakhstan in accordance with (International Plant Protection Convention) Procedure Manual.

Table 2 - Classification of land in Kazakhstan, given in accordance with IPPC Procedure Manual

Level 1	Level 2
Forest area	pecially protected natural areas, forest fund lands
Meadowland	grassland
	perennial plantations
	wild land
Ploughland	ploughland, incl. irrigated
	non-agricultural land
	lands of settlements
	industry, transport, communications and other land of non-agricultural nature
Moorland	Land reserve
Settlements	Water reserve land

Note: compiled by the authors

The qualitative condition of land on large areas in the Republic of Kazakhstan is complicated by the presence of signs that adversely affect their fertility [7]. Agricultural land with negative signs accounts for about 80.0% of the land (Figure 1).

The "National report on the state of the environment and on the use of natural resources of the Republic of Kazakhstan for 2020" provides the following figures: "... in the whole country, the ameliorative group with uncomplicated negative signs is 19.4%, with negative signs to a weak

degree - 20.1%, and in a me-dium and strong degree - more than 60%." [6]. The following conclusion is drawn: "... As a result of the transformation of agricultural lands, there is a qualitative change in the composition of ploughland, mainly due to the withdrawal of its low-productive part from the semidesert light chestnut zone and the development of new ploughland in the steppe chernozem and dry steppe chestnut zones, and also in the piedmont regions of the republic, where the most productive lands are located [6].

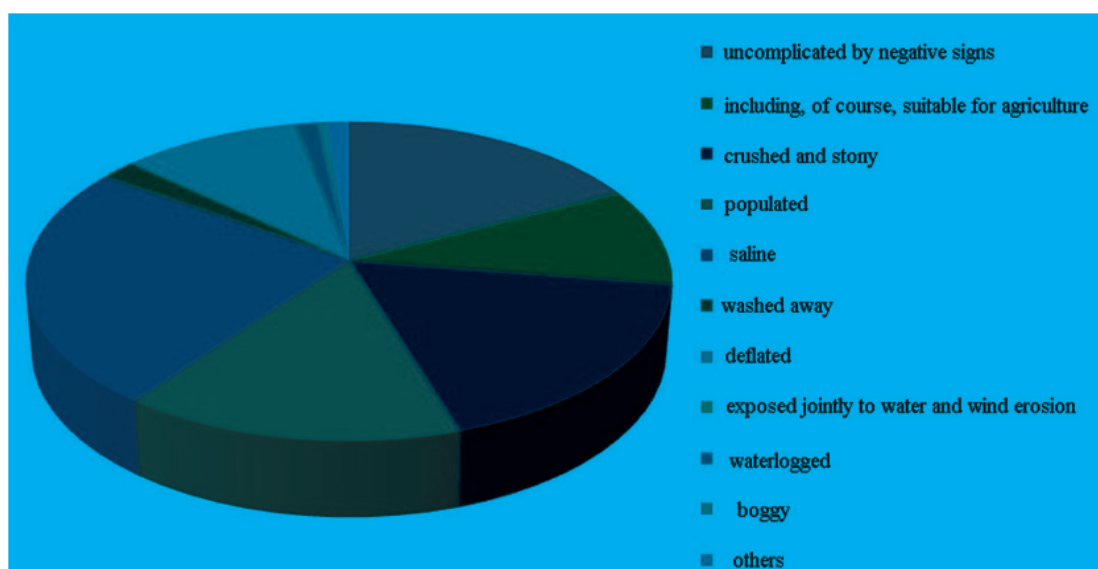


Figure 1 – Meliorative groups of land

The various types of land use result in the certain forms of land degradation [1]. Table 3 shows the types of land degradation in the field of natural resource conservation according to (World Overview of Conservation Approaches and Technologies).

Table 3 - Comparative characteristics of land degradation types

Types of land degradation, the source – World Overview of Conservation Approaches and Technologies (https://www.wocat.net/en/global-slm-database)	Land degradation in Kazakhstan, the source- The National Report on the State of the Environment and the Use of Natural Resources of the Republic of Kazakhstan (https://ecogofond.kz/wp-content/uplo... https://ecogofond.kz)
Water erosion - loss of topsoil and erosion of ploughed layer	- Vulnerable to water erosion (eroded) from the total area of eroded lands occupy an area of 4.9 mln ha or 2.3% of agricultural land
Wind erosion of soils - loss of top soil	- Vulnerable to wind erosion (wind-eroded) - 24.2 mln ha 127 or 11.3% of agricultural land
Chemical soil damage -reduced fertility and reduced organic matter content	- Pollution with oil and oil products is observed on an area of more than 1.5 mln. ha. - During the period of activity of the uranium mining industry on the territory of Kazakhstan, about 200 mln tons of radioactive waste were generated. - Soil pollution with heavy metals - Emissions into the atmosphere, solid and liquid waste from industrial enterprises, energy, military-industrial complex, domestic waste, vehicles
Physical soil damage - mining, construction	- 243.4 thousand ha of land disturbed during the construction of industrial facilities, linear structures and other entities, during the development of deposits of useful minerals
Water degradation - the decrease in the quality of surface water caused by wastewater from large entities of agribusiness industry, the ingress of industrial, waste water and used water into rivers	- non-compliance with the size of water-conservation zone, - formation of spontaneous household landfills, - sewage waters of industrial and agricultural facilities, placement of residential and industrial facilities on the banks of river beds, - accidents at sewerage facilities
Biological degradation – threatened animals and plants	- 387 plant species are included in the Kazakhstan Red Data Book as rare or endangered due to the irrational use of natural resources. - The spread of highly dangerous pets with numbers above the economic injury level can lead to a loss of 15-30% of the crop yield

Note: compiled by the authors

All types of land degradation are also peculiar to Kazakhstan land resources.

Land productivity means the biological productivity of land, the source of all food, fiber and fuel necessary for human activity [1].

Net Primary Land Productivity can be calculated from the indicator for large areas using remote sensing of the earth techniques. The most practicable currently is the use of vegetation indices for (net primary land productivity) proxy indicators [1]. The Normalized Difference Vegetation Index (Normalized difference vegetation index) is the

most commonly used vegetation index.

Kazakhstan ranks 5th in the world in terms of pasture land and only 30% of which is currently used. To inspect the largescale processes in pastures associated with vegetation for a number of technical characteristics, Terra/Aqua-MODIS remote sensing system is used. The most informative for determining the average grass-cover thickness are (Normalized difference vegetation index) and (Soil-adjusted vegetation index) indices. Almost all vegetation indices actively respond to changes in plant biomass, as

well as to changes in the density of vegetation of natural pastures from 60% or more.

To determine the state of pastures with low projective cover (0-20%) and, accordingly, low productivity, it is advisable to use the red range of the red spectrum in combination with the (Normalized difference vegetation index) index.

According to the measurements obtained, a red value above 0.15 indicates low productivity or overrun of the analyzed pasture areas. These stages of pasture degradation are noted during ground surveys, and then tracked on satellite images, as well as during automated processing of satellite images (Figure 2).



Figure 2 – Field surveys of pastures in Aktobe region

To verify (calibrate) remote sensing data, we planned field surveys. For example, in 2020, according to remote sensing data, the state of pastures in the Aktobe region is generally assessed as bad and very bad. This is due to the location of the area: a desert and semidesert natural zone. The maximum hot and dry summer did not contribute to the development of green vegetation.

Our surveys of pastures in the Magnistur region in 2018-2020 also confirm that the lack of available water sources and the destruction of water supply facilities has led to an increase in the processes of desertification of the territories. Vegetation cover is experiencing a strong anthropogenic impact, forage plant species are decreasing, which causes degradation of pastures (Figure 3).



Figure 3 – State of pasture vegetation in Mangistau areas according to ground-based observations in 2020 (Shetpe village)

Based on the results of comparing the degree of damage to pastures obtained by remote methods and on the basis of ground surveys, it was found that the reliability of the correct determination of a weak degree of damage corresponds to 75%, an average degree of damage - 85% and a severe degree of damage - 90%. (Figure 4)

We have established that the main degraded

areas fall on the share of the South-Western region of the Republic of Kazakhstan, where desert pastures are located. The lack of accessible water sources and the destruction of water supply facilities led to an intensification of desertification processes in the territories, especially the Aral Sea region, the Betpakdala desert, Saryarka, and the Moyunkum sands.

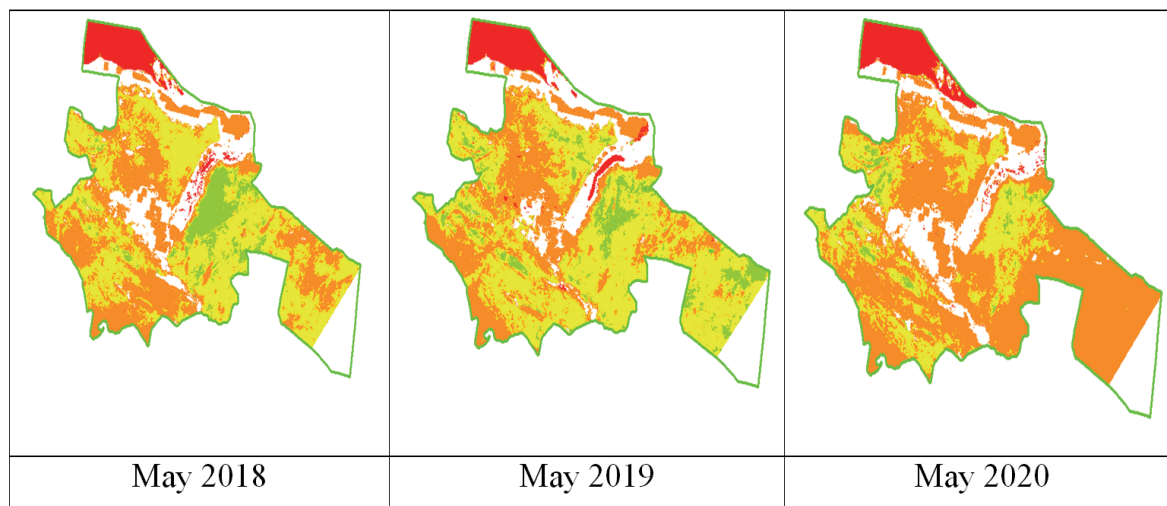


Figure 4 – Pasture areas of Mangistau region in different periods based on «Modis» data

Remote sensing provides calibrated, quantitative, repeatable and inexpensive information over large areas that can be duplicated or refined by ground data. Remote sensing provides important information about soil erosion, and the appropriate processing of satellite images can be no less important factor in the prediction of erosion processes than ground-based observations.

Table 4 shows an example of one of the accepted soil and vegetation cover degradation classifications.

Table 4- Classification of degraded lands

Degree	Description	Value
Very weak	Very weak erosion, the process is just beginning and has no clear signs, traces of mineral deposits are visible in places of accumulation of rainfall.	1
Weak	Weak erosion, the signs of erosion begin to be visible. Demolition of fine fractions is visible, heavier fractions (gravel) are exposed, rain streams are muddy.	2
Moderate	Moderate erosion, clear signs of removal of particles from the surface. Erosion is evident, with a well-exposed loamy substratum. There are signs of stream erosion.	3
Severe	Severe erosion, erosion of the soil cover with gravel remaining on the surface, numerous stream erosion, ravines begin to form. Very little remains of the original soil layer, the soil begins to change color.	4
Most severe	Very severe erosion, all original soil layer eroded, soil color changed, active ravines and changes in soil texture observed.	5

Pasture degradation is a gradual change in the plant community under the influence of excessive or long-term pasture load. During pasture degradation in steppe ecosystems, we noted the following four stages: feather grass-forb (weak and moderate degradation); fescue (moderate degradation); wormwood sheep fescue (most severe degradation); complete degradation (degraded bare land with single oppressed weeds). These stages of the pasture degradation are

observable in ground surveys and then monitored on satellite images. On cattle passes, around summer and winter camps and around settlements, and in some places even on large areas of pastures, completely knocked out, highly sparse grass stands are formed, consisting mainly of weeds, as in the area of the village of Shetpe, Mangistau region. This stage of the degradation is clearly visible on satellite images of various scales, and also it manifests itself in the spectral signature of

the earth's surface.

Thus, the land degradation as a long-term decline in the ecosystem function and the productivity can be assessed using the long-term remote sensing data of the Normalized Difference Vegetation Index.

The next indicator is (soil organic carbon) - a general indicator of soil quality, which is the main carbon storage in the terrestrial ecosystems and regulates the soil productivity. Thus, soil organic carbon runoffs are not only of local importance, but also of global significance due to their role in the global carbon cycle.

Soil organic carbon is strongly influenced by the agricultural production, agricultural land structure and land management practices. The productive capacity of soils depends on these

Discussion

In opinion of many scientists there is certain relationship between soil organic carbon levels and yields. The article “Soil Potential for Climate Change Mitigation through Carbon Sequestration” says that “Firstly, organic fertilizers will bring not only carbon but also nutrients to the soil. Therefore, the increase in cropping productivity can be associated with the presence of additional nutrients, and not with the improvement in soil quality due to soil organic carbon. Secondly, soil organic carbon stocks can be expected to rise in the well-managed agricultural systems that increase yields, as experimentally found in Rasooletal studies (2007), Zingoretal. (2007) and

Conclusion

As part of the Sustainable Development Goals, countries aim to achieve land degradation neutrality by 2030, in which the quantity and quality of land resources remain stable or increase over certain time and space scales. In order to achieve this sustainable land management methods are required to be introduced to increase the sustainable provision of ecosystem goods and services for population life support.

Our research shows that land productivity indicators obtained from satellites are successfully detected by means of sustainable land management methods on primary productivity, herewith these indicators serve as important elements of the monitoring and assessment tools needed to track the condition of land in order to guarantee the neutral balance to land degradation, since only the technologies with more than a 10-year

factors. The maintenance of the normal level of soil organic carbon is necessary to maintain or improve soil health and is directly mentioned in the strategic documents of Global Environment Fund [9].

Based on the literature data, scientists have established a large contribution of pasture lands to the global accumulation of soil carbon, but they also noted that there is uncertainty about grazing in such territories. In this regard, the study of soil organic carbon for pasture lands of the territory of the Republic of Kazakhstan is one of the main tasks in the global climate agenda, and geospatial data, along with ground-based studies, will help solve the problem of constructing mathematical dependencies between the studied indicators in the shortest possible time.

Kukaletal. (2009). On the contrary, if the introduction of alternative management techniques leads to lower crop yield, this may negatively affect soil organic carbon stocks (Ogleetal, 2012). Due to the variety of possible chemical, biological and physical factors preventing yield potential from being realised, soil organic carbon content escalation is an important safeguard against crop failure from soil perspective, moreover it can be the best strategy for restoration of fertility in degraded lands, for example when the moisture-holding capacity is the main limitation of crop yield (Bruceetal., 1995)” [10].

implementation period show statistically significant improvements [11].

In the course of a series of studies, we substantiated natural sounding as an information basis for planning the sustainable development of regional agricultural systems based on the use of the agrosresource potential of the territory, analyzed the level of gross regional product in the agricultural industry based on the integration of statistical, spatial and temporal approaches and indicators of sustainable development, an information system has been developed for compiling dynamic models of the input-output balance using the method of economic cybernetics.

As a result, the best direction of development for carrying out transformations in the territories based on domestic priorities, demand and agro-

resource potential allows the presence of the SDGs in the regional programs of socio-economic development [12].

In 2022, the first carbon polygon was created in Kazakhstan, located in Zholtaptyk aul, Zhelezinsky district, Pavlodar region. The projects being developed at this polygon are based on new technologies for capturing, transporting, processing and sequestering carbon. In addition, the scientists analyze the territory to calculate the biological mass, species composition of plants and soil conditions using unmanned systems and ground equipment.

Information on financing

The article includes studies on the topic of program-targeted financing of scientific and technical progress BR10764919 “Research on impact of government policy in the agricultural sector on the development of cooperative processes in the agroindustrial complex, sustainable development of rural areas and food security governance.”

The scientists around the globe came to the common scientific conclusion: we must strive to increase the area of recultivated land, reduce the area of degraded land in order to achieve land degradation neutrality and reduce trade-offs between land degradation neutrality and other Sustainable Development Goals in the future [13, 14, 15, 16, 17].

We have an opportunity to achieve the land degradation neutrality by 2030 only if we move on the sophisticated solutions based on the analysis of socio-economic and ecological systems using concepts such as nature-based solutions.

References

- 1 LDT TS - Technical Guide chrome-extension [Text]/ efaidnbmnnnibpcaj-pcgglefindmkaj/ https://knowledge.unccd.int/sites/default/files/2018-08/LDN%20TS%20Technical%20Guide_Draft_Russian.pdf 2016. -P.68.
- 2 Framework And Guiding Principles For A Land Degradation Indicator To Monitor And Report On Progress Towards Target 15.3 Of The Sustainable Development Goals, The Strategic Objectives Of The Rio Conventions And Other Relevant Targets And Commitments [Text]/ Framework and Guiding Principles for a Land Degradation Indicator (cbd.int), 2016. -P.20.
- 3 United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and [Text]/ or Desertification. 1994. UN General Assembly. A/AC.241/27. 12 September 1994. <http://www.unccd.int/convention/text/pdf/conv-rus.pdf>.
- 4 UN. United Nations. A/RES/70/1. General Assembly. Resolution adopted by the General Assembly. Transforming our world: the 2030 Agenda for Sustainable Development [Text]/ http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E
- 5 Resolution adopted by the General Assembly on 6 July 2017 A/RES/71/313. “Work of the Statistical Commission pertaining to the 2030 Agenda for Sustainable Development” [Text]/ http://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A_RES_71_313.pdf
- 6 Svodnyj analiticheskij otchet o sostoyanii i ispol'zovanii zemel' Respubliki Kazahstan za 2021 god <https://www.gov.kz/memleket/entities/moa/documents/details/291911?directionId=1416&lang=ru>
- 7 Nacional'nyj doklad o sostoyanii okruzhayushchej sredy i ob ispol'zovanii prirodnyh resursov Respubliki Kazahstan za 2020 god [Text] <https://www.gov.kz/memleket/entities/ecogeo/documents/details/243132?lang=ru>
- 8 Kust G., Andreeva O., Cowie A. Land Degradation Neutrality: Concept development, practical applications and assessment [Text]/ Journal of Environmental Management, -2017. -Vol.19. -P.16–24.
- 9 Govers, Gerard & Merckx, Roel & Oost, Kristof & Wesemael, Bas Soil organic carbon management for global benefits: a discussion paper [Text] / GEF STAP workshop on 'Soil Organic Carbon for Global Benefits: A Scoping Study', 10th-12th September 2012.
- 10 William R. Horwath, Yakov Kuzyakov, Chapter Three - The Potential for Soils to Mitigate Climate Change Through Carbon Sequestration, Editor (s): William R. Horwath, Yakov Kuzyakov, Developments in Soil Science [Text]/ Elsevier, -2008. -Vol.35. -P.61-927. ISSN0166-2481

11 V. V. Akimov, Assessment of the current state of pasture lands based on satellite data analysis [Text]/ S. K. Makenova, M. R. Shayakhmetov, O. S. Muzyka // Bulletin of Science of the Kazakh Agrotechnical University. S. Sei-fullin. - 2021. - No. 2 (109). – P. 37-49.

12 Gonzalez-Roglich M., Synergizing global tools to monitor progress to-wards land degradation neutrality: Trends [Text]/ Zvoleff A., Noon M., Liniger H., Fleiner R., Harari N., Garcia C. // Earth and the World Overview of Con-servation Approaches and Technologies sustainable land management database– Environ, -2018. Sci. Policy, 93. -P.34–42.

13 Keesstra S., Soil-related sustainable development goals: Four concepts to make land degradation neutrality and restoration work [Text]/ Mol, G., de Leeuw, J., Okx, J., Molenaar, C., de Cleen, M., Visser, S. // Land, -2018. -Vol.7(4). -P.133.

14 Keshavarzi A., Kumar V., Bottega E.L., Rodrigo-Comino, J. Deter-mining land management zones using pedo-geomorphological factors in potential degraded regions to achieve land degradation neutrality [Text]/ Land, -2019. -Vol 8(6). -P. 92.

15 Sims N.C., Developing good practice guidance for estimating land deg-radation in the context of the United Nations Sustainable Development Goals. Environ [Text]/ England, J.R., Newnham, G.J., Alexander, S., Green, C., Minelli, S., Held, A., // Sci. Policy, -2019. -Vol. 92. -P. 349–355.

16 Tóth G., Hermann T., da Silva, M.R., Montanarella, L. Monitoring soil for sustainable development and land degradation neutrality [Text] / Environ, 2018. -Vol. 190.

17 WOCAT database, 2020 <https://www.wocat.net/en/global-slm-database>.

ҚАЗАҚСТАНДАҒЫ ЖЕРДІҢ ТОЗУЫ ТУРАЛЫ МӘСЕЛЕСІ

Мәкенова Сауле Қажапқызы

PhD, қауымдастырылған профессор

С.Сейфуллин атындағы Қазақ агротехникалық зерттеу университеті

Астана қ., Қазақстан

E-mail: saule_makenova@mail.ru

Әліпбеки Оңғарбек Әліпбекұлы

PhD, профессор

С.Сейфуллин атындағы Қазақ агротехникалық зерттеу университеті

Астана қ., Қазақстан

E-mail: oalipbeki@mail.ru

Татаринцев Владимир Леонидович

Ауыл шаруашылығы ғылымдарының докторы, профессор

Алтай мемлекеттік аграрлық университеті

Барнаул, Ресей Федерациясы

E-mail: kafzem@bk.ru

Инкаров Даян Сабырұлы

Докторант

С.Сейфуллин атындағы Қазақ агротехникалық зерттеу университеті

Астана қ., Қазақстан

E-mail: inkarov96work@mail.ru

Асанова Гүлнара Әбділдіқызы

Экономика ғылымдарының кандидаты, доцент

С.Сейфуллин атындағы Қазақ агротехникалық зерттеу университеті

Астана қ., Қазақстан

E-mail: assanga@mail.ru

*Музыка Олеся Сергеевна**Ғылым магистрі**С.Сейфуллин атындағы Қазақ агротехникалық зерттеу университеті**Астана қ., Қазақстан**E-mail: o.muzyka@kazatu.kz***Түйін**

Ғылыми мақала дүниежүзілік ғылыми қоғамдастық, атап айтқанда, қазақстандық ғалымдар бақылап, зерттеп жүрген жердің тозуының өзекті мәселесіне арналған. Деградацияға ұшыраған аумақтардың жай-күйін жіктеу және зерделеу мәселелері аса маңызды болып табылады, өйткені олар проблеманы одан әрі бақылаумен, табиғатты қорғау шараларын жүзеге асыруға қаржылық шығындарды анықтаумен және осы ландшафттардың тұрақты дамуын қамтамасыз етумен байланысты. Қазақстандағы ауыл шаруашылығы жерлерінің 90%-дан астамы деградациялық процестерге ұшырайтыны және бұл көрсеткіш жердің түріне және оның кеңістікте таралуына байланысты өзгеретіні анықталды.

Жайылымдарды бақылау кезінде жайылымдардың деградациясын анықтау үшін Terra және Aqua спутниктерінің мәліметтері пайдаланылды. Дистанциялық әдістермен алынған жайылымдардың зақымдану дәрежесін салыстыру нәтижелері бойынша және жер бетіндегі зерттеулер негізінде зақымданудың әлсіз дәрежесін дұрыс анықтау сенімділігі 75%-ға, орташа зақымдану дәрежесіне сәйкес келетіні анықталды. - 85% және ауыр зақымдану дәрежесі - 90%.

Мақала авторлары Қазақстан жерлерінің IPPC сәйкес жіктелуін ұсынды және WOCAT сәйкес Қазақстандағы жердің тозуының түрлерін анықтады. Қазақстан Республикасының аумағында деградация процестерінің көрінуінің анықталған заңдылықтары АЖПК деңгейлері бойынша жіктеледі. Жіктеу ерекшеліктерін ескере отырып, ауыл шаруашылығы жерлерінің тұрақтылығын арттыру бағыттары айқындалады. Ғылыми зерттеу материалдарын жерге орналастыруда және Қазақстан Республикасының шөлді егіншілік ландшафттарының тұрақтылығын арттыруға бағытталған агро, фито, орман-мелиоративтік шараларды әзірлеуде пайдалануға ұсынылады.

Кілт сөздер: жердің тозу көрсеткіштері; жер өнімділігі; топырақтың органикалық көміртегі; Жер ресурстарын бағалау; өсімдіктердің нормаланған индексі; Жерді қашықтықтан зондтау; жерді пайдалану.

К ВОПРОСУ О ДЕГРАДАЦИИ ЗЕМЕЛЬ В КАЗАХСТАНЕ*Макенова Сауле Кажжаповна**PhD, ассоциированный профессор**Казахский агротехнический исследовательский университет им. С.Сейфуллина**г. Астана, Казахстан**E-mail: saule_makenova@mail.ru**Алипбеки Онгарбек Алипбекулы**PhD, профессор**Казахский агротехнический исследовательский университет им. С.Сейфуллина**г. Астана, Казахстан**E-mail: oalipbeki@mail.ru**Татаринцев Владимир Леонидович**Доктор сельскохозяйственных наук, профессор**Алтайский государственный аграрный университет**Барнаул, Российская Федерация**E-mail: kafzem@bk.ru*

Инкаров Даян Сабырович

Докторант

Казахский агротехнический исследовательский университет им. С.Сейфуллина

г. Астана, Казахстан

E-mail: inkarov96work@mail.ru

Асанова Гульнара Абдильдиновна

Кандидат технических наук, доцент

Казахский агротехнический исследовательский университет им. С.Сейфуллина

г. Астана, Казахстан

E-mail: assanga@mail.ru

Музыка Олеся Сергеевна

Магистр наук

Казахский агротехнический исследовательский университет им. С.Сейфуллина

г. Астана, Казахстан

E-mail: o.muzyka@kazatu.kz

Аннотация

Научная статья посвящена актуальной проблеме деградации земель, наблюдаемой и изучаемой мировым научным сообществом и, в частности, казахстанскими учёными. Вопросы классификации и изучения состояния деградированных территорий являются первостепенными, так как связаны с дальнейшим мониторингом проблемы, определением финансовых затрат на осуществление охранных мероприятий и придания этим ландшафтам устойчивого развития. Установлено, что сельскохозяйственные угодья в Казахстане более чем на 90% подвержены деградационным процессам и этот показатель варьирует в зависимости от вида угодий и их пространственного размещения.

При мониторинге пастбищных угодий для определения деградации пастбищ использовались данные спутников Terra, Aqua. По результатам сравнения степени повреждения пастбищ, полученных дистанционными методами и на основе наземных обследований, было выявлено, что достоверность правильного определения слабой степени повреждения соответствует 75%, средней степени повреждения — 85% и сильной степени повреждения - 90%.

Авторами статьи предложена классификация земель Казахстана в соответствии с IPPC и определены типы деградации земель Казахстана в соответствии с WOCAT. Выявленные закономерности проявления деградационных процессов на территории РК классифицированы по уровням IPPC. Определены направления повышения устойчивости сельскохозяйственных земель с учётом классификационных признаков. Материалы научного исследования рекомендуются к использованию при управлении земельными ресурсами и разработке агро-, фито, лесомелиоративных мероприятий, направленных на повышение устойчивости пустынных агроландшафтов РК.

Ключевые слова: показатели деградации земель; продуктивность земель; органический углерод почвы; оценка земельных ресурсов; нормализованный индекс растительности; дистанционное зондирование Земли; землепользование.