International Summer School on
V International Summer School
on Land degradation in Kazakhstan
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M.Auezov South Kazakhstan State University

D.Serikbaev East-Kazakhstan State Technical University

11-16 June 2018

Program

11 June 2018 (main building of M.Auezov SKSU, 254 room, conference-hall)
Welcome and introductory remarks
09:30-09:45 Rector of M.Auezov South Kazakhstan State University Kozhamzharova Daria,
09:45 -10:00 IUCLAND kickoff - Claudio Colombo
10.00-10.20 – Vice-rector for E and EMWBaibolovKanat (University presentation)
10:20 – 10:30AlinaUtmaQuestionnaires
10:30 – 10:35 -Taking photo
10:35- 11:00--- Break ---
11:00 - 12:00SaparbekovaAlmira,"Soil degradation and land protection in Kazakhstan".
12:00 – 13:00 Turebekova Gauhar "Ecological consequences of anthropogenic impact on the lithosphere on the example of the South-Kazakhstan region".
13:00 - 14:30 --- Lunch ---
14:30 - 15:30 MutaliyevaBotagos
Processing of the agriculture waste for production of bio fertilizer and biogas
15:30 - 16:00 --- Break ---
16:00 - 17:00BubniakAndrey
Natural and man-made hazards as a factor of soil degradation
17:00- 19:00 Practical classes

12 June 2018 (main building of M.Auezov SKSU, 312/342 room)
09:00 - 11:00 Claudio Colombo "Soil and Land degradation in Italy"
11:00 - 11:30 --- Break ---
11:30 – 12:00 Monica Zovko "Land degradation in Croatia"
12:00 – 13:00 KenjahimovKadyrbek
Influence of the groundwater conditions on the ecology of irrigated sierozemic soil of the Chui valley and the way of their regulation
13:00 - 14:30 --- Lunch ---
14:30 – 15:30 TashebaevaZulumban
"Soil contamination with pesticides in Kyrgystan and way of solving the problems"
15:30 – 16:00 --- Break ---
16:00 -17:00 AimenovaZhanar
Pharmacological preparations based on plants growing in the South Kazakhstan region.
17:00- 19:00 Practical classes

13 June 2018(main building of M.Auezov SKSU, 312/342 room)

09:00 - 11:00 Environment – main source of contamination of raw materials and food products
10:00 - 11:00 AlibekovRabshambek, OrimbetovaGulbagi
11:00 - 11:30 --- Break ---

11:30 - 12:30 TashbalatBaibolat
“Scientific and methodological basis for assessment and management of mudflow risks
Dangerous exogenous processes, including mudflows”
12:30 – 13:30 – PavolBielek
“Soil information system as a tool of land protection”
13:30 - 15:00 --- Lunch ---
15:00 - 16:00 IztleyovGani, AbduovaAisulu
“Electrochemical methods of wastewater treatment”
“Research and assessment of ornamental and rare plants of Syr-Darya-Turkestan regional nature park”
16:00 - 17:00 Meeting with stakeholders
17:00- 19:00 Practical classes

14 June 2017
Excursion
08.00 – 20.00 -Field trip in summer campus of M. AuezovSKSU, industrial zones ofShymkent

15 June 2018, (main building of M.Auezov SKSU, 312/342 room)
09:00 - 11:00 OlgaFrolova
Ecological and economic assessment of agricultural lands contaminated with heavy metals.
11:00 - 11:30 --- Break ---
11:30 - 12:30 BubniakAndrey
Technical capabilities and management of drones for obtaining information for assessing land degradation.
12:30 – 13:30 BubniakAndrey
Remote sensing in land degradation
13:30 - 15:00 --- Lunch ---
15:00 - 16:00 BubniakAndrey
Processing data obtained with UAV
16:00 - 17:00 Olga Frolova
The negative impact of mining and metallurgical enterprises on the degradation of the soil
17:00- 19:00 Practical classes

16 June 2018(main building of M.Auezov SKSU, 312/342 room)

09:00 - 10:00 TokhanovaRoza, Land reform in Kazakhstan
10:00 - 11:00 RahmetovaGulshat, Land legal relations in Kazakhstan
11:00 - 11:30 --- Break ---
11:30 - 13:30 Group presentation
13:30 - 15:00 --- Lunch ---
15:00 - 16:00 Final test
16:00- 17:00 Awarding certificates and summarizing

IUCLAND International university cooperation on land protection in European –Asiatic countries
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TEACHING MATERIALS

M.Auezov South Kazakhstan State University

D. Serikbaev East-Kazakhstan State Technical University

Shymkent, 11-16 June 2018

Content

Soil degradation and land protection in Kazakhstan

Prof. Saparbekova A.A.

The total area of the Kazakhstan republic is 272 million hectares. Agricultural land is 222 million hectares, including about 27 million hectares of arable land. Most of Kazakhstan's plains (about 90% of the area), but only from the south and south-east, they are framed by the mountains of the Tien Shan, Tarbagatai and Altai.

On the plains from the north to the south, the following soil-geographical zones and subzones are distinguished:

1. Steppe zone of chernozems with subzones of gray forest and meadow-chernozem soils, ordinary and southern chernozems.
2. Dry-steppe and desert-steppe zone of chestnut soils with sub-zones of dark chestnut soils, chestnut soils and light chestnut soils.
3. Desert zone of brown, gray-brown and takyr-like soils with arrays of sands.

In Kazakhstan, there are 25.7 million hectares (M. ha) of black soils (Chernozems), 90.4 M. ha of chestnut soils (Kastanozems), 119.2 M. ha of brown and grey-brown soils (Calcisols), and 37 M. ha of mountain soils (Faizov et al. 2006, Fig.).

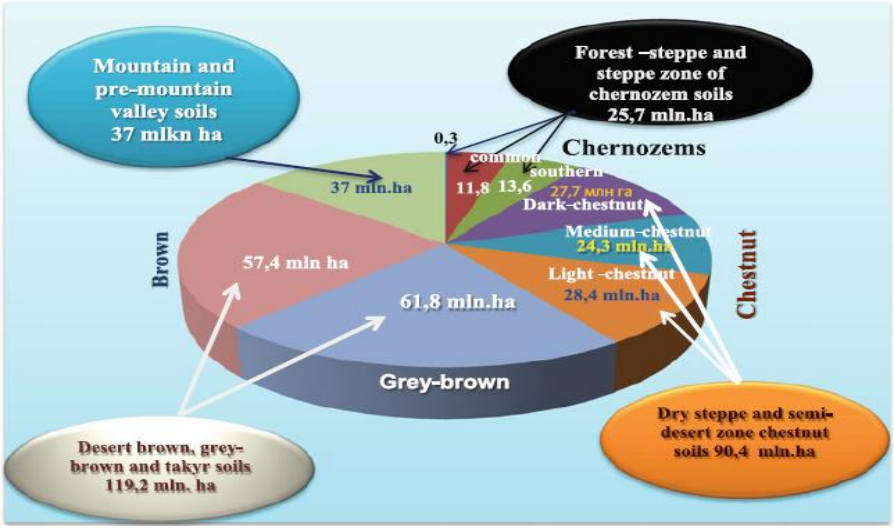


Fig.1.

The structure of the vertical zoning (altitudinal zonality) of the mountain regions of Kazakhstan is much more complicated. It is different in different mountain systems. In general, we can distinguish two large groups of high-altitude zones - the belts of the mountain regions of Kazakhstan.

The foothill desert-steppe zone of the Tien Shan and Altai with serozems and light chestnut soils.

Piedmont and intermontane steppe, mountain-forest-steppe, meadow-forest and meadow zones) with a predominance of dark chestnut soils, mountain chernozems, mountain forest dark and mountain-meadow soils. Picture 1-6.

1

2

3

4

5

6

1. Desert brown soil
2. Medium chestnut soil
3. Light chestnut soil
4. Brown soil
5. Dark chestnut soil
6. Grey brown soil

The destabilization of the ecological situation has led to the degradation of the soil in all natural zones of the republic. As you know, Kazakhstan is one of the largest countries in the world with the largest area, and the population is on the 80th place in terms of population. Making up 0.3 of the world's population, Kazakhstan occupies 2% of the globe.

In general, the territory of Kazakhstan is characterized by a large aridity, the bulk of it - in the sector of the globally integrated system of the Earth's biosphere,

make up dry steppes, semi-deserts and deserts with sharply continental foothill climate conditions. So the average annual precipitation for the whole territory of Kazakhstan is only 207 mm per year, almost half as much as in Russia (389 mm).

This is one of the most environmentally unsuccessful regions of the Eurasian mainland. The arid climate, the flat nature of the surface, predetermines the development of a strong wind regime and associated deflationary processes. Under such conditions, they are formed with low power, mainly saline with low biological productivity. Such landscapes are fragile, easy to tear down and are subject to rapid destruction due to the unreasonable impact of human civilization on them and have the potential for self-healing.

Arid climate, flat land surfaces allow strong wind spread out in central Asia with very high speed and connected with it erosion processes.

Erosion process is the wide-spread problem in the agriculture. It can destroy soil in very short time, therefore prophylactic approach is most important for protection land.

Erosion processes are also developing intensively in the Akmola. In 8 districts of the Akmola region, there are slightly eroded soils (where the thickness of the humus horizon has decreased by 30 %), medium-eroded soils (by 50 %), and heavily eroded soils (characterized by the lack of an arable horizon).

According to the Institute of Soil Science of the National Academy of Sciences,

in Kazakhstan more than 70 million hectares of land, or 26% of the territory of the republic, are prone to erosion.

Of these, more than 52 million hectares of land are prone to wind erosion and more than 17 million hectares to water.

The predominance of wind erosion is associated, first, with the flat relief of most of Kazakhstan, secondly, with frequent strong winds and, thirdly, with a slight mechanical composition of the soil (sandy, sandy loamy). Therefore, the development of such lands requires a very responsible attitude.

The development of water erosion on chernozems is associated with a sharp continental climate witch lead to deep freezing of the soil and rapid snowmelt, the rainfall of summer precipitation and anthropogenic activity, which creates favorable conditions for the formation of intensive runoff and water erosion,
picture 7.

The distribution of washed up soils in the agricultural lands of Northern Kazakhstan was distributed as follows:

Akmola region - 562.0 thousand hectares, Kostanay region - 158.7 thousand hectares, North-Kazakhstan oblast 56.0 thousand hectares, Pavlodar region - 0.9 thousand hectares.

Picture 7.

As a part of agricultural lands, lands subject to water erosion occupy an area of 4.9 million hectares in northern Kazakhstan, of which 1.2 million hectares are cultivated. The largest areas of eroded soils in the arable land have been identified in Akmola. For example, more than 60% of the arable land is subject to water erosion in the Akmola region alone.

Current environmental problems arising from anthropogenic overload and irrational use of resources have undoubtedly affected the state of the land.

Human activity cause problem negative factor in agriculture so, in 1955-1958 year в in Pavlodar area were ploughed dark-chestnut ground with light mechanical composition. As a result 805 thous. ha were a subject to erosions and became to be unfit for husbandry. Kostsnay region had same situation.

Long-term treatment of chernozems in Northern Kazakhstan resulted in loss of humus in the plow layer by 20-27%, compared to the virgin soil, and nitrogen-by -13-30%. In these soils, the transformation of nutrients is observed, where losses of gross potassium reserves are observed up to 2.06-2.24%, phosphorus up to 0.050-0.079%, and almost doubled nitrogen reserves (0.172-0.292%). The loss of mobile nitrogen forms more than 30% of the original reserves.The main indicator of soil fertility, decreased by 20-30%.

It should be noted that in the pursuit of the area following the virgin lands in 1961-1986, more than 11 million hectares of unproductive pastures were plowed up. Intensive use of agricultural lands of the country without consideration of the agro-ecological potential of the territory and scientifically justified land cultivation systems has led to a significant decrease in soil fertility.

Table 1 Application of mineral fertilizers in the Republic of Kazakhstan

Types of fertilizer	Years						
	1986	1995	2000	2005	2006	2007	2008
Mineral fertilizers (kilotonnes)	1,039	36.2	10.7	37.5	41.4	58.9	30.9
Organic fertilizers	33,196.0	1,141.0	17.5	7.8	13.7	7.8	7.4
Applied mineral fertilizers per 1 ha of arable land, kg NPK	29	1.3	0.7	2.0	2.3	3.1	1.5
Share of arable lands treated with fertilizers, %	47	1.5	0.5	3.5	3.6	4.8	4.9
Total arable area, K. ha	35,500	28,679	15,400	18,400	18,400	18,954	20,119

One of the major factors in the improvement of soil fertility is a scientifically justified fertilizer application system. The systematic application of mineral fertilizers provided an increase in the yield of sugar beets of almost 3 times the level, 1.6 times for wheat grain, 1.3 times for corn, In Kazakhstan, the application of fertilizers has significantly decreased, resulting in a decrease in soil fertility and yields. The quality of production improved significantly: the content of protein in the wheat grain increased by 0.8–1.2 %, the concentration of sugar in the roots increased by 0.9–1.0 %, (Saparov et al. 2010).

However, there is an assumption that fertilizers are a potential source of soil contamination with heavy metals.An assessment of the degrees of soil contamination with heavy metals was carried out, identifying the mobile forms in them according to Vazhenin (1987): weak, moderate, medium, increased, high and very high levels of pollution. To calculate the amount of heavy metals penetrating the soil with the fertilizers, data was used from a long-term station experiment conducted by the Kazakh Institute of Land Cultivation and Crop Production (Table 2).

Table 2 Inputs of heavy metals (HMs) into the soil through the long-term use of complete mineral fertilizers (1961–2005)

Fertilizer	Application of fertilizers, kg/ha	Input into soil, g/ha						
		Zn	Cu	Fe	Pb	Cd	Cr	Ni
Urea	2,850	37.2	5.0	155	8.0	1.5	–	–
Granulated superphosphate	2,500	253.8	188.0	21,678	559	46	78.9	43
Potassium chloride	3,080	67.4	24.7	2,209	68.5	23	–	–
Input of HM, g/ha of soil	–	358.4	217.7	24,042	635	71	78.9	43
Input of HM, mg/kg of soil	–	0.12	0.07	8.0	0.2	0.02	0.02	0.01

On such landscape backgrounds, many years of industrial, agricultural and military-industrial development of the territory of Kazakhstan without taking into account their threshold of environmental sustainability. The republic was a storehouse of many minerals: out of 105 elements of Mendeleyev's table was discovered in the depths of 99, explored reserves of 70, involved in the production

of more than 60 elements. At the same time, the share of chromites in the former Soviet Union was 98.2, barytes 81.7, phosphorites 64.7, tungsten 53, lead 38.5, molybdenum 29.3, copper 38.4, bauxite - 22.1, asbestos - 20.1%.

On the verge of extinction are forests in East Kazakhstan. On the territory of the republic forests occupy only 3.5% of the total area. In the East Kazakhstan region, 60.5% of all forests of Kazakhstan are located. Irrational deforestation, neglect of plantings of new trees led to the current critical situation

The main source of atmospheric air pollution is emissions from stationary sources of 372 enterprises.

Of the nine cities in Kazakhstan, where the highest level of atmospheric pollution is observed, three - Ust-Kamenogorsk, Ridder, Zyryanovsk - are in the East Kazakhstan region.

A significant proportion was oil and gas, manganese and coal, iron and uranium ore. Kazakhstan in the extraction of minerals was mainly a raw material base. In the places of extraction, primary processing and enrichment, all wastes remained, and enriched pure "cream" ready for industry were sent to the centers.

Technical progress and intensive extraction of natural resources from the bowels were one of the reasons for the degradation of the soil cover of the republic. The society, developing various branches of the national economy, fulfills the function of a great geological and geochemical power. For each inhabitant, about 25-30 tons of various minerals and rocks are mined annually. But the trouble is that only 1.5-2.0% of the extracted turns into useful products, and the rest turns into nature often in such a way that natural forces are unable to incorporate these garbage into their circulation.

The area of disturbed land in Kazakhstan, according to incomplete data, not including sanitation zones is 200 thousand hectares. It should be noted that there are still many lands in the republic that have not yet been classified as broken. These are the areas reserved for the military-industrial complex, most of which were violated and contaminated, including radiation during nuclear test explosions or littered with unsafe "space debris" in places where the residual parts of missiles with components of radioactive fuel fell. The enterprises of the military-industrial complex suffered great damage to the soil cover of the republic. The area of such territories until recently was secret, only now it became known that the land allotted for the purposes of "defense" amounted to more than 20 million hectares. We have to state that Kazakhstan is the only place on the planet where the nuclear-strategic programs were implemented in full: starting with the extraction of raw materials, manufacturing and testing of nuclear warheads before testing and destruction of rocket and space complexes. This lasted for 40 years. In addition, in many regions of the republic, not to mention the Semipalatinsk test site, nuclear tests were conducted, the consequences of which were a particular danger to the soil cover. More than 20 nuclear and more than 500 air and underground explosions were conducted.

No less dangerous were the consequences of radioactive contamination of soils. Soils and all other components of the ecosystem in the areas of uranium deposits were heavily polluted. In the Karagiyi Depression, near Aktau, they extracted uranium ore for a long time and enriched it in a suburban secret enterprise - the Prikaspiisky Mining and Metallurgical Combine. Radioactive wastes of enrichment accumulated in the lake of Koshkarata, located near the city and the Caspian Sea. Accumulated waste is a threat to the environment. It is more likely that they can enter the sea in an underground runoff, the level of which is continuously rising, flooding the coastal areas.

In the oil regions of Western Kazakhstan more than 500 thousand ha, there are large sections of soil contaminated with oil and radioactive materials, high levels of salinity with industrial waste water and technological transformation of the soil landscape, leading to the accumulation of toxic heavy metals (lead, cobalt, nickel, vanadium etc.) and radionuclides (thorium, barium, radium).

In Western Kazakhstan, petrochemical pollution has become widespread, where more than 90% of the explored and potential hydrocarbon resources are concentrated. The area of promising for oil and gas bearing areas is 17,000 thousand km2, which is more than 62% of the country's total territory and includes 208 oil deposits.

Most part of the oil reserves are concentrated in the 15 largest fields - Tengiz, Kashagan, Karachaganak, Uzen, Zhetybai, Zhanazhol, Kalamkas, Kenkiyak, Karazhanbas, Kumkol, Kenbai, Severnye Buzachi, Alibekmola, Central and Eastern Prorva, Kenbai, Royal .

Many researchers note the strong toxic effect of light fraction on microbial communities and soil animals. The light fraction, migrating along the soil profile and aquifers, expands, sometimes significantly.

After the evaporation of the light fraction of oil, the heavy fractions which remain in the soil, saturated with resins, wax and asphaltene, glue together the granulometric fractions to form a dense mass, and form bituminous crusts ranging from 5–10 to 20–40 cm specific technogenic soils with different genetic characteristics than the natural zonal soils are formed.

In the world practice, methods of microbial cleaning of oil-contaminated surfaces are successfully used. These are such well-known firms as Occidental Chemical (USA), Beistritent (England), Biodetox (Germany). In the South Kazakhstan State University. M. Auezov microbiologists have developed a biopreparation "Peroyl“ consisting of cultures *Micrococcus luteus* B1Ag 8 G and *Rhodococcus erythropolis* LN 304 B-7. The effectiveness of the biopreparation for cleaning the soil of arid regions from oil and oil products is 96.5%.

In Kazakhstan, a composition based on natural strains of *Pseudomonas putida* GNPO PE-R-6, *Pseudomonas fluorecens* GNPO PE-R-5, *Bacillus subtilis* GNPO

PE-R-7 and a complex of mineral fertilizers-ammonium dihydrogen phosphate and potassium was developed.

A critical environmental situation has developed in the Aral Sea area - a zone of intensive desertification, salinization and deflation. At present, the level of the Aral Sea has decreased by 18 m, the salinity of water has reached 70 g / l, dried up and the water area of the sea has become deserted on the territory of 3.5 million hectares, including 2 million hectares in the Kazakh part.

Speaking about the ecological state of the soil cover of the republic, one should not forget about the severely degraded pastures from overgrazing of cattle and their irrational use, which should also be attributed to the disturbed lands. The area of degraded pastures reaches 60 million ha, incl. 15 million hectares of agricultural output. A lot of lands that are disturbed and polluted from the technogenic and transport load, as well as petroleum bitumen wastes and oil and gas emissions in the Caspian region, the area of this territory is 5 million hectares.

Intensive anthropogenic activity significantly affects the floral composition. The vegetation cover is thinned, open areas of the earth, prone to wind and water erosion. Dry steppes in the south border on the natural and climatic zone of semi-deserts, therefore, uncontrolled intensive anthropogenic activity increases the risk of desertification processes

Ecological systems of Kazakhstan are characterized by low resistance to anthropogenic impacts and are at increased risk of environmental destabilization. The vegetation cover of natural ecosystems serves as the main indicator of ecological stability, therefore the study of the state of vegetation cover is of great interest especially in places with high anthropogenic load

Thus, the total area of disturbed and polluted land in the republic is 100 million hectares. Based on the above, we can say that the soil-ecological state of the territory of Kazakhstan is extremely tense. The destabilization of the ecological situation has reached such an extent that the processes of soil self-healing have become impossible. The development of an integrated program for the rational use, protection and restoration of fertility of disturbed soils, measures to prevent further degradation of soils, restoration of fertility of eroded, dehumidified and technogenically disturbed soils, improvement of pastures and other issues with solving environmental and soil conservation problems is required.

Ecological consequences of anthropogenic impact on the lithosphere on the example of the South-Kazakhstan region

Turebekova Gauhar

The negative impact of industrial facilities on the lithosphere is mainly due to disruption of the upper layer of the earth's crust during mining, waste disposal, road construction, etc.

The upper part of the lithosphere, which directly acts as the mineral base of the biosphere, is currently undergoing an increasingly anthropogenic impact. In the

era of rapid economic development, when practically the entire biosphere of the planet is involved in the production process, a person became "the largest geological force" under whose action the face of the Earth changes. The scientific and technical process led to a qualitative and quantitative consumption of lithospheric resources.

Already, the human impact on the lithosphere is approaching the limits, the transition of which can cause irreversible processes almost throughout the surface of the earth's crust. In the process of transformation of the lithosphere, a man (according to the data at the beginning of the 90's) extracted 125 billion tons of coal, 32 billion tons of oil, more than 100 billion tons of other minerals. More than 1,500 million hectares of land have been plowed, 20 million hectares of waterlogged and saline. Erosion over the past hundred years destroyed 2 million hectares, the area of ravines exceeded 25 million hectares. The height of the waste tanks reaches 300 m, the mountain dumps - 150 m, the depth of the mines passed for gold mining exceeds 4 km. (South Africa), oil wells - 6 km.

The ecological function of the lithosphere is expressed in the fact that it is the "basic subsystem of the biosphere: figuratively speaking, the entire continental and almost all marine biota is based on the earth's crust. For example, technogenic destruction of a minimum layer of rocks on land or shelf automatically destroys the biocenosis.

Almost all chemical elements are used in practice. However, only about one-seventh of the minerals extracted are used in the production of finished products.

Waste disposal and storage is an expensive activity. The cost of them can be up to 30% of the value of annual output.

However, valuable and scarce minerals fall into the waste: refractory clays, phosphorites, dolomites, limestones, quartzites, etc. Only one-fifth of the slag of non-ferrous metallurgy is involved in the turnover. The task of recycling industrial products is very urgent.

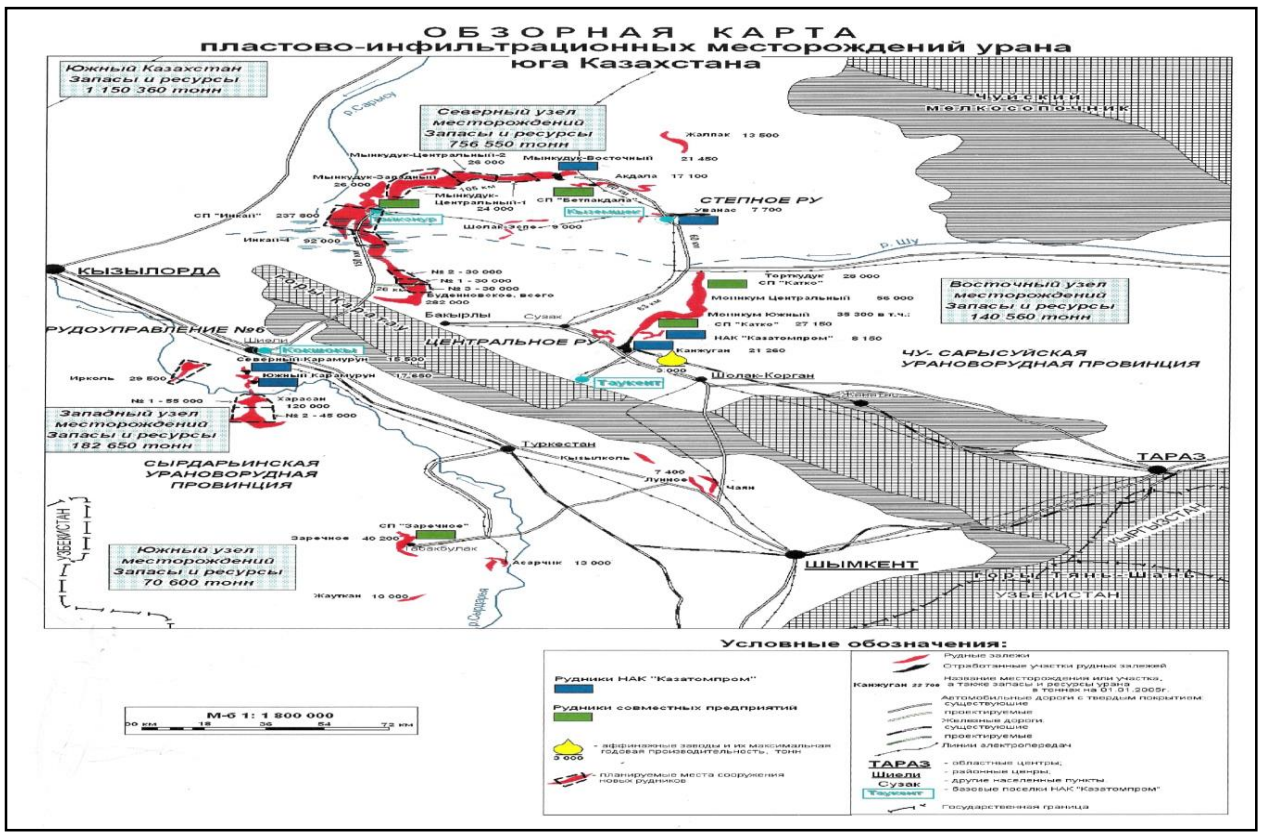
The main pollutants of the soil:

1) pesticides (pesticides);
2) mineral fertilizers;
3) waste and waste products;
4) gas-smoke emissions of pollutants into the atmosphere;
5) oil and oil products.

Development of uranium ores in the Sozak District of the South Kazakhstan region

The existing mine is located on the territory of the Budenovskoye-2 deposit, which is located in the deserted inaccessible sparsely populated southwestern part of the Shu-Sarysuu depression in the territory of the Suzaksky district of the South

Kazakhstan region, 60 km from the settlement of Taikonur, expedition No. 7 of JSC Volkovgeology. The territory is limited by the following coordinates: 44o35-45o20 N and 67o45-67o35.



Picture 1. Overview map of the location of the uranium mine

The ore field is traced in the submeridional direction by 75 km and represents the deposits of the lower and upper Inkuduk subhorizons lying in the depth interval 640-665 m. In the north it is separated by a small break from the Inkaisk deposit and in the south it is limited by the Main Karatau fault. The deposit is divided into two sections: northern, Saumalkol and southern, Kabanbulak. At the first of them, exploration work in 1987-1990. expedition number 7, and the second in 1982-1989. Expedition No. 5 of the PGO Volkovgeology. As a result of the carried out prospecting works it is established that uranium mineralization in the field is confined to the western regional zone of formation oxidation and, being actually the southern extension of the Inkaisk deposit, has much in common with the geology of this field. Uranium ores of the southern part are characterized by high area productivity up to 22.02 kg / m2 (average productivity in the deposit is 1-13.31 kg / m2), uranium minerals are in finely dispersed form and easily pass into solution under the influence of weakly concentrated sulfuric acid.

Currently, the experimental work of the underground borehole leaching is carried out at site No. 2 (deposit 1) of the southern part of the Budenovskoye deposit. In working out there are geotechnological counting blocks-1-1C1, 1-2C1, 1-3C1, 1-4C1, 1-5C1, 1-6C1, 1-7C1, and 1-8C1. Technological wells at the test site during the development of operational units are arranged in a hexagonal scheme with interwell spans of 45-50 meters.

The projected estimate of uranium resources at the Budenovskoye-2 deposit is 31600 tons in P1 category, reserves of 6900 tons were approved for category C2 (Mining and Exploration Committee of the Republic of Kazakhstan, No. 378-05-A of January 27, 2005).

During 2006-2008 exploration works were carried out and in 2008 were protected in the State Reserves Commission and 1820 tons of uranium were placed on the balance of the state in categories C1 and C2.

Picture 2. Drilling cuttings

On the other hand, the deposit is in favorable conditions for uranium mining by the method of underground borehole leaching.

The area is rich in building materials: in the mountain part - granite, limestone, marble, slates, in the foothills - gravel, gravel, sand, clay, in the sand bar - sand.

The section of underground uranium leaching at the Budenovskoye-2 deposit is located in the Suzak district of the South Kazakhstan region. The area of work is a flat foothill accumulative plain adjoining the Karatau ridge from the northeast to the breadth, which is 20-40 km long and extends along the ridge in the north-west direction with an inclination angle of about 1.

The relief is represented by an alternation of hills, gentle hillocks and river valleys stretched in the north and north-east directions. In the transitional part to the sandy massif of Moinkum (in the north), an intermittent band of solonchaks and sorrows of the northwestern strike is traced; the largest solonchak lakes (Akzhaykyn, Aschikolskie) are located in the lower reaches of the Shu River, in the northern part of the deposit Budenovskoye and to the north-west of it.

The southern part of the Suzak region is a hollow inclined piedmont plain. B. Karatau, dismembered by erosion cuts to a depth of 5-20 m and complicated by cumulus sands and flat-bottomed takyr depressions. Absolute marks are 200-400 m. To the north are the hummocky and cellular sands of the Moinkum massif, stretched by a strip 20-30 km wide in the sublatitudinal direction. Sands of alluvial-eolian origin, covered with meager desert vegetation. Absolute marks of the flat part of the area +125 m, sandy massif +310 m. The normative depth of freezing of soils, fine sand -143 cm, loam -109 cm.

The hydrographic network is represented by the rivers Shu and Sarysu. In recent years the waters of the Shu River have not reached the region in question even during the flood period. The dry bed of the river, again the solonchak hollows in the spring are filled with meltwater, rapidly evaporating with the onset of summer heat. The main riverbed r. Sarysu is filled with pro-exact waters in May. By the middle of summer, salted water is preserved only in isolated reaches. Small mountain streams from B.Karatau mountains are lost in loose deposits of the foothill plain. On the area of the ore field of the deposit Budyonovsk hydro-graphic network is absent.

Picture 3. Measures for research of waste during uranium mining

The climate of the region is sharply continental and is characterized by significant annual and diurnal amplitudes of temperature fluctuations: severe winter, hot summer, dry air and low precipitation. A frost-free period in the air is established in the second half of April and lasts 5-6 months. The average long-term temperature of the coldest month (January) is -13ºC. The average long-term temperature of the hottest month (July) is + 35.3ºC. The average annual air temperature is + 9,9 ° C. The average monthly multi-year maximum air temperature is + 16.8 ° C, the minimum is 3.3 ° C.

The maximum air temperature during the summer period reaches + 44 ° C (the second half of the day), the minimum temperature in winter is -41 ° C (the second half of the night).

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The hydrographic network is represented by the rivers Shu and Sarysu. In recent years the waters of the Shu River have not reached the region in question even during the flood period. The dry bed of the river, again the solonchak hollows in the spring are filled with meltwater, rapidly evaporating with the onset of summer heat. The main riverbed r. Sarysu is filled with pro-exact waters in May. By the middle of summer, salted water is preserved only in isolated reaches. Small mountain streams from B.Karatau mountains are lost in loose deposits of the foothill plain. On the area of the ore field of the deposit Budyonovsk hydro-graphic network is absent.

Picture 4. Drilling rigs

The climate of the region is sharply continental and is characterized by significant annual and diurnal amplitudes of temperature fluctuations: severe winter, hot summer, dry air and low precipitation. A frost-free period in the air is established in the second half of April and lasts 5-6 months. The average long-term temperature of the coldest month (January) is -13ºC. The average long-term temperature of the hottest month (July) is + 35.3ºC. The average annual air temperature is + 9,9 ° C. The average monthly multi-year maximum air temperature is + 16.8 ° C, the minimum is 3.3 ° C.

The maximum air temperature during the summer period reaches + 44 ° C (the second half of the day), the minimum temperature in winter is -41 ° C (the second half of the night).

The work site is located in the northwestern part of the Suzak depression within the Aksumba protrusion between the Bugejil uplift - in the north and the B.Karatau ridge - in the south.

In the roof of the Paleozoic uplift, hidden under the cover of loose deposits at a depth of 400-900 m, there are siltstones and argillites of Permian age.

According to gravity-magneto-prospecting data, intrusions of acidic and average composition are not occurring in the thickness of the Paleozoic.

Determining role in the formation of the modern structural plan work area belongs to large Aksumbinskomu and North Aksumbinskomu faults north-westerly direction, which are quite well manifested in the rocks of the Mesozoic-Cenozoic cover. Well-established fractures of the north-western strike are well documented and partially

expressed in the modern relief, separate fragments of submeridional disturbances are also noted.

Species Meso-kajnozojskogo cover on conditions of occurrence and characteristics of the composition are divided into Jurassic PRIRAZLOMNAYA depression, chalk-Paleogene platform and Neogene- quaternary platform and partially suborogenny complexes.

Jurassic sediments are poorly understood and allocated within Dautskoy graben-syncline, located along the Main Karatausskogo fault, and to the north-west of g.Daut, and are represented by sandstones, siltstones and mudstones with lenses and interlayers of conglomerates.

Above the deposited sand and gravel formation Upper Cretaceous (Mynkuduk, inkuduksky and zhalpaksky horizons) power of about 250 m, sandy-argillaceous sediments Paleocene-Eocene "variegated" kanzhugansky, Uyukskaya and ikansky horizons) power of 200 m, of Upper clays about 160 m thick , red dense sandy Neogene clay with a thickness of 200 m, and low-power, up to 10 m, Quaternary sands and quartz sand.

The ore horizons of the Budenovsky deposit are the horizons of the Upper Cretaceous.

According to the results of previous work / 16 / in the territory of the geological disposal of the Budenovskoye-2 project mine, the external gamma radiation dose rate does not exceed -45 mR / h, taking into account the normative allowable excess of 30 mcR / hr above the level of the natural radiation background (Section 2.4 .5 SP LKP-98). The natural radiation background on the territory of the projected mine is an average of 15 microR / hour, which corresponds to the natural radiation background of this region.

Based on the results of analysis of selected samples in the Budenovskoye-2 deposit in the soil, the lead content is within the range of 0.0010-0.0036%, arsenic from less than 0.002 to 0.0026%, thorium from less than 0.001 to 0.0013% , uranium from 0.0003 to 0.0010%, in vegetation - lead 0.0045-0.0058%, arsenic less than 0.002 to 0.0037%, thorium from 0.0014 to 0.0020%, uranium - from 0.0007 to 0.0012% (16).

The reaction of the soil medium is alkaline and strongly alkaline. The alkalinity of the soils, determined from the pH of the water extract in the area, is 8.27-9.98. Soils on the territory of the deposit "Budenovskoe-2", depending on their types contain 0.7-1.1% of humus. The soil surfaces are highly carbonate (9-11% CaCO3). Some soils from a depth of 60 cm contain a considerable amount of readily soluble salts (over 1%). In aqueous extracts in the anions predominate sulfates, to a lesser extent - chloride, from cations - calcium, sodium and magnesium. The background values of dense residues of water extract in the territory of the Budenovskoye deposit are 0.1-1.62%, that is, the soils in some places are saline. With the gamma background value (15 micrograms / hour), the total specific activity of

alpha-emitting radionuclides in the soil is in the range of 329-1048 Bq / kg, in vegetation - 96-235 Bq / kg.

On the site, aquiferous horizons of the Quaternary, Upper Pliocene, Middle Eco, Lower-Middle Eco, Lower-Upper Paleocene and Upper Cretaceous deposits are allocated.

The mine for extraction of uranium-bearing ores by the method of underground borehole leaching (PSV) is located directly on the site of occurrence of ores.

The production is intended for the extraction of uranium-bearing ores by the method of downhole leaching. Processing of the obtained productive solutions of PV is carried out by the method of sorption concentrating. The technology of PV of uranium from the depths is connected with the extraction of the minimum amount of ore on the surface in the preparation of operational blocks and is practically a non-waste production.

Production on the industrial site is represented by two main parts:

- a geotechnological field (GTP) consisting of a system of in-line and pumping wells, as well as pipelines for pumping solutions;
- a processing complex (PC), including a workshop for processing productive solutions (CCPP), a building for calcining and obtaining finished products, units for preparing technological solutions, pipelines for transporting solutions, sludges for cleaning solutions from mechanical suspensions and other impurities etc.

Mine PV on the deposit "Budenovskoe-2" includes the following sites:

Site 1 - a range of wells, including a system of pumping and pumping wells, units for the reception of productive solutions (PR) and distribution of leaching solutions (BP), a system of technological solutions and power supply;

Site 2 - a solution processing site, including a workshop for the processing of productive solutions (CCPP), an affinity shop and other auxiliary buildings and structures;

Site 3 - shift camp with existing and projected facilities for staff accommodation;

Site 4 - industrial waste disposal site, where the existing filtration field and projected landfills for burial of solid household waste (MSW) and for disposal of solid industrial waste (TPO) are located;

Expansion of production of the projected enterprise is envisaged with the release of finished products in the form of nitrous oxide with a capacity of 2000 tons of uranium per year.

The technological process of the projected production consists of the following stages:

• electric pump solution of uranium-containing (productive) solutions from wells;
• collection of productive solutions from a mining range (geotechnological blocks);
• transportation of productive solutions through the pipeline to the site "Budenovskoe-2" in the sand ponds of the PR;

• sedimentation of solutions from mechanical suspensions in sand settlers;
• Uranium sorption at the mine processing plant;
• transportation of returnable solutions through pipelines to the sand pit and further to geotechnological blocks of the mining site;
• "Acidification" of return solutions with sulfuric acid, in order to obtain leach solutions in technological nodes of acidification;
• pumping leach solutions into the wells of the mining site;
• Uranium desorption at the mine processing facility;
• purification of impurities (preparation of water-insoluble hydrates of salts);
• receipt of uranium peroxide;
• Washing of uranium peroxide with desalted water to purify from mechanically trapped impurities;
• calcination of uranium peroxide in rotating tubular furnaces;
• Packing of received uranium oxide-uranium into a transport container of the container-barrel type TUK-44;
• shipment of uranium oxide-uranium pelletized into drums into 20-foot sea containers and dispatch to the consumer.

A sanitary protection zone (SPZ) has been established around the enterprise. The boundary of the SPZ is determined by the boundaries of the SPZ of the mining site (well site) and the processing complex. The SPZ of the mining site is installed at a distance of at least 250 m from the projection to the surface of the outer boundaries of the processed blocks of ore bodies, and the SPZ of the processing complex - 500 m radius from the boundary of the sources of pollutant emissions from the industrial site.

The main factors of the negative impact of industrial facilities on the environment are:

- geomorphological (transformation of the Earth's surface by pouring or pouring dumps, digging quarries, etc.);
- hydrogeological (flooding and drainage of territories, pollution of groundwater, changing conditions for feeding and unloading aquifers);
- geochemical (dispersion of chemical elements, substances and compounds, violation of water-salt balance, change in oxidation-reduction conditions);
- engineering geological (development of landslide phenomena, karsts, subsidence, mud flows, etc.);
- Mineralogical (depletion of the earth's interior);
- geophysical (violation of the structure and power of the Earth's magnetic and electric fields, the appearance of wandering currents, seismic and sound waves).

WASTE PRODUCED IN THE PROCESS OF ACTIVITY ENTERPRISES

During the mine operation the following types of waste are formed:

1. Non-radioactive solid domestic and industrial waste, similar to the waste of ordinary manufacturing enterprises, operating vehicles, maintenance facilities, energy supply and life support systems for maintenance personnel, etc.,
2. Specific waste of drill cuttings formed during the construction of technological PSV wells.
3. Specific radioactive waste inherent only in uranium mining by the method of underground well leaching (PSV).
To prevent the harmful impact of waste on the environment and human health, the landfill of industrial waste and solid household waste is equipped with an anti-filtration screen, a dedusting system, a system for collecting and cleaning water, the bottom of the trenches after excavation is carefully planned with slopes, compacted by a roller with simultaneous moistening to the bottom of the sides landfill for solid domestic wastes (SDW) and industrial non-radioactive waste.
The landfill for solid non-radioactive production wastes is subject to systematic monitoring of the possible occurrence of anthropogenic waters and the impact of its surrounding atmosphere and soil in accordance with the schedule approved by the chief engineer of the enterprise, agreed with the local bodies of the State Sanitary Inspection and representatives of the regional ecology department.
In order to avoid getting to the landfill of waste previously in contact with radionuclides, storing them at the landfill of solid industrial non-radioactive waste is allowed only after checking by the dosimeters of the department of the Republic of Bashkortostan and the Environmental Protection Agency.
The lifetime of the test site is 20-25 years. The beginning of operation is November 2006. Waste is laid by layer-by-layer compaction to a density of 0.3 t / m3, which makes it possible to use the polygon capacity more rationally and extend its service life.
As a rule, the geological section of uranium deposits of hydrogen type is complicated by unstable sandy-argillaceous watered rocks, which determines the choice of optimal physicochemical parameters of the clay mud used in drilling, as well as the means and methods of cementation of the wells.
The actual drilling of geotechnological wells consists of two stages: drilling a pilot hole with a diameter of 112-118 mm and expanding it to 150-295 mm under a casing string.
Usually drilling of the pilot well to the roof of the ore-bearing horizon is carried out in a non-corn method by hydromonitor picodours and with the selection of the core by carbide crowns along the ore interval. In this case, the parameters of the drilling mode are reduced in comparison with the drilling of prospecting and exploration wells. Expansion of the wellbore to the design diameter is carried out successively with roller cone bits or special expanders with a diameter of 151, 161, 190, 243, 295 mm. In the process of drilling, to prevent the complications associated with the collapse of the walls of wells, which occurs as a result of swelling and erosion of

clay rocks and, the clay solution is treated with chemicals that reduce the water loss of aquifers to 8-10 cm3 / for 30 minutes.

The enterprise generates wastes of amber and green levels of danger.

The wastes of the Amber level of danger include:

- Fluorescent mercury-containing lamps.
- Waste electrolyte from storage batteries;
- Lead scrap from used batteries;
- Cooling liquid used;
- Waste gear oil and motor oil;
- Oily rags.

Waste of the Green hazard level includes:

- construction garbage;
- scrap of ferrous metals, formed during the repair of equipment and waste generated during metalworking;
- Wear tires of cars;
- worn polyethylene bags;
- solid household waste (including from the dining room).

The composition of solid household (non-toxic) waste generated in the shift camp and on industrial sites of the mines includes polymeric materials (plastic bags), glass, metal, food waste, waste air conditioning systems.

The ecological function of the lithosphere is the main life-supporting function that determines the development and existence of modern society, as well as the entire vegetable and living world.

In conclusion, I believe, it is necessary to list all the ways of reducing the negative impact of industrial facilities:

implementation of measures to strengthen the material and technical base of all types of production activities, one way or another related to pollution;

improvement of production technologies;

to increase the level of technical equipment of industry;

the creation of trade unions, conservation societies, youth and other public organizations that actively promote the rational use, reproduction, protection and protection of the lithosphere;

a precisely verified choice of the geographic location of future developments;

Precisely tested seismic position choice of future developments;

artificial filling, formed in the aftermath of activity, emptiness;

making preliminary forecasts for the use of rocks.

Among other solutions to environmental problems is also necessary: the introduction of state control of enterprises; introduction of various restrictions; licensing;

Creation of specially designated places for utilization of wastes that do not affect the life of the environment and people.

Processing of agriculture waste for production of biofertilizers and biogas

Co-funded by the Erasmus+ Programme of the European Union

Mutalieva A.A.

1 The situation of microbiological anaerobic biomass conversion among other technologies and the current state of research in the direction of intensification of processes

The process of development of society is associated with an increase in energy consumption. The society has repeatedly faced with energy deficiency. Despite constant involvement in the use of new energy sources, there is a deficiency of energy. In addition, there is a constant increase in the cost of production of traditional energy sources and their transportation. The creation of the energy-saving technologies is an actual at present time.

Biomass is the cheapest and large-scale form of accumulated and renewable energy. The annual biomass increase on the Earth makes up 200 billion tons, equivalent to 3,1021 J. Energy. This value is approximately 10 times higher than the annual energy consumption for all mankind on earth.

The technology of producing biogas and processing of organic waste into high-quality fertilizer by anaerobic digestion has long been known to mankind. It is successfully applied in a number of countries, and it can dramatically improve the economic, environmental and social conditions in agriculture.

Biogas plants show a record payback period of 1-2 years for the technological equipment, and the use of the fermented residue as fertilizer promises a real breakthrough in increasing of yields.

Biogas typically refers to a mixture of different gases produced by the breakdown of organic matter in the absence of oxygen. Biogas can be produced from raw materials such as agricultural waste, manure, municipal waste, plant material, sewage, green waste or food waste. Biogas is a renewable energy source.

Biogas can be produced by anaerobic digestion with methanogen or anaerobic organisms, which digest material inside a closed system, or fermentation of biodegradable materials. This closed system is called an anaerobic digester, biodigester or a bioreactor.

Biogas is a multilateral renewable energy source that can replace conventional fuels to produce heat and power; it can also be used as gaseous fuel in automotive applications. Biomethane (upgraded biogas) can also substitute for natural gas in chemicals production. Recent evaluations indicate that biogas produced via anaerobic digestion (AD) provides significant advantages over other forms

of bioenergy because AD is an energy-efficient and environmentally friendly technology.

In comparison with fossil fuels, AD technology can reduce GHG emissions by utilizing locally available sources. In addition, the byproduct of this technology, called digestate, is a high-value fertilizer for crop cultivation and can replace common mineral fertilizers.

Among the industrialized countries, Denmark holds the leading place in the production and use of biogas by relative indicators - biogas occupies up to 18% of its total energy balance.

In absolute terms, the leading place in the number of medium and large installations is occupied by Germany - 10,000 pcs.Germany is the pioneer country in global biogas production, with approximately 25% installed capacity due to the strong development of agricultural biogas plants on farms. At the end of 2014, more than 8000 agricultural biogas production units were in operation in Germany. Several countries have already become involved in the development of new pathways for biogas production from biomass and biowaste. Many European countries have established favorable conditions for electricity production from biogas. It is remarkable to note that the agro-biomass available for AD is as high as 1.5×10^9 t in Europe. In Western Europe at least half of all poultry farms are heated with biogas. The United States, China, and India are also investing in alternative technologies for biogas production from cellulosic resources, and are likely future producers. In China, there are about 20 million biogas plants (usually household ones). Their use makes it possible to replace 10.9 million tons of equivalent fuel.

Table 1. The top five biogas producers in Europe (in toe).

№	**Country**	**2006**	**2009**	**2013**
	Germany	1665	3675	6716
	UK	1498	1637	1824
	France	298	453	465
	Italy	383	410	1815

	The Netherlands	141	248	302

Although biogas (and/or biomethane) based on waste is a promising substitution for, or contribution to, the natural gas network, the amount produced is limited in comparison with the annual global consumption. There is no clear answer regarding which feedstock is most appropriate for the biogas economy. In general, carbohydrates, fats, and proteins can be used in many applications. The necessity for global sustainable waste management has led to research interest in alternative fuels based on agro-waste and biowaste. In our studies we discussed about using of immobilization of methanogenic bacteria for solving of the current problems and barriers affecting different biogas production pathways.

A wide range of waste types can be used as substrates for biogas production using AD technology. Large quantities of lignocellulosic waste are collected from agricultural, municipal, and other activities. The most typical forms of waste used in the European energy industry are: ① animal manure and slurry, ② sewage sludge, ③ municipal solid waste, and ④ food waste.

Table 2 compares the production amount and energy potential for the different feedstocks that can be utilized for biogas production.

Table 2. Comparison of biogas yield and electricity produced from different potential substrates.

№	**Type**	**Biogas yield per ton fresh matter (m^3)**	**Electricity produced per ton fresh matter[a](kW·h)**
	Cattle dung	55–68	122.5
	Chicken litter/dung	126	257.3
	Fat	826–1200	1687.4
	Food waste (disinfected)	110	224.6
	Fruit wastes	74	151.6
	Horse manure	56	114.3

	Maize silage	200/220	409.6
	Municipal solid waste	101.5	207.2
	Pig slurry	11–25	23.5
	Sewage sludge	47	96.0

35% electrical efficiency combined heat power, heating value 21 $MJ \cdot m^{-3}$, 55% methane content, 3.6 $MJ \cdot (kW \cdot h)^{-1}$.

Biomass contains carbohydrates, proteins, fats, cellulose, and hemicellulose, which can be used as feedstocks for biogas production. In current practice, co-substratesare usually added to increase the organic content and thus achieve a higher gas yield. Typical co-substrates include organic wastes from agriculture-related industries, food waste, and/or collected municipal biowaste from households. The composition and yield of biogas depend on the feedstock and co-substrate type. Even though carbohydrates and proteins show faster conversion rates than fats, it is reported that the latter provide a higher biogas yield.

To avoid process failures, feedstock pretreatment is necessary. The application of pretreatment methods enhances the degradation of substrates and therefore the process efficiency. Chemical, thermal, mechanical, or enzymatic processes can be applied to speed up the decomposition process, although this does not necessarily result in a higher biogas yield.

The production of biogas is especially effective in agro-industrial complexes where there is a possibility of a full ecological cycle. The raw material for biogas production is all sorts of organic waste: manure of animals and birds, waste of slaughterhouses, canneries, meat processing plants, etc.

One of the parameters reflecting the efficiency of fermentation of the substrate is the amount of biogas released. Fermentation products are advisable to use as non-traditional fertilizers, because they contain organic substances.

The composition and main characteristics of the constituent of biogas obtained by anaerobic digestion of livestock and poultry waste are presented in Table 3.

Table 3. Composition and characteristics of biogas components of livestock and poultry waste.

Components of biogas	CH_4	CO_2	H_2	H_2O	CO	C_mH_n	N_2	O_2	H_2S
Volumetric concentration, %	55-70	27-44	1-4	2-4	1-4	1-3	1-2	0,2-0,4	0,1-1
The lowest heat of combustion of dry gas, kkal/nm^3	8550,0	-	2570,0	-	3050,0	21000,0	-	-	5470,0
Density, kg/nm^3	0,714	1,977	0,09	0,805	1,25	1,261	1,25	1,43	1,536

As follows from Table 3, the main constituents of biogas are methane (55-75% vol.) And carbon dioxide (27-44% vol.), And the calorific value of biogas is determined by the content of methane in it as a fuel component. Depending on the methane content (55-70%), the calorific value of biogas is 4700-6000 kcal / m3 (20-25 MJ / m3 or 0.68-0.85 kg of equivalent fuel), respectively.

Anaerobic fermentation converts a major part of organic nitrogen to ammonia, which is then directly available, though also potentially phytoxic, for plants as a nitrogen source. It was found that in addition to nitrogen, the fermented residue as a fertilizer could satisfy the plants' need for phosphorus, whereas potassium needs to be added through fertilization Consequently, this work will investigate the quality of the fermented residue as a biofertilizer produced from chicken manure in the process of anaerobic fermentation.

The created situation has brought to need of the revealing the possibilities of the rational use of resource of the traditional energy and development of the research work on use of untraditional and renewed sources of energy.

Results of analysis of literature shown that the biogas yield dependence from the contents of co-ferments in agricultural plants.

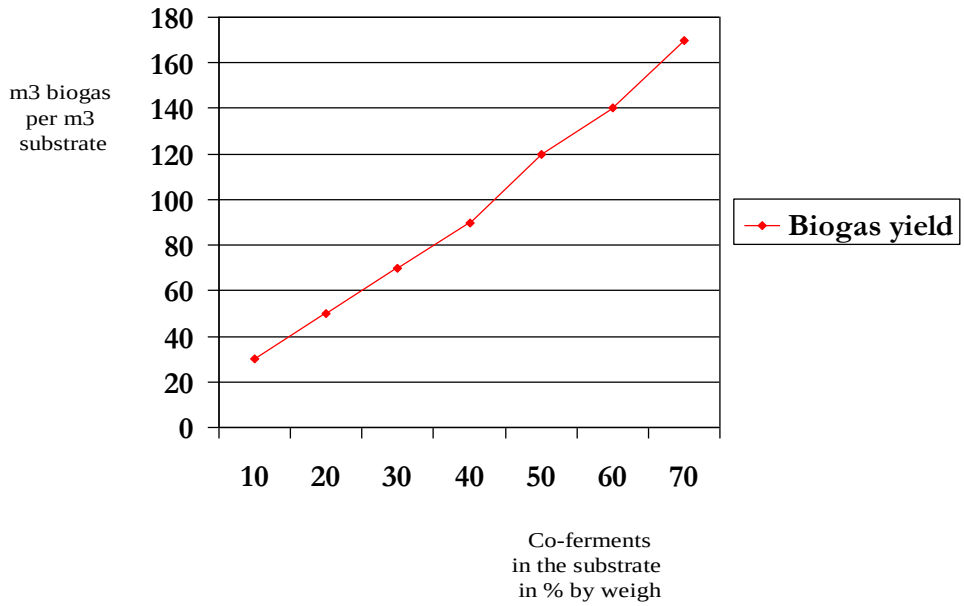

Figure 1. Biogas yield in correlation to the percentage of co-ferments in agriculture plants

In general, all types of biomass can be used as substrates as long as they contain carbohydrates, proteins, fats, cellulose, and hemicellulose as main components. It is important that the following points are taken into consideration when selecting the biomass:

- The content of organic substance should be appropriate for the selected fermentation process.
- The nutritional value of the organic substance, hence the potential for gas formation, should be as high as possible.
- The substrate should be free of pathogens and other organisms which would need to be made innocuous prior to the fermentation process.
- The content of harmful substances and trash should be low to allow the fermentation process to take place smoothly.
- The composition of the biogas should be appropriate for further application.
- The composition of the fermentation residue should be such that it can be used, e.g., as fertilizer. Lignin, the main constituent of wood, and most synthetic organic polymers (plastics) simply decompose slowly. Some substrates legally require a proper sanitization before and after the fermentation process. In the following sections some of the substrates are described more in detailed.

By co - substrates added to the liquid manure the content of organic substrate is increased, hence the yield of biogas. From an economic point of view it is only

profitable, however, when the materials are sourced from a location within a distance of 15 – 20 km. In general, the content of dry matter (liquid manure and co - substrates) in the substrate should be below 2 – 12% to ensure the functionality of standard pumps and a proper mixing in the bioreactor, what is important for an efficienttransfor- mation process. But the addition of co - substrates poses a higher hygienic risk. If the residue from the fermentation process is to be used as fertilizer for agricultural areas, the co - substrates should meet the national laws and should not pose any hazard from exposure, e.g., they must be free of pathogens. Some co - substrates, like residues from separated fat, leftovers, and flotated material from a fat removal tank, contain nitrogen - rich nutrients. When distributing this to fields, the upper limit for nitrogen can be exceeded, given e.g. The limit is set at 210 kg ha − 1, which corresponds to the quantity of nitrogen in excreta of 3.5 GVE ha − 1. In this case, the residue from fermentation may not be used on the agricultural areas from which the residue came, but must be transported to, e.g., cattle- less agricultural enterprises in the neighbourhood, what often involves additional costs.

With pure and fresh cattle dung there is usually no scum problem. Floating layers will become a problem when e.g. undigestible husks are part of the fodder. This is often the case in pig feeds. Before installing a biogas plant at a piggery, the kind of fodder and consequently the kind of dung, must be checked to ensure that it is suitable for a biogas plant. It might be necessary to grind the fodder into fine powder. The user must be aware of the additional costs before deciding on a biogas unit. The problem is even bigger with poultry droppings. The kind of fodder, the sand the chicken pick up, and the feathers falling to the ground make poultry dung a difficult substrate. In case of serious doubt, the building of a biogas plant should be re-assessed.

The following table show the biogas yield at the usage the various wastes from livestock of husbandry as a substrate.

Table 4.Biogas yield at the usage the various wastes from livestock of husbandry as a substrate

Substrate for biogas production	DM [%] oDM in DM [%]	Biogas yield [m^3 kg − 1 oTS] Retention time [d]
Liquid manure from cattle	6-11	0,1 – 0,8

Excreta from chicken	10 – 29 67 – 77	0.3 – 0.8
Excreta from sheep (fresh)	18 -25 80-85	0,3 – 0,4
Excreta from pigs	20 – 25 75 – 80	0.27 – 0.45

Table 5.Gas production from poultry wastes

	Liquid manure [m^3] per animal			Gas production [m^3/GVE/day
	Per day	Per month	Per year	
Poultry Young feeder poultry, young hens (up to 1200 g)	0.0001	0.006	0.07	3.5 – 4.0

The presence of foreign matter leads to an increased complexity in the operating expenditure of the plant. For example, during the process of fermentation of liquid manure from pigs and cattles the formation of scum caused by feed residues and straw and/or muck is expected. Likewise, the addition of rumen content and cut grass can contribute to its formation. Pig liquid manure rather causes aggregates at the bottom as the feed contains a certain proportion of sand and consists of undigested parts of corn or grain. Likewise, excreta from hens lead to a similar phenomenon due to the high content of lime and sand.In general, organic acids, antibiotics, chemotherapeutic agents, and disinfec- tants found in liquid manure can impair and even disrupt the fermentation process in biogas plants. In the liquid manure of pigs the high content of copper and zinc derived from additives in the feed can be the limiting factor. The degree to which the organic substance in the biomass is decomposed in the bioreactor depends on the origin of the liquid manure. The

organic content in liquid manure derived from cattle is only 30% decomposed because of the high content of raw fibers in the feed, while about 50% of pig liquid manure and more than 65% of chicken liquid manure is broken down. The more decomposable the organic substance, the higher is the content of ammonia in the liquid manure compared to the untreated material. The amount of ammonia in hen liquid manure represents about 85% of the total original nitrogen content.

Table 6.Usual parameters for biomass fermentation

Substrate	Degradation of organic substances [%]	Degradation of organic acids [%]	Percentage of ammonium nitrogenfrom total nitrogen [%]
Liquid manure from poultry	67	-	85 8,2

Obtaining of the mixed culture of methanogenic bacteria

The species of microorganisms vary depending upon the materials which are to be degraded; e.g., Clostridium degrades butyricum, Cl. Pasteurianum and Citrobac- terfreundii degrade particularly hexadecimal chlorine cyclohexane, Micrococcus, Aerobacter, Alcaligenes, Flavobakterium , and Pseudomonas decompose the alkylsul- fonate of detergents. Alcohols, fatty acids, and aromatic bonds can be degraded by microorganisms with anaerobic respiration. They use, among other nutrients, nitrate, sulfur (Desulfuromonasacetoxidans, Pyrodictiumoccultum), sulfate (Desulfovibriodesulfuricans, Desulfonemalimicola) carbonate (Acetobacteriumwoodi, Clostridium aceticum, Methanobacteriumthermoautotrophicum), fumarate or Fe(III) (Alteromonasputrefaciens) as electron acceptors, so they are called nitrate reducer, sulfate reducer etc. accordingly. However other microorganisms also compete around nitrate as electron acceptors, so that nitrate is rapidly reduced to ammonium and the nitrate reducer plays a subordinate role in fermentation processes. But the sulfate reducers are deeply involved in the degradation of low - oxygen compounds such as lactates and ethanol. The microorganisms form a culture from obligatory or facultative anaerobic bacteria at a concentration of 10^8 – 10^9 fermenting bacteria per mL. In the first and second phase of degradation, at least 128 orders are involved

of 58 species and 18 genera. Clostridium, Ruminococcus, Eubacterium and Bacteroide are the species mainly occurring. In the third and fourth phase of degradation, methane bacteria are in the majority – so far, 81 species from 23 genera, 10 families, and 4 orders have been specifi ed. Also, there are many microorganisms which belong to the ecological system of a bioreactor and which are indirectly involved in the degradation. Staphylococcus, which can cause health dangers for personnel, should be mentioned. At all four phases of degradation, the species Acetobacter and Eubakteriumare involved in nearly equal amounts. Some kinds are homoacetogenic, i.e they conver carbon dioxide and/or monomers of carbohydrates via the acetyl CoA. Since the CO_2 is constantly delivered by the metabolic processes and therefore CO_2 is available in the reactor in unlimited quantity, some of carbohydrates are degraded by homoacetogenesis. There are some signs, that homoacetogenic bacteria are involved in other metabolic processes also, e.g., in the splitting of the aromatic ring system of substituted aromatics and/or in the dissolution of structures similar to lignin.

Methanogenics

The last phase of the anaerobic decomposition is dominated by a special group of microorganisms, the methanogenicArchaea. These are characterized through the co - factor F_{420} , which acts in the presence of hydrogenase as a carrier for H_2, appears only in methanogenics, and can be detected by its autofluorescence in an optical microscope. Active methanogenics appear in the second phase of fermentation, the acido- genic phase, but the number of methanogenicArchaeae obviously increases in themethanogenic phase. Methanobacterium, Methanospirillumhungatii, and Methanosarcina are the main species. When the acetate concentration is low, the fi lamentousMethanosaeta is able to stand up to the coccusMethanosarcina, because of its considerably lower substrate saturation efficiency and its higher substrate affinity. Especially in flow - through systems, Methanosaeta has advantages over other methanogenics because of its ability to grow on hydrophobic surfaces and hence to withstand washing effects.

The cell walls of all Archaea contain phytanyl ether lipids but no muramic acid. Gram - positive species have cell walls of pseudomurein with incorporated C_{20} – isopranyldiether and C_{40} – isopranyltetraether, methanochondroitin, or heteropoly-saccharides. Gram - negative organisms have only (glyco) - protein cell walls. The domain Archaea is divided into four phyla: Crenarchaeota, Euryarchaeota, Korarchaeota, and Nanoarcheota. The methanogenicArchaea belong to the phylum Euryarchaeota. The Euryarchaeota are a physiologically deverse phylum with many extremo- philic organisms. Extremely halophilic, methanogenic, and hyperthermophilic genera and species belong to it. But also some species of the hyperthermophilicArchaea are methane forming. The acidophilic group called Thermoplasma, which does not have cell walls, should be mentioned. How the phylum Euryarcheota is best subdivided down to the species is still matter of

research. MethanogenicArchea exist in all possible shapes: rods, short lancet - shaped rods, cocci, irregular plates, or spirilli. MethanogenicEuryarchaeota are strictly anaerobic and live off H_2 /CO_2, H_2 /CO, formate, acetate, methanol, methanol/H_2, methylamines, or dimethyl sulfides. Some species use primary and secondary alcohols as electron donors. Nickel is obligate for euryarcheota. They produce methane from methyl-CoM catalyzed by the enzyme methyl-CoMreductase in presence of the cofactors F_{420}, F_{430}, metha- nopterin, and CoM.

The orders, families, genera and species are able to produce biogas. Many of them do not occur in biogas plants of today and/or in the rumen ofcattles, but could perhaps be used in special applications to produce biogas.

2Anaerobic digestion as a basis for obtaining of highly effective biofertilizers

The destroyed organic material in the process of obtaining biogas in addition to the remains, if it is of good quality, can be used as a fertilizer. Mineral nutrition, available in organic material, is realized and concentrated in the final fermented product. If fermentation is performed with relatively clean substrates, such as manure, food waste, residues can be used as a fertilizer in feed production. This product should not be mixed with residues known as sludge obtained from slurry fermentation in the treatment of sewage plants. Due to the content of metals or organic contaminants in them, fermented sludge is not suitable for use in agricultural areas. The quality and nutritional value of the fermented residue depends on several factors, including the type of substrate, the pre-treatment method, the process conditions (temperature, storage time, etc.), post-treatment, and storage.

The fermented residue works well as a fertilizer and can yield better yields than when using mineral fertilizers. It also has a positive effect on the chemical status of the soil, the soil structure, and the community of microorganisms.

Importanceofplantnutrition

During the microbial decomposition of organic material in the biogas process, various minerals are used. The fermented residue contains N (nitrogen), P (phosphorus), K (potassium) and Mg (magnesium) form, suitable for plants. The fermented residue also contains various rare elements for plants. The value of plant nutrition, that is, the concentration of various elements, differs between the fermented area from different biogas plants, and depends mostly on the substrate used in the biogas process and how the process proceeds (Table 1). The great benefit of using residues as a fertilizer is that it contains high proportions of ammonium nitrogen (NH4 + -N), which can be directly taken by plants.

Until all the organic material is converted to biogas during the anaerobic process, the fermented residue also typically includes a certain amount of organic carbon and nitrogen. Part of this fraction is further decomposed in the soil and this subsequently leads to the release of large nutrients to the plants. The organic fraction also has a general stimulating effect on biological activity in the soil,

which is beneficial for plants. However, the fermented residue can sometimes contain a small amount of phosphorus (P), and this nutrient needs to be added as an addition to avoid phosphorus deficiency in the soil for as long as a digestat is used.

Table 7.The means of the results of the chemical analysis of the fermented residue samples with chicken manure as the raw material

№	Designation of chemical analysis		Chicken manure
1	pH directly		6,7
2	E.C. mS/cm		35,00
3	% (dry matter 105^{0}C)		28,75
4	% H		71,25
5	% burning residue		28,70
6	% burning loss		71,30
7	% organic matter		68,00
8	% C orhanic		39,00
9	% N	In the natural sample	0,62
10		Total in dry matter	2,16
11	% P		1,96
12	% K		3,60
13	% Ca		3,00
14	% Mg		1,16
15	% Na		0,46
16	Mg/kg Mn		259,00
17	Mg/kg Zn		100,00

18	Mg/kg Cu	46,00
19	Mg/kg Fe	890,00
20	Mg/kg Pb	3,78
21	Mg/kg Cd	0,46

Impactonsoil

The quality of any given soil is determined by physical (porosity, texture, humidity), chemical (moisture, pH), and bioloigic parameters (number and activity of organisms living in the soil).The fermented residue improves soil quality while it contains chemical contaminants that are toxic to soil organisms. For example, organic matter is produced from the residue, increases the buffer capacity of the soil and retains water and air in the soil.The introduction of the fermented residue also affects the microorganisms in the soil in a positive way. Most of the soil microorganisms are known as heterotrophic, which means that they use organic carbon compounds as a source of carbon and energy for growth. The addition of organic material to the fermented residue, therefore, leads to general stimulation of microbial growth.

Microorganisms play a key role in soil fertility, as long as they mineralize organic material and thereby release various nutrients to plants. Microorganisms facilitate the assimilation of nutrients by the plant, form polysaccharides, which stimulate the formation of stable soil aggregates, and also protect plants against diseases. In addition, the content of mineral nitrogen (ammonium) in the fermented residue provides substantial plant nutrition, which leads to good plant growth, which increases the carbon content in the soil, leading to root secretion. This carbon, in turn, stimulates the growth of various microorganisms.

Thus, when processing agricultural waste, biofertilizers are formed, where the substances become easily digestible for plants. As was studied in previous studies, the application of fertilizers in a diluted form in a ratio of 1:10, based on 3 tons of fertilizers per 1 ha, increases yield by 20-50%

The production of biofertilizers based on biogas waste is beneficial, since it allows to save almost all nutrients. Thus, the value of biofertilizers is considered to be dependent on the chemical composition, and therefore the composition of the feedstock plays an important role in obtaining biofertilizers as one of the end products of biogas production. Since the depth of processing plays an important role in the anaerobic processing of waste, the study of the factors influencing the process of biogas production, and therefore biofertilizers, is one of the urgent problems, the

solution of which contributes to solving not only energy but also environmental problems.

Pharmacological preparations based on plants growing in the South Kazakhstan region

Aimenova Zh.E.

Now biotechnology - one of key directions of qualitative technological development in variety of branches of economy. The potential of possibilities and a spectrum of application of biotechnology has transformed branch into the leading factor of development of economy of the world community as a whole. Therefore, many developed countries as the USA, Japan, China, Canada and others, pay now huge attention to its development, develop and realize national and international programs on biotechnology. For example, only in 2009 the annual sales volume of biotechnological preparations in the world has made $164 billion From them of pharmaceutical preparations on $27 billion.

In Republic of Kazakhstan the big attention is also paid to biotechnology development. Development of modern biotechnology in our country is based on results of long-term works of visible scientists of Kazakhstan as Shigaeva M. H, Iljaletdinov A.N., Isaeva A.U. Now are known a number of biological products of a domestic production which are successfully applied to the decision of problems in areas of ecology, medicine and the food-processing industry. For the purpose of biotechnology development in 1993 in Kazakhstan has been created the National centre of biotechnology of Republic of Kazakhstan, being a leading biological centre of science of the country which realizes a state policy of support and development of biotechnological branch, which carries out and co-ordinates scientific and technical programs financed by the state in the field of biotechnology, biological safety and ecology. One of the centres on chemistry-pharmaceutical and pharmacological workings out in Republic of Kazakhstan is the Institute of phytochemistry of Ministry of Education and Science RK, organized in the Karaganda. Holding

"Phytokhimiya" makes complex working out of original domestic phytopreparations: from search of biologically active substances, cultivation of medicinal raw materials to its processing before manufacture of trial parties of medicinal forms of new preparations. Are developed and introduced in manufacture 72 new original phytopreparations. Among them an antineoplastic preparation «Arglabin», hepaprotector «Salsokollin», antiparasitic preparation «Sausalin», hypolipidemic agent «Aterolid», adaptogenic preparation «Ecdifit», etc. Preparations «Arglabin» and «Salsokollin» are included in the Medicinal data card of Kazakhstan.

Despite biotechnology development in pharmaceutical and medical branches, biological preparations of hemostatic action in the domestic market are not presented. The prevailing majority of known preparations, which have hemostatic action are synthetic, possessing a number of collateral actions. In this connection research of possibilities of creation of a substance of the effective biological product possessing hemostatic action on the basis of vegetative raw materials is an actual scientific problem.

The flora of South Kazakhstan is rich on medicinal species of plants. One genus *Lagochilus*, known as a source of vegetative raw materials for manufacture of preparations of hemostatic action, contains 11 species from which it is well investigated only *Lagochilus inebrians*. Now many species from this genus are undeservedly remain out of interests of pharmaceutics. On literary data it is known, that *L.setulosus* represents practical interest for pharmaceutics. As it, except known diterpene lagochilin, also contains lagochirzin which is an active substance of hemostatic preparations.

Process development of biologic medical product, possessing hemostatic effect on the basis of extracts of *Lagochilus* genus plants.

To achieve the purpose of the study there were presented tasks as follows:

- to investigate areas of distribution of *L.setulosus* species, to estimate phytoresources of its natural populations, to establish vegetation terms, to study micro-and macro - morphological features of plants and agrotechnical elements of cultivation in the conditions of a typical grey soil;
- to investigate macro-and microelement structure of phytomass of *L.setulosus;*
- to carry out qualitative and quantitative analyses of biomass *L.setulosus* on definition of biologically active compounds (diterpenes, tannins, essential oils etc.);
- to investigate the quantitative maintenance of diterpene lagochirzin in phytomass and certain vegetative parts of *L.setulosus*, to establish optimum terms of gathering of vegetative raw materials, to study influence of the electrochemical activated water on process of extraction of diterpenes from phytomass of plants and to receive a hemostatic drug excipient;
- to carry out tests on efficiency of hemostatic drug excipient for indicators of a hemostasis of blood of experimental animals - on changing of quantity of thrombocytes in peripheral blood, on resistance of capillaries and on process of

formation of a hemostatic physiological blood clot on walls of vessels, changing of bleeding time and size of blood loss;

- to carry out experiments on efficiency of designed drug excipient for presence of inhibitors of blood coagulation in the raised concentration;

- to investigate and establish dose indicators of acute toxicity of drug excipient of the received biological preparation for organisms of warm-blooded animals;

- on the basis of results of the carried out researches to develop technology of reception of drug excipient of hemostatic biological product on the basis of vegetative raw materials from plants *L.setulosus*.

Floristic researches were carried out on the routeing expeditions spent in Kazgurt, Otyrar, Ordabasy, Baidibek, Tjulkubass, Tolebii, Suzak areas of the South Kazakhstan oblast in the period from 01.05.2013 to 01.09.2013. During researches have been collected plant materials in number of 655 plants which specific accessory have been defined on the basis of results laboratory processings of the collected material and taxonomic analysis of species. Results of taxonomic analysis had been established 11 species of *Lagochilus* genus which areas of distribution meet in all three floristic areas of area.

Thus, species *Lagochilus inebrians* and *Lagochilus setulosus* have appeared the most widespread. The large populations of a sort established by us *Lagochilus* in South Kazakhstan belong to these species. Thus the basic part of phytoresources of species *L. inebrians* is concentrated in Ordabasy area, and *L.setulosus* in Kazgurt area. Other species are extended in Karzhantau and Aksu-Dzhabagli areas and meet spontaneously, occurrence of plants of these species on a scale of an estimation of Drude abundance corresponds sp. - it is absent-minded; sol. - it is rare.

It has been established, that specie *L.inebrians* and *L.setulosus* are dated for different soil-climatic belts of area which are located in a direction from mountains to a river Syr-Darya valley. Thus *L.setulosus* grows in soil-climatic conditions of a foothill zone western Tjan-Shan' which is characterized by a moderate temperature mode, waterprovision and a typical grey soil, and *L.inebrians* in the conditions of more expressed arid type of a climate which is characterized by deficiency of a soil moisture, a heat and a light grey soil.

Results of researches according to phytoresources of these species have shown, that populations of *L.inebrians* and *L.setulosus* are not numerous and occupy the limited areas.

So, in Kazgurt area (near villages «Kyzyl dala») by us are found 4 populations *L.setulosus* which area vary in limits from 1,3-4,5 hectares are revealed. However, the density of plants on district not high - does not exceed 1,2±0,1 plants on m^2 (figure 1). The projective covering of soil vegetation makes no more 15,3±1,3 %. Plants meet separate copies, the bushy form, height 35-40±1,7 sm (figure 2).

Figure 1. lagochilus populations


Figure 2 - appearance of plants *Lagochilus setulosus*
general view of plants; a kind of floriferous bine of plants

Application of mineral fertilizers and their influence on soil fertility of the Republic of Kazakhstan

Mahmudov Zhamal

In the conditions of development of market relations by the major problem of domestic agriculture of republic reproduction soil fertility and on this basis increase of efficiency of agricultural crops and quality of production is. The successful decision the given problem inseparably linked with rational and an effective

utilisation of ground resources, application of fertilizers and protection frames of plants in the country agriculture, providing their achievement of high agronomical, economic and ecological efficiency.

As a result of sharp reduction of volumes of manufacture and application of mineral fertilizers and protection frames of plants in agriculture and irrational use of the earths of an agricultural purpose intensive development of degradation of soils, desertification, salinization and decrease in soil fertility and efficiency of an arable land is observed. For last years are deduced from an agricultural turn more than 12 million in hectares of an arable land, as a result the arable land area was reduced from 35,5 million in hectares in 1985 to 22,4 million in hectares in 2004, including more than in 2 times the area of the irrigated earths was reduced.

Under the forecast of demographers for globe the population by 2030 will increase to 8-9 billion persons and in this connection demand for manufactures of high-quality agricultural production will sharply increase. In this plan Kazakhstan, having huge territory and the fertile earths, can become one of the basic suppliers of agricultural production on the Euroasian continent. However now level of used technologies, differentiations of systems of delay and system of introduction of achievements of an agrarian science in manufacture which contain systematic growth in certain degree and developments agrarian economy sectors is insufficiently high.

For reception of an ecological net production of plant growing *biological products* which promote reproduction of the soil microorganisms providing plants by additional elements, intensively take root into world practice of cultivation of agricultural crops of 100,0-120,0 % of mineral fertilizers equivalent to entering. Besides biological products allow to reduce hectare norm of entering of means of a food and plant protection at their high efficiency, raise immunity of plants to illnesses and stresses. The world market of biotechnologies in agriculture and the food-processing industry are estimated in 45,0 billion US dollars and annually raise on 20,0-30,0 %.

From **272,5 million in hectares** of territory of republic to desertification it is subject **to 179,9 million in hectares** or **66,0 %** земель.**963,20 million US $/year.** - The missed income of erosion of an arable land - **of 799,00 million US $/year.**

-*Secondary salinization and to saline soil formation* it is subject **to 62,0 thousand in hectares,** and on the area **of 12,0 thousand in hectares** secondary saline soils were already formed.

-From secondary salinization waterlogging and other reason is lost the income in the sum **of 375,00 million US $.**

-*Annual damage from loss of humus* are estimated in **2,50 billion the US dollars** which decrease in the maintenance on 1,0 % leads to crop decrease on 5,0-6.0 %.

Each ton of mineral fertilizers satisfy annual requirement for a foodstuff of 5-6 persons. Thanks to application of mineral fertilizers, it is provided on the average,

40,0 - 50,0 % of a gain of a crop of agricultural crops, and protection frames of plants promote preservation more than 40,0 % of a crop of agricultural crops. Efficiency application of mineral fertilizers and chemical protection frames of plants is expressed not only in increase of productivity and production preservation, but also in considerable growth of labour productivity in agriculture. Expenses for manufacture and application of fertilizers in 2-3 times pay off in cost of additional agricultural production, and chemical protection frames of plants-3-6 time at the expense of a cost price and crop preservation.

The factors influencing system of delay of Republic Kazakhstan and reception of highly profitable qualitative production with the low cost price, are: *the modern technics and misture-source saving technology of cultivation of agricultural crops; a qualitative seed material; fertilizers; plant protection frames; микробиоудобрения, biological products.* Without the modern high-efficiency technics and technology of processing of soils food safety of ours the State cannot be provided.

Environment – main source of contamination of raw materials and food products

Ravshanbek Alibekov

Human demands in the basic food substances

By the composition the food products are complex multi-component system that containing as main components a limited number of ingredients (nutrients).

All compounds that may be content into the food products are divided into three main classes:

- Macronutrients;
- Micronutrients;
- Unalimentary compounds (non-food).

Macronutrients - a class of main nutrients that are sources of energy and biopolymer (structural) materials; that present in food products in relatively large amounts: proteins, carbohydrates, lipids.

Micronutrients - a class of nutrients that have pronounced biological effects on various functions of the body; and contained usually in small amounts - minerals, provitamins, vitamins, certain amino acids, oligosaccharides.

Nonedible substances (nonfoods), found in foods, but not used by the body during the human life:

- technological additives (fragrances, dyes, preservatives) toxic substances, and the like;
- ballast substances.

Food products are safely and healthy objects of animal or vegetable origin used in food in natural or processed form as an energy source, food and flavoring substances.
All modern foods are divided into 4 groups:

- Products of mass consumption of traditional technologies;
- Consumer products with the chemical composition (vitamin fortified, low-calorie);
- Therapeutic and dietary products are products with modified chemical composition and physical properties, specially created for therapeutic and preventive food (with a high content of protein, fiber and others.);
- Baby food products, specifically designed for children up to 3 years of age.

At present, consumers are paying more attention to the second food group are beneficial to health; do not contain cholesterol and other undesirable components having a lower energy value (calorie).

Modern consumers believe that food should provide for the body a cleansing and even therapeutic effect, to help cope with stress, environmental pollution and prevent the accumulation of excess weight. The range of promising types of foods is very wide - from fortified vitamins to the products with reduced fat and sugar. In this regard, significantly expand a range of ready-to-eat foods with complex recipes that are difficult to prepare at home conditions. As well as a taste quality has increasingly important value.

Under state policy in the field of healthy nourishment is understood the complex of measures, directed toward for the creation of the conditions that ensure the satisfaction of the needs of population for the rational nourishment taking into account its traditions, habits, economic position, in accordance with the requirements of medical science.

Unsatisfactory nourishment is one of the most important reasons for worsening in the health. In the majority of population are revealed the disturbances of valuable nourishment, caused by both the insufficient consumption of food substances and by disturbance of the vitamins, macro- and micro cells, valuable proteins, and by their irrational relationship. Most important disturbances of food status of the population:

- The hypernutrition of animal fats;
- The deficiency of the polyunsaturated fatty acids;
- The deficiency of full valuable (animal) proteins;
- The deficiency of vitamins (ascorbic acid, riboflavin (B2), of thiamine (B1), of folic acid, retinol (A) and of β- carotene, tocopherol and others);
- The deficiency of mineral substances (calcium, iron);
- The deficiency of microelements (selenium, zinc, iodine, fluorine);
- The deficiency of food fibers.

A physiological value of the food products is a balanced content in the foodstuff of the available irreplaceable substances: irreplaceable amino acids, vitamins, mineral substances, the unsaturated fatty acids. The concept of food nourishment value includes also the optimum relationship in the foodstuffs of proteins, lipids, carbohydrates, which compose 1:1:4. The percentage in the product of the food substances is determined with the calculation of the food nourishment value of product: mineral substances (calcium, magnesium, etc), vitamins (thiamine, ascorbic acid, etc), from the optimum daily consumption of this substance. The conclusion about full value or inferiority of food product by its composition is done according to the obtained results.

Energy that is freed from the food substances in the process of biological oxidation it is used for guaranteeing the physiological functions of organism, the *energy value of foodstuff* is determined.

It is accepted to express the energy value of food products in the kilocalories, calculation they conduct in 100 products. The conversion factors of the energy value of the most important component parts of the raw material and of the foodstuffs comprise:

- Proteins - 4 kcal;
- Carbohydrates - 4 kcal;
- Sum of the mono- and of disaccharides - 3,8 kcal;
- Lipids - 9 kcal;
- Organic acids - 3 kcal
- Alcohol is ethanol - 7 kcal.

By the level of energy value, the foodstuffs are divided into four groups:

- Separately high energy (chocolate, fats) 400 - 900 kcal
- High energy (sugar, croup) 250 - 400 kcal
- Medium-energy (bread, meat) 100 - 250 kcal
- Low-energetic (milk, fish, vegetables, fruits) to 100 kcal

For the fulfillment of all functions of the human organism it spends daily 2200-2400 kcal for the women and 2550-2800 kcal for the men. With the increased physical loads of expenditure of energy they grow to 3500 - 4000 kcal.

Tasks for the fortification of biological values, quality and safety of food products

The organization of the healthy nourishment of population - complex and multifactor process that can be realized, only by relying on profound knowledge, ordered scientific concept and the thought-out scientific and technical policy.

The technical progress in the food industry is in many respects determined by the demographic changes (population, an increase in the fraction of elderly and sick people), social changes, changes in the conditions of life and labor (increase in the number of urban population, a change in the nature of labor, the social stratification of society).

The creation of contemporary and the perfection of the technology of obtaining traditional food products requires the study of the structure of the nourishment of population, analysis of the state of the food and processing branches of agribusiness, correct and thought-out scientific and technical policy in the region of healthy nourishment taking into account of demographic changes, development of science in the region of healthy nourishment. Important is also resolution of questions of the carrying out of plant protein, biologically active additives (BAA), food additives (FA), and the organization of the industry of the products of children's nourishment. The decisive role in the realization of these questions belongs to the development of studies in food chemistry, to food biotechnology, development of the new technological solutions and equipment, methods of analysis and system of management of quality.

Control questions:

1. What arenonedible substances?
2. What are macro- and micronutrients?
3. What is an energy value of foodstuff?
4. What kind of substances should be used for the essential nourishment?
5. What are basic requirements of the food value?

CHAPTER 2: FOOD SAFETY

1. Actuality of Food Safety

2. Classification of allogenic chemical substances

ACTUALITY OF FOOD SAFETY

The problem of security of food - a difficult complex problem that requires many efforts for its solution, both on the part of scientists -.biochemists, microbiologists, toxicologists, etc., and from the manufacturers of sanitary-epidemiological service, state bodies and, finally, consumers

The actuality of the problem of the safety of food products every year increases, since it is the security of food raw materials and food is one of the main factors determining the health of people and the preservation of the gene pool.

Under the food safety should be understood there is no danger to human health when they are used, both in terms of acute adverse effects (food poisoning, and food infection), and from the point of view of the danger of long-term effects (carcinogenic, mutagenic and teratogenic effects). In other words, it can be considered a safe food, not obstruction, adverse effects on the health of present and future generations.

With food in the human body can do considerable amounts of hazardous substances to health. Therefore, acute problems associated with increased responsibility for the efficiency and objectivity of quality control of food products, guaranteeing their safety for the health of the consumer.

CLASSIFICATION OF ALLOGENIC CHEMICAL SUBSTANCES

Allogenic chemical substances can accidentally get into food in the form of contaminants-pollutants, for example, from the environment or during processing when contact with the equipment; sometimes they are administered especially in the form of food supplements, when it is related with technological necessity. In addition, food raw materials and finished food products may contain natural ingredients that have a detrimental effect on human health.

In general, classification of harmful and allogenic substances in raw materials, drinking water and food can be presented in the form of a diagram (Figure 1).

Despite the fact that environment remains the main source of contamination of raw materials and food products, currently there are new and modifierade traditional technologies of producing foods that are often associated with the use of hard impacts on raw materials and intermediates, which in turn is not always justified and leads to the appearance of toxic substances.

Additionally, widespread various kinds of untested supplements and new packaging materials are distributed; a large number of small enterprises, the technological process and the quality of food that is poorly controlled or not controlled as a whole. It should not be forget about anti alimentary nutritional factors contained in raw materials and finished food products and is able to have adverse effects on the human body.

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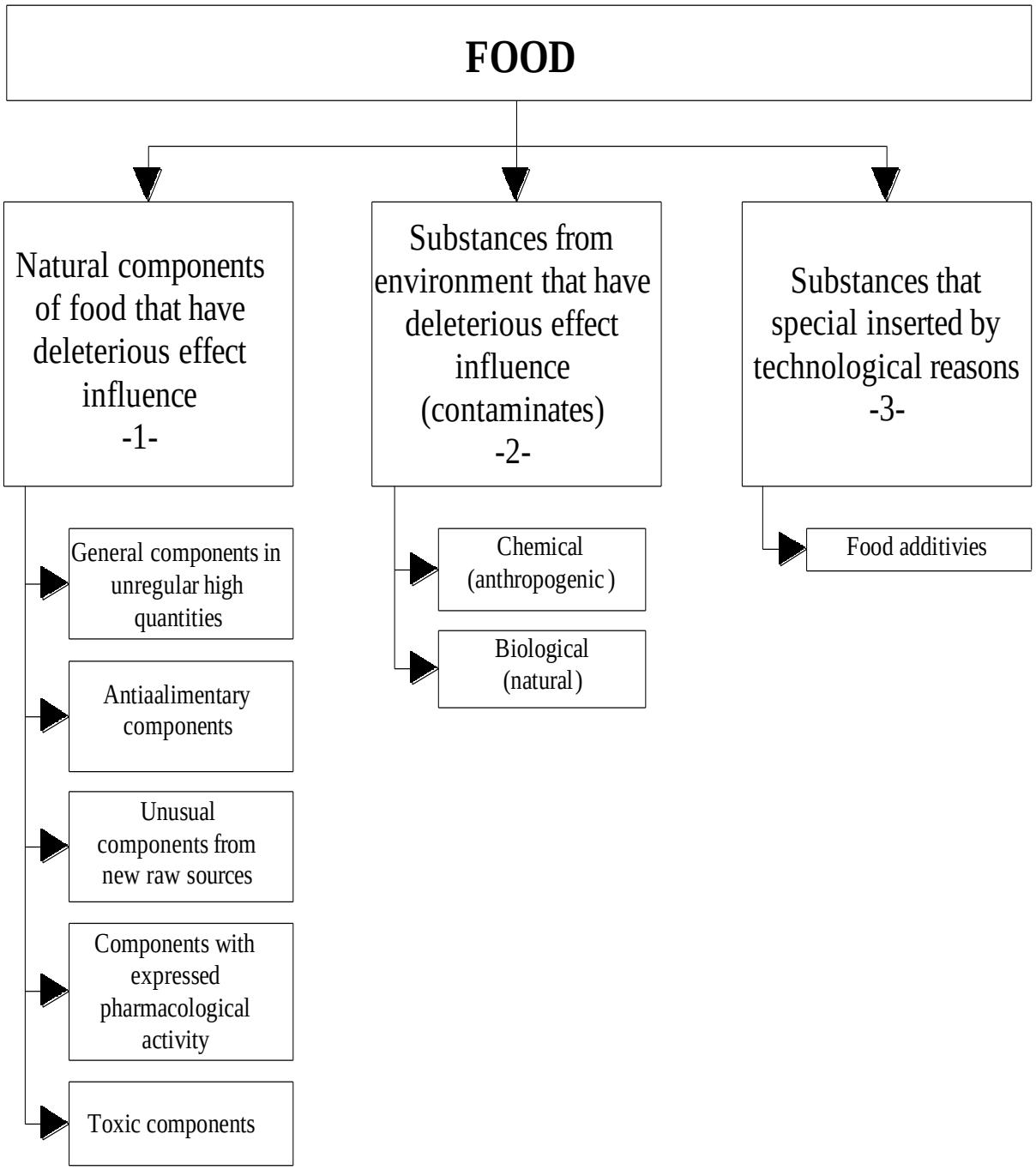


Figure 1. Classification of allogenic and harmful substances of food

Questions:

1. What are natural components of food?
2. What are substances from environment?
3. What are food additives?
4. Why is actual a problem of Food safety?
5. What are reasons of origins of allogenic chemical substances

CHAPTER 3: FOOD SAFETY (cont)

1. Food safety
2. Key principles of food hygiene.
3. Toxicity.

FOOD SAFETY

Food safety is a scientific discipline describing handling, preparation and storage of food in ways that prevent foodborne illness. This includes a number of routines that should be followed to avoid potentially severe health hazards.

Food can transmit disease from person to person as well as serve as a growth medium for bacteria that can cause food poisoning. In developed countries there are intricate standards for food preparation, whereas in lesser developed countries the main issue is simply the availability of adequate safe water, which is usually a critical item. In theory, food poisoning is 100% preventable.

KEY PRINCIPLES OF FOOD HYGIENE

The five key principles of food hygiene, according to World Health Organization (WHO) are:

1. Prevent contaminating food with pathogens spreading from people, pets, and pests.
2. Separate raw and cooked foods to prevent contaminating the cooked foods.
3. Cook foods for the appropriate length of time and at the appropriate temperature to kill pathogens.
4. Store food at the proper temperature.
5. Do use safe water and cooked materials.

Actuality of the problem of food safetyincreases every year, because it ensures the safetyof food raw materialsand food productsis oneof the main factorsthat determine thehealth of peopleand the preservationof the gene pool.

Under thefood products safetyshould be understand a danger absent for healthif ingested, both in terms ofacuteadverse effects(foodpoisoning andfoodborne illness), and from the pointof view ofthe dangerof remote consequences(carcinogenic, mutagenicandteratogenic effects). Otherwisewords, food products harmlesscan be considered by not adverse influence to the healthof present and futuregenerations.

Withfood tothe human bodycan intake considerable quantity ofsubstances hazardous for health. Due to there are actual problemsassociated with increasedaccountability for performanceand objectivityof the food controlto ensuretheir safetyfor the healthof the consumer.

Currently the ecology problems and environment are main sources for edible raw materials pollutions. As well as new food productions approaches often use the hard kinds of influence on the processing and that is not always justified and results in occurrence of toxic substances.

Pollution of food raw materials and foodstuff by alien substances or xenobiotics directly depends from an environmental contamination degree. As a result of human economic activities at the biosphere it is completed a lot of various xenobiotics both inorganic and organic origin, possessing exclusive toxicity circulates. Anthropogenous toxicity has got considerable volumes that does real harm to human health and threatens to outgrow into the ecological accident.

As a result of anthropogenous human activity in the environment, inpoured xenobiotics are capable to collect in soils, reservoirs, with atmospheric and water streams to extend for thousand kilometers. By moving on food chains, xenobiotics penetrate to a human body and can be a cause of various health disbolisms.

TOXICITY

Toxicity is a degree to which a substance can damage an organism. Toxicity can refer to the effect on a whole organism, such as an animal, bacterium, or plant, as well as the effect on a substructure of the organism, such as a cell (cytoxicity) or an organ such as the liver (hepatoxicity). There are generally three types of toxic entities: chemical, biological, and physical:

- Chemical toxicants include inorganic substances such as lead, mercury, asbestos, hydrofluoric acid, and chlorine gas, and organic compounds such as methyl alcohol, most medications, and poisons from living things.
- Biological toxicants include bacteria and viruses that can induce disease in living organisms. Biological toxicity can be difficult to measure because the "threshold dose" may be a single organism. Theoretically one virus, bacterium or worm can reproduce to cause a serious infection. However, in a host with an intact immune system the inherent toxicity of the organism is balanced by the host's ability to fight back; the effective toxicity is then a combination of both parts of the relationship. A similar situation is also present with other types of toxic agents.
- Physical toxicants are substances that, due to their physical nature, interfere with biological processes. Examples include coal dust and asbestos fibers, both of which can ultimately be fatal if inhaled.

Toxicity can be measured by its effects on the target (organism, organ, tissue or cell). Because individuals typically have different levels of response to the same dose of a toxin, a population-level measure of toxicity is often used which relates the probabilities of an outcome for a given individual in a population. One such measure is the LD_{50} or LD_{100} (lethal dose). When such data does not exist, estimates are made by comparison to known similar toxic things, or to similar exposures in similar organisms. The toxicity dose identifies with concentration. The high toxic level has substances with low LD value. Following classification for toxicity (LD_{50} for the laboratory rats by oral dosing), unit measure is mg/kg.

Extremelytoxic	<5
Highlytoxic	5-50
Moderatelytoxic	50-500
Low toxic	500-5000
Almostnontoxical	5000-15 000
Almostharmless	> 15 000

Due to chronic influence of extraneous substances on a human body and a danger arising, the major value has got a carcinogen (cancer tumours involve), mutagen (qualitative and quantitative changes in the genetic device of a cell) and teratogenby xenobiotics actions (anomalies in the fruit development, caused by structural, functional and biochemical changes in an organism of mother and baby).

ENVIRONMENT – MAIN SOURCE OF CONTAMINATION OF RAW MATERIALS AND FOOD PRODUCTS
Lecturer: Orymbetova G.

Unsafe food poses global health threats, endangering everyone. Infants, young children, pregnant women, the elderly and those with an underlying illness are particularly vulnerable. Every year 220 million children contract diarrhoeal diseases and 96 000 die.

The urgency of the problem of the safety of food products increasing every year, since it is the security of food raw materials and food is one of the main factors determining the health of people and the preservation of the gene pool.

Under the food safety should be understood there is no danger to human health when they are used, both in terms of acute adverse effects (food poisoning, and food infection), and from the point of view of the danger of long-term effects (carcinogenic, mutagenic and teratogenic effects). In other words, it can be considered a safe food, not obstruction, adverse effects on the health of present and future generations.

The Second International Conference on Nutrition (ICN2), held in Rome in November 2014, reiterated the importance of food safety in achieving better human nutrition through healthy nutritious diets. Improving food safety is thus a key in achieving Sustainable Development Goals. Governments should make food safety a public health priority, as they play a pivotal role in developing policies and regulatory frameworks, establishing and implementing effective food safety systems that ensure that food producers and suppliers along the whole food chain operate responsibly and supply safe food to consumers.

Food can become contaminated at any point of production and distribution, and the primary responsibility lies with food producers. Yet a large proportion of foodborne disease incidents are caused by foods improperly prepared or mishandled at home, in food service establishments or markets. Not all food handlers and consumers understand the roles they must play, such as adopting basic hygienic practices when buying, selling and preparing food to protect their health and that of the wider community.

Food safety includes actions aimed at ensuring the greatest possible safety of all food products. Policies and actions on food safety should cover the food chain in its entirety - from production to consumption.

Foodborne disease is particularly dangerous for high-risk groups. Although, from foodborne illness no one is not guaranteed, around the world a growing number of people who are at higher risk of acquiring these diseases often with serious consequences. Children, the elderly, pregnant women and persons with weakened immune systems are particularly susceptible to foodborne disease. Proper food preparation can prevent most foodborne diseases.

Problem of food safety. Ranking contaminants in foods

Safe food supplies support national economies, trade and tourism, contribute to food and nutrition security, and underpin sustainable development.

Urbanization and changes in consumer habits, including travel, have increased the number of people buying and eating food prepared in public places. Globalization has triggered growing consumer demand for a wider variety of foods, resulting in an increasingly complex and longer global food chain.

The quality requirements to food products are different at various stages of the food chain. Therefore it is important to realize responsibilities starting from the raw material production until distribution of the end product. The stages of food chain and links between various stages and responsibilities are presented in Figure 1.

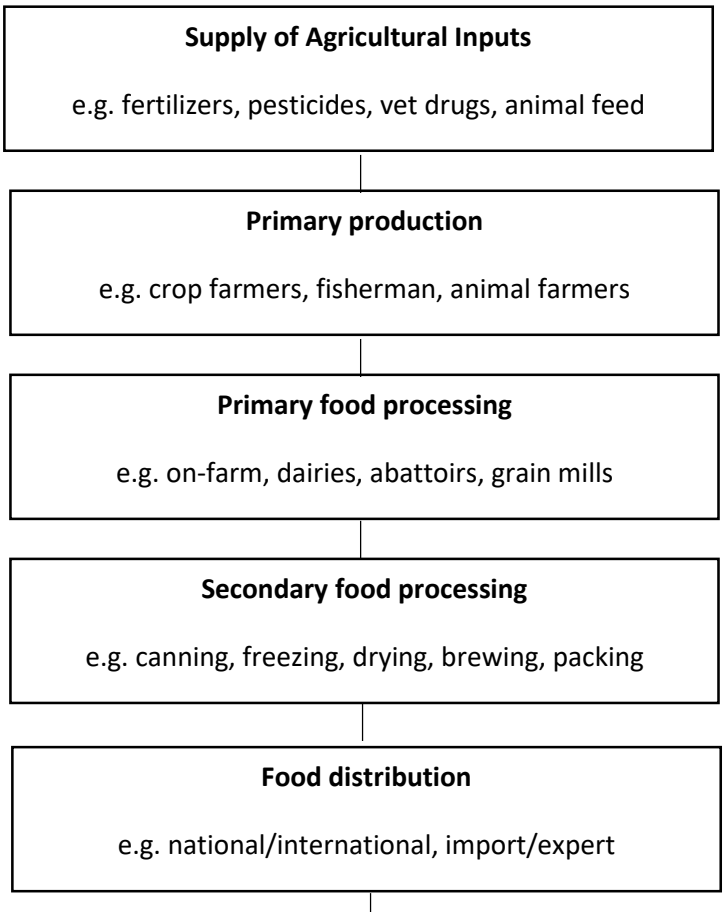


Figure 1. Stages of food circulation chain (farm to table responsibility)

Food quality is affected by various factors at each step of food production chain (Figure 2).

As the world's population grows, the intensification and industrialization of agriculture and animal production to meet increasing demand for food creates both opportunities and challenges for food safety. Climate change is also predicted to impact food safety, where temperature changes modify food safety risks associated with food production, storage and distribution.

These challenges put greater responsibility on food producers and handlers to ensure food safety. Local incidents can quickly evolve into international emergencies due to the speed and range of product distribution. Serious foodborne disease outbreaks have occurred on every continent in the past decade, often amplified by globalized trade.

Food storage is a very important step in the technological process. Food quality may be changed due to various chemical, biochemical and physiological reactions, and food quality can change. Therefore it is important to know the factors, which have to be considered at product storage. The possible causes of product quality changes are summarized in Table1.The food industry, covering the industries producing food for consumers, is a central element in ensuring food safety. In this context, quality, a balanced view of medical standards and safe food is particularly important. Food quality and safety must become a national priority, the national idea for the country.

In the modern food industry the use of various techniques of improving food

quality and perfecting process are widely applied. Consider that the most economical is the use of food additives, whereby they are widespread in most countries.

One-way of solving the food problem - the chemical synthesis of food products and their components, in particular the production of vitamin supplements and premixes. Biotechnology solves the problems of protein and vitamins due to high speed growth of microorganisms, which is 1,000 times higher than the growth rate of farm animals, and 500 times - the plants. For the growth of microorganisms a variety of chemicals and compounds: natural gas, oil, starch hydrolysates, etc. are used.

The problems of the environment, widely used in agriculture pesticides, fertilizers, hormones, antibiotics, development of new technologies, the use of new food additives, the creation of genetically modified products, adulteration of food products made it necessary to include food and food raw materials in the field of eco-analytical monitoring. According to the World Health Organization (WHO) in the industry more than 500 thousand chemical compounds, among them -. 40 thousand harmful and 12 thousand toxic are used. For many compounds not set maximum permissible levels of content, including for food products.

In connection with the appearance on the market of largernumber of ingredients derived synthetically, and care from natural products and traditional food, on the conclusion of the international organizations, significant harm to the human population has caused.

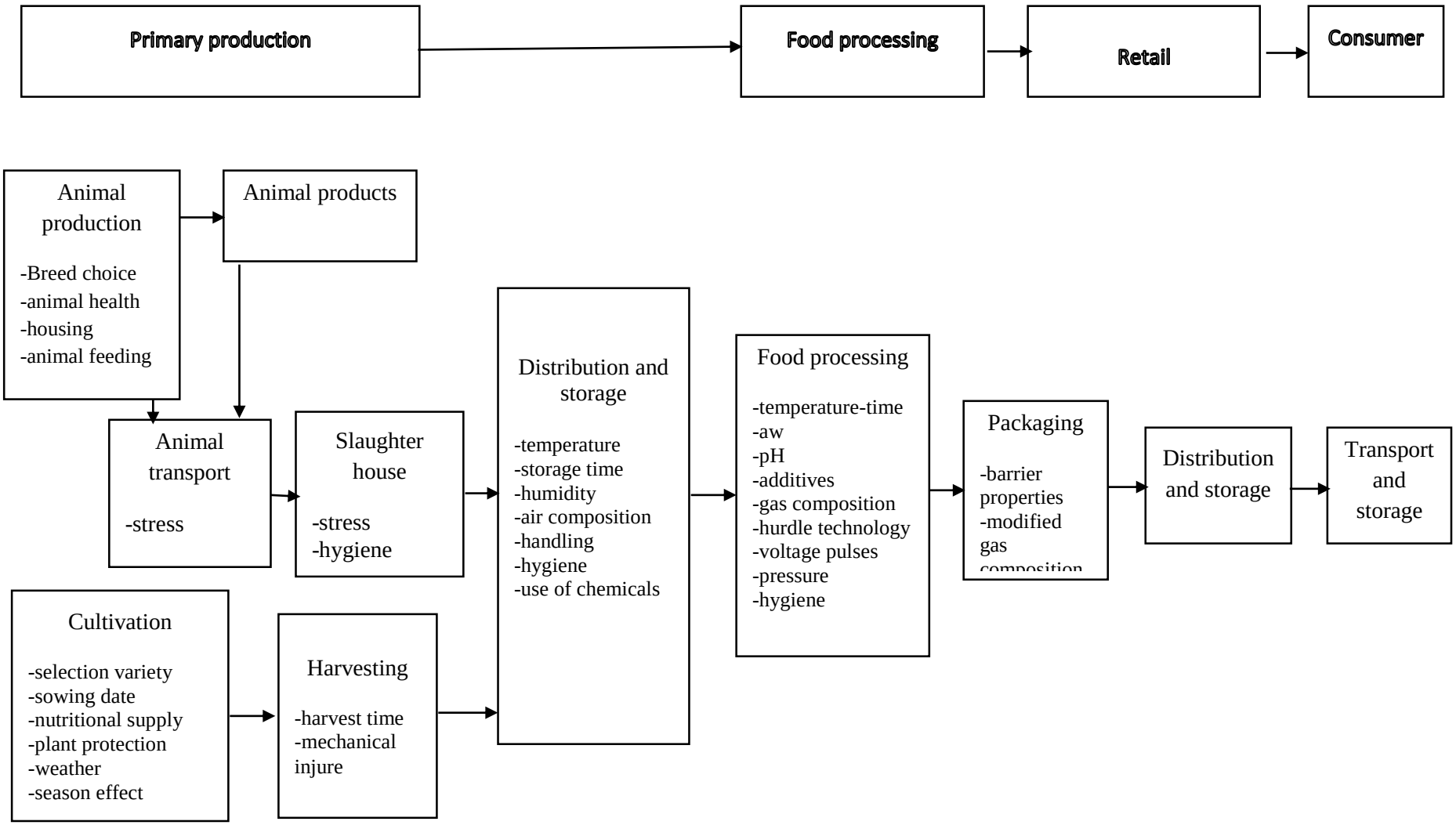

Primary production
Food processing
Retail
Consumer
Animal production
-Breed choice
-animal health
-housing
-animal feeding
Animal products
Animal transport
-stress
Slaughter house
-stress
-hygiene
Distribution and storage
-temperature
-storage time
-humidity
-air composition
-handling
-hygiene
-use of chemicals
Food processing
-temperature-time
-aw
-pH
-additives
-gas composition
-hurdle technology
-voltage pulses
-pressure
-hygiene
Packaging
-barrier properties
-modified gas
Distribution and storage
Transport and storage
Cultivation
-selection variety
-sowing date
-nutritional supply
-plant protection
-weather
-season effect
Harvesting
-harvest time
-mechanical injure

Figure 2. Quality affecting factors in food production chain

Table 1. Causes of product quality changes

Shelf life limiting changes	Causes or type of reaction	Undesirable effects
1	2	3
Microbiological changes	Growth of spoilage microorganisms; typical spoilage bacteria, moulds and yeast's: • *Acinectobacter* (fresh meat, poultry) • *Aeromonas* (fresh meat) • *Erwinia* (fruits and vegetables) • *Pseudomonas* (fresh meat, poultry) • *Cladosporium* (fresh/frozen meat) • *Rhizopus* (meat, vegetables) • *Candida* (fresh/frozen meat)	Common effects: loss of texture, development of off-flavours and off-colours, formation of slime, rotting
Chemical reaction	Non-enzymatic browning (Maillard reaction)	• Browning of e.g. dried milk powder • Formation of bitter compounds
	Oxidation reactions	• Formation of rancid off-flavours by lipid autoxidation • Bleaching of carotenoids by autoxidation
Biochemical reactions	Enzymatic reactions; typical enzymes: • Phenolase • Milk proteinase • Lipases • Lipoxygenase • Chlorophyllase • Phospholipase	• Browning on cut surfaces of light coloured fruits and vegetables • Gelation in milk subjected to ultra-high short-time (UHST) temperature processing • Short-chain fatty acids in milk lead to undesirable hydrolytic rancidity; the fatty acids formed can also lead to other undesirable flavours • Degradation products of the polyunsaturated fatty acids can have undesirable effects on flavour, colour, texture and nutritional value • Released fatty acids are substrates for lipoxygenase leading

		to off-flavours in affected plant foods or undesirable textural changes in frozen fish • Degradation of green chlorophyll pigments during post harvest storage
		Continued Table 1.
1	2	3
Physical changes	Mishandling of agri-food products • Bruising or crushing • Temperature fluctuations Humidity conditions	• Development of rot during post harvest storage of fruits and vegetables • Phase changes e.g. due to thawing and refreezing of foods • Undesirable desiccation or moisture pick-up
	Other typical physical reactions Retrogradation of starch	• Undesirable texture changes of starch containing bakery products
Physiological reactions	Processes in respiring agri-foods • Respiration process • Post-harvest defects by ethylene • Chilling injury	• Accelerated ripening by ethylene or by incorrect storage conditions • Typical effects like bittering of sprouts, browning of nerves of leaves • Some fruits and vegetables get brown spots upon storage at too low temperature

Ranking contaminants in foods

Due to industrialization and chemicalization of industrial production, the use of new technologies in recent years significantly increased intake of heavy metals in the environment and on the food chain to humans.

At present, the permissible levels of contaminants in foodstuffs are set by the Technical Regulations of the Customs Union TR CU 021/2011 "On food safety", TR CU 033/2013 "On the milk and dairy products safety ", TR CU 034/2013 "On meat and meat products safety".

From the standpoint of toxicity and prevalence the greatest danger are following contaminants.

Microbial toxins - toxic products of metabolism of microorganisms (bacteria, fungi), plants and animals. Mycotoxins, such as aflatoxin and ochratoxin can be present in high concentrations in staple foods such as maize or cereals. Prolonged exposure to these toxins can cause breach immune system and normal development of the body, or cause of cancer. Patulinis detected in the processed products of fruit - juice, jam, puree, which is associated with impaired technology and using non-standard materials.

Toxic elements (heavy metals), may occur during the growth of plants and animals in the contaminated territories, in violation of technologies of processing or storage of food.

The main sources of pollution are coal, metallurgy, chemical industry, etc. The most dangerous toxic elements are mercury, lead and cadmium.

Antibiotics may be added to the feed for the prevent disease or due to the fact that some antibiotics help to the animals gain weight faster. In the case of non-compliance with the rules on the use of antibiotics their can be found in meat, animal milk, chicken eggs, and so on (according to statistics their found in 15-20% of all products of animal origin). The most potent allergens are considered such antibiotics as penicillin, streptomycin, oleandomycin, levomitsetin. The presence in the milk of streptomycin, penicillin, and others antibiotics may be due to the use of drugs for the treatment of these animals, including mastitis in cows, a long-acting by oil-based preparations.

Pesticides are widely used in agriculture to protect plants from diseases, weeds, pests, which increases the risk of hitting their residues in food and adversely impact on the human body. The use of some from them is prohibited. But, despite this, numerous cases of poisoning is described by various pesticides through contaminated food - flour, sugar, nuts. Ofparticulardangeristhesimultaneouspresenceofseveralpesticides, thelevelofwhichexceedsthemaximumpermissibleconcentration. They are spread over large areas, very distant from the places of their application. Many of them can be stored in soil for a long time (half-life of DDT in water is estimated in 10 years, and for dieldrin it exceeds 20 years).

Nitrates, nitrites, nitrosamines. In agriculture as highly effective fertilizer nitric acid salts are widely used - sodium nitrate, potassium, ammonium and calcium.The problem is related to the irrational use of fertilizers, which leads to an accumulation of contaminants, enhance nitrosation process and the formation of highly toxic compounds - nitrosamines. Currently, nitrosamines are found almost in all meat, fish and other products, at this to 36% meat and 51% fish products contain them in concentrations exceeding hygienic standards.

Dioxins and dioxin-like compounds, includingpolychlorinatedbiphenyls (PCBs) arepersistentorganicpollutants (POPs) and is subjecttotheStockholmConvention. Theycantransportedoverlongdistancesfromtheirplaceofreleaseandbioaccumulateinthefoodchain. Thesesubstancesareby-productsofcombustionandvariousindustrialprocesses, suchaspaperpulpbleachingbychlorineandmeltingmetals. While production of PCBs has had to be stopped, and their release into the environment still occurs as result of

disposal of bulky electrical equipment and waste.Entering dioxins and dioxin-like substances in the human body occurs mainly through consumption of contaminated food. Dioxins are highly toxic and can cause problems in the field of reproductive health and development, destruction of the immune system, hormonal disorders and cancer.Some case of dioxin contamination were more significant, with broader implications in many countries. At the end of 2008 Ireland withdrew from the sale of many tons of pork and pork products, as in samples taken pork dioxin levels were found to exceed the safe level of 200 times. This led to the withdrawal from the market because of chemical pollution one of the largest batches of food. Risk assessments carried out by Ireland, have shown that the problems of the public health not. It has been traced, that source of pollution were contaminated feed.

Polycyclic aromatic hydrocarbons are formed as result of natural and technogenic processes.They are found in water, air, tobacco smoke and smoking, food, gasoline, and diesel exhaust gases, and also the incomplete combustion of fuel. Carcinogenic hydrocarbons cause cancer, usually at a low effective dose at the site of action. Carcinogenic activity of actual PAH combinations by 70-80% due to the presence in their structure of benzopyrene.A large number benzapilene enters in the food products during processing by smoke. Benzopyreneis controlled in the grain, in smoked meat and fish products. It is not allowed the presence of benzopyrene in infant and dietetic foods.

Radionuclides. The risk of internal exposure due to contamination and accumulation of radionuclides in the body through food. Thebiologicaleffectsofexposuretosuchradioactivesubstancesaresimilartoexternalradiation. Along with the testing of nuclear weapons, sources of environmental pollution can be: mining and processing of thorium ores; obtain uranium fuel; operation of nuclear reactors; reprocessing of nuclear fuel to extract radionuclides for the needs of the national economy; storage and disposal of radioactive waste.

Dietary supplements – chemical substances of natural or synthetic origin, especially added into food products in various stages of its manufacture, storage or transport in order to achieve the desired effect. These include sweeteners, flavors, colorants, antioxidants, stabilizers.

Some groups of toxic substances controlled in certain food products and raw materials are shown in Table 2.

Chemical hazards. Toxic elements

Chemical elements in the form of ions, mineral salts, complex compounds with inorganic and organic substances are part of the living matter and are essential nutrients. The minerals as ions involved in transmission of nerve impulses, provide a number of physiological processes of the body, part of the organic compounds, such as hemoglobin, are the material of construction for the body tissue etc.

Table 2. Contaminants is controlled in the different groups of food products and raw materials

Groups of food and feed	Contaminants
Cerealsandcerealproducts	Pesticides, mycotoxins
Meatandmeatproducts	Toxic elements, nitrates, antibiotics, nitrosamines, hormones, polychlorinated dibenzodioxins and dibenzofurans
Fish and fish products	Pesticides, toxic elements, nitrosamines, histamine
Vegetables, fruits and products of processing, potatoes	Pesticides, nitrates, patulin
Milkanddairyproducts	Pesticides, antibiotics, toxic elements, aflatoxins, polychlorinated dibenzo dioxins and furans

Minerals in food products and the human body depending on the amount are divided into micro and macro components. If the mass fraction of the component at least 10%, it is considered microcomponents. Metals are minerals the body needs nutrients. Metal have dual role: on the one hand, they are essential for normal physiological processes, on the other - toxic at high concentrations of bioavailable. According to the WHO content of 8 chemical elements monitored by the international trade in food: Fe, Cu, Hg, Cd, Pb, As, Sr, Zn.

Quantitative determination of toxic elements is associated with a number of difficulties due to low values of the MPC in food, which requires the use of highly sensitive physicochemical methods of analysis. In addition, a complex organic matrix, the volatility of the individual elements, cause extra care in sample preparation.

Hygienic requirements for the safety of food products for the maintenance of toxic elements (TR CU 021/2011) (Table 3).

Table 3. Hygienic requirements for the safety of food products (TR CU 021/2011)

Product	Permissible levels of toxic elements mg/kg, not more			
	lead	arsenic	cadmium	mercury
Fruit	0.4	0.2	0.05	0.02
Vegetables	0.5	0.2	0.03	0.02
Cereals and bakery products	0.5	0.2	0.1	0.03
Fish products	1.0	1.0	0.2	0.3
Meat and meat products	0.5	0.1	0.05	0.03
Milk and dairy	0.1	0.05	0.03	0.005

products				

Lead - one of the most common and dangerous toxins. Leadrisktohumansisdeterminedbyitsconsiderabletoxicityandtheabilitytoaccumulateint hebody. Most lead enters with food (from 40 to 70% in different countries and for different age groups) and drinking water, atmospheric air, during smoking, when accidentally swallowed of pieces lead paint or lead-contaminated soil. With atmospheric air enters small amounts of lead - only 1-2%, but most of the lead is absorbed into the human body. The highest levels lead content are found in canned food in a tin container, fish, fresh and frozen, wheat bran, gelatin, molluscs and crustaceans. High lead levels observed in the roots and other plant foods grown on the land near the industrial areas and along roads.

MPC of lead in tap water is 0.03 mg/kg. This characteristic is significantly higher in the air - 1.5 g/m^3. The total content of lead in the human body - 120 mg. ADI - 0.007 mg/kg body weight.

Cadmium is used widely in various industries, in the production of plastics, semiconductors, in the manufacture of batteries. Salts thereof are part of some phosphate fertilizer and use in veterinary medicine as an anthelmintic and antiseptic agents.

Cadmium is the most dangerous contaminant of food. 80% of this element in the human body comes from food, 20% - through lungs from the atmosphere, at smoking. One cigarette contains 1.5-2 micrograms of cadmium and its level in blood and kidneys of smoking in 1.5-2 times higher. With the diet of an adult per day may get 150 or more μg of cadmium, but in the daily set of products of the content of this toxic element should not exceed 30-35 μg. ADI - 70 μg/day. MPC in drinking water - 0.01 mg/l. 92-94% of cadmium excreted from the body (0.1% per day - high retention time). This element forms a complex with the low molecular protein metallothionein. As such, non-toxic metal. A healthy adult body contains 50 mg of cadmium, in the body of the newborn is not stored and accumulated only to 10 months. Like lead, cadmium is not essential body nutrient.

Tin. Its necessity has not been proved to the human body. An adult human contains 17 mg of tin, indicating the possibility of its involvement in metabolic processes. High tin content gives the unpleasant taste of the product. At receive a tin with food ~ 1% is digest. Inorganic tin compounds have low toxicity, more toxic - organic.Tin compounds are used in agriculture as fungicides, in the chemical industry as stabilizers-polyvinylchloride polymers. The main source of pollution - cans, jars, containers, equipment, which is manufactured using tinning and galvanizing. Активность перехода олова в ПП возрастает с увеличением содержания органических кислот, окислителей, нитратов при температуре хранения более 20 ^{0}C. Activity transition tin in foods increases with the content of organic acids, oxidizing agents, nitrates at storage temperature 20 ^{0}C.Risk of poisoning by tin is enhanced at the constant presence of its lead partner. Tin toxic dose once it arrives – 5-7 mg/kg

body weight, i.e. 300-700 mg. MPC is 200 mg/kg. An effective measure of prevention of food contamination by tin is coating surface of containers and equipment by hygienically safe lacquer or resin material.

Mercury - one of the most dangerous and toxic elements that can accumulate in the human body, animals, plants. Due to solubility, volatility of mercury and its compounds are widespread in nature. In the earth's crust its content is 0.5 mg/kg, seawater - 0.03 mg/kg. The adult human body contains ~ 13 mg of mercury, but it is not a nutrient. Human with a daily diet gets 0.045-0.06 mg of mercury. Mercury can accumulate in the human hair (30-40 μg/g).

Migration and distribution of mercury in the environment is carried out in a cycle of two types: 1) transfer of elemental mercury from land-based sources in the world's oceans; 2) circulation of mercury compounds formed in the process of vital activity of bacteria.

The second type of cycle is more dangerous, leading to the formation of methyl-, dimethyl-, and other highly toxic compounds entering the food chain. Methylation of mercury is carried out by aerobic and anaerobic microbes, micromycetes, that live in the soil, sediment.

At cooking fish, meat mercury concentration is decreases and remains constant in the processing of mushrooms. This is because the mercury in fungi associated with amino compounds, in the fish, meat - with sulfur-containing amino acids.

MPC food is 0.005-0.70 mg/kg, MPC in water – 0.005 mg/kg.

Arsenic. Arsenic is present in high concentrations naturally in groundwaters in many countries. Thegreatestthreattohumanhealthiscontaminatedwater byarsenic,usingfordrinking, cookingandirrigationoffoodcrops. Long-term exposure to inorganic arsenic, mainly at drinking contaminated water, food consumption, prepared with use such water or food consumption in food crops, irrigation water with a high content of arsenic, can lead to chronic arsenic poisoning. The most characteristic effects are skin lesions and skin cancer.

In humans is 1.8 mg of arsenic. The need his presence in the body is not proven, but the arsenic has a stimulating effect on the processes of hematopoiesis. Arsenic additives in low concentration in the feed poultry, cattle significantly accelerate their growth.

Daily admission As in the body is 0.05-0.42 mg, ADI – 3 mg.

Arsenic depending on the dose can cause acute and chronic poisoning. After mercury, this element is the second food contaminant toxicity. Chronic intoxication occur with prolonged use of drinking water with a concentration of 0.3-3.2 mg/l. A single dose of 30 mg is lethal. Arsenic compounds are protoplasmic poisons. They are absorbed well in the gastrointestinal tract. In the blood, arsenic forms a resistantcompounds with protein part of hemoglobin and in the form protein complex distributed in organs and tissues. 90% of the arsenic is excreted.

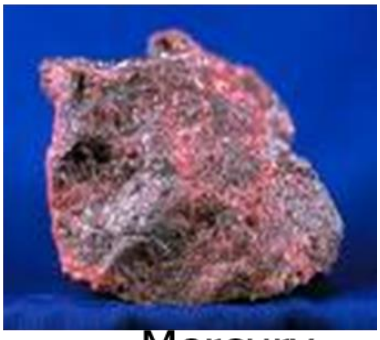
Contamination of foodstuffs due to the use of arsenic compounds as insecticides, fungicides. In the form of lead arsenate, copper, it is part of the wood preservatives,

sterilizers soil. Arsenic compounds are used in the manufacture of dyes, glass and semiconductors.

Atmospheric air in the station area, working on the coal-fired, oil, contains a substantial amount of arsenic.

The concentration of toxic elements may be reduced in a foodstuff by choosing a suitable method for preparation. Precooking treatments such as the peeling of plant products as well as some cooking methods can remove some of the heavy metals. Cooking methods such as boiling and frying can alter the content of a toxic element through the loss of water and volatiles, and, to some extent, metal binding to macronutrients such as carbohydrates, lipids, and proteins. Since toxic elements are not evaporated or broken down to safer compounds, the elements which are removed from foodstuff during frying, boiling, or canning processes definitely migrate from food to the frying oil, boiling water or cooking stocks. However, some of cooking methods and herbal marinating reduce bioaccessibility of toxic elements through binding of elements to other compounds and forming unbioaccessible complexes. Mercury can be eliminated from food using acids because an acidic medium assists in the removal of mercury bound to the protein in fish tissue.

Lead



Mercury

Research and assessment of ornamental and rare plants of Syr-Darya-Turkestan regional nature park

Abduova A.

1. **Introduction**

The process of anthropogenic changes is accompanied by the extinction of a number of plant species, a general depletion of the flora, a decrease in the genetic diversity of individual species. Currently, there is a need to study and assess the threat of extinction of ornamental and rare plants, as the most vulnerable part of the flora, to study their ecology and biology in order to preserve their biodiversity, which was the main prerequisite for this project.

The main participants of the project are scientists of M. Auezov SKSU and specialists of “Syrdarya - Turkestan Regional Natural Park”, whose scientific interests are aimed at studying and evaluating ornamental and rare plants.

2. Aim of the research

The aim of the project is to develop a methodology for collecting, processing and formalizing data on the habitats of rare and endangered plants as a basis for developing recommendations for regional ecological monitoring of plant populations within the Syr Darya-Turkestan regional nature park. Research and evaluation of ornamental and rare plants will allow to develop a system of cadastre

of plant populations and to clarify their species composition in the region, to overshadow the threat of their extinction.

3. Tasks of the research

To achieve this aim it had to solve following tasks:

1. To identify the optimal regimes for the existence of ornamental and rare plants, to assess the factors that threaten their populations.

2.To work on specific examples of a methodology for identifying and describing reference and control sites that can be used to organize regional monitoring of populations of rare and endangered plant species.

3. To study the biological features.

4. To study the rhythm of seasonal development of plants of different ages.

5. Identify the features of flowering and fruiting.

6. To cover the decorative characteristics of species.

7. To study the seed productivity of species as an indicator of the degree of adaptation to new conditions; to clarify the features of germination of seeds.

8. Conduct an analysis of prospective ornamental plants of the local flora and suggest ways of using them in green building

4. Scientific novelty and significance of the research

The prerequisites for the development of this project are ornamental and rare plants growing on the territory of the Syrdarya-Turkestan Regional Natural Park. The territory of the Boraldai branch of the park is represented by 114 rare species, which is 19% of the total composition of the identified flora and almost 50% of the total list of rare species. The rare species identified in this area belong to 81 genera and 32 families. The leading in the rare group are plants listed in the Red Book of Kazakhtan. *Juniperusseravschanica*, archa,*Stipakarataviensis*,*Cladiummariscus*,*Arumkorolkowii*,*Eminium Lehmannii (=E.regelii)*,*Tulipagreigii*etc.).Currently, there are 40 species in this category within the boundaries of the projected park. In the Turkestan and Syrdarya branches in the floodplain and delta of the river.Syrdarya recorded 282 species of higher plants belonging to 181 genera and 52 families. Of the species identified, the most numerous in number of species are the families of the mare (Cenopodiaceae), 18%, Compositae (AstasteraeaDumort) - 16%, cereal (Poaceae Barnhart) - 12%, legumes (FabaceaeLindl.) - 6%, cruciferous (BrassicaceaeBournett) 4%, buckwheat (Poligonaceaeus.) - 3%. The rest of the family (Lyutik, Willow, Clove, Umbrella, Osoca, Nightshade, Burachnikov, Liliaceae, Malvaceae, Convolvulaceae, Juncaceae, Plantaginaceae, etc.) are represented 2-0.3%..In the study area, five endemic species were found: *Ephedralomatolepis, Eryngiumkaratavicum, Prangosequisetoides, Saussurearobusta*. From rare red-listed species, one should note the relic of moisture-loving tertiary forests - the turangasolist (Populuspruinosa), a species with a shrinking range and abundance, and SkrypusKazachstanits. Places of their growth require special protection. (A permit will be obtained from the management of the South Kazakhstan akimat concerning the seizure of the Red Book plants for its reproduction).

To study the most accurate list of rare and endangered species of plants listed in the Red Book of Kazakhstan, the literature data from 1935 to 2015 were analyzed, among which the works of Aralbaev N., Ivashchenko A., Karmysheva N., Wintergaller B.A., BaymakhambetovaZh.U. In 2006, a new resolution of the Government of the Republic of Kazakhstan “On approval of the List of rare and endangered species of animals and plants” of Kazakhstan, which approved the updated list species subject to wound and came fourth last

redaction Red Book of Kazakhstan listed in the Red Book of Kazakhstan plants are also at risk of extinction. It is quite rare in nature.

These plants are very vulnerable, so it is worth paying special attention to their conservation. Given the global nature of the problem of biological diversity, it is very important to protect not only individual species, but also to protect a number of unique plant communities, their diversity and sustainability - the most important condition for optimality of the environment in biological productivity. An insignificant part of the communities is protected in one way or another in the reserves or reserves of the region, but there is no general list of reference lists of endangered and rare plant communities, the protection of which is extremely important for the future.

The Republic of Kazakhstan signed in 1992 and ratified the United Nations Convention on Biological Diversity in 1994, and in 1998 completed the development of the National Action Plan for the Protection of the Environment, in which biodiversity is an essential component. The National Strategy and Action Plan for Conservation of Biodiversity is one of the most important components of the National Environmental Protection Action Plan, which is an instrument for implementing the long-term strategy -2030 “Ecology and natural resources”. Adoption of the Strategy - 2030 creates objective prerequisites for the successful implementation of the provisions of the Convention on Biological Diversity. Kazakhstan recognizes biological security as one of the most important components of the Convention on Biological Diversity. The Head of State signed the Law on the Ratification of the Cartagena Protocol on Biosafety.

A number of them are of exceptional interest as standards of stable species relationships, as well as a gene pool for the selection of useful, especially food and fodder plants. Many communities have very narrow ranges and for this reason accidental death can lead to their loss in nature. Save these rare and endangered species can only be measures of enhanced protection of their communities.

Among the problems of conservation of rare and endangered species, three most important ones are noted.

Plants are not included in the list of endangered species of IUCN, which creates an information vacuum and does not allow international organizations to pay due attention to their preservation through their programs and projects.

Secondly, because of this, Kazakhstan's rare plants are also not included in the Annex to the CITES Convention regulating the rules of trade in fauna. Plants, raw materials and derivatives are exported abroad unhindered, which threatens the existence of rare and endemic species.

And, thirdly, the authorized bodies and the scientific community are not familiar with the procedures for the provision of lists of rare and endangered plants to the IUCN and CITES

lists, which significantly hampers the conservation of flora and the prevention of the destruction of its hayland species.

Scientists and workers of the environmental services of the region carried out extensive inventory studies of bioresources, which made it possible to identify small, rare and endangered species of animals and plants.

In the region, a scientifically based system of protected natural areas has been formed, covering all administrative regions and all natural areas.

As a result of the constant budget deficit and applied practice of financing environmental works, including research, on the residual principle, the adoption of laws on changing ownership of a number of natural resources, centralized management and financing of activities for studying and conserving biodiversity in the regions has practically ceased. In the current situation, the region is obliged to solve the problems of biodiversity conservation independently through the active operation of its state and environmental services, the enthusiasm of the scientific and environmental community.

To date there are all the necessary prerequisites for the preparation of a model structure and recommendations for the development and adoption of a regional strategy for the conservation and rational use of bioresources and, first and foremost, rare and endangered plant species, ensuring the functioning of a regional wildlife management system.

The scientific novelty of the project is the study and evaluation of ornamental and rare plants in the villages to ensure the consistent and effective use of all possible ways and means to preserve their biodiversity.

In the development of a regional strategy, the authors of the project identify the following main stages:

- analysis and assessment of information on the current status of biodiversity and distribution of rare and endangered species throughout the region, their abundance and trends.

The result of this work is the formation of flora cadastres; Preparation of the list of rare and endangered species of ornamental and rare plants.

- development of basic guidelines for the implementation of strategic principles and priorities in the field of biodiversity conservation and development of strategies for the conservation of selected rare and endangered species;

- an outline of the basic principles of the legal framework, mechanisms, organizational principles, criteria for assessing effectiveness;

- development of a regional action plan for the conservation of biodiversity in the countryside and measures to conserve rare and endangered species, in particular .

with the inclusion of representatives of all interested organizations in it.

On the basis of the Strategy, a long-term Action Plan for the conservation of biodiversity of the region should be prepared and adopted for a period of at least 5 years with the following main sections:

- conservation of rare species and natural communities, specially protected natural areas;

- restoration of lost diversity;

- creation of mechanisms to ensure the conservation of biodiversity in economically exploited territories;

- ecological education;

- regulatory and legal framework, management, economic mechanisms.

It is extremely important that the developed materials - the Strategy and Action Plan for Biodiversity Conservation - after their broad discussion were approved as regional legislative acts and normative documents and thus form the basis of state policy in the sphere of wildlife conservation in the region.

3. RESEARCH METHODS AND ETHICAL ISSUES

3.1 Description of scientific methods used in the Project as a justification for the ways to achieve the goals

According to the **"List of rare and endangered species of plants and animals" (Resolution of the Government of the Republic of Kazakhstan dated on October 31, 2006 N 1034)**, it is impossible to ensure the sustainable existence of decorative rare plants that are endangered, without performing several important tasks. This - the study of biological features of decorative rare species and mechanisms of the action of limiting factors, inventory and inventory compilation, monitoring organization, development of biological principles and methods of conservation, improvement of measures for their conservation. When performing the tasks set, identifying the reasons for the rarity or the oppressed state of rare and decorative species and developing measures that help to block this state, methods of population plant biology are being actively used.

3.2 Critical points, alternative ways of project implementation

If it is impossible to conduct some stages of scientific research, the mobility of employees from the countries of the near abroad will be used on the basis of a bilateral agreement between organizations for joint scientific research.

It is possible to invite foreign scientists who will provide consulting services on adjusting planning and carrying out research and will also participate in the interpretation of the data obtained.

If it is not possible to invite foreign scientists to the university to provide consulting services, the costs stipulated in the estimate will be used for a foreign internship on the issue of the head or executors of the project.

3.3 Ways to enforce the principles of scientific ethics

The project participants guarantee observance of the principles of scientific ethics, i.e. ethical management procedures, in particular, maintaining high standards of intellectual integrity and preventing the fabrication of scientific data, falsification, plagiarism, false co-authorship, the use of individual participants in collective research, data and findings obtained in studies without agreement with other participants;

3.4. The detailed procedure and mechanism of the research

At the initial stage of research in the field, we obtain a general characteristic of habitat conditions for rare species.

1) collection of information on the area of growth and the degree of isolation from other cenopopulations of this species;

2) determination of the rank of the population unit of interest (in the case of an ectopic or local population, a series of cenopopulations of a rare species is being studied);

3) carrying out a typical geobotanical description, obtaining characteristics of the structure and species composition of the community with the participation of a rare species, its place in the succession and ecological ranks.

It is impossible to carry out population studies without knowledge of the biology of the species, structure and nature of plant development. When describing the life form of a species in an adult generative plant, the following attributes will be taken into account: 1) the structure of vegetative and generative shoots, the duration of their life; 2) the ratio of the perennial and one-year parts of the shoots; 3) the location of the kidneys of renewal; 4) the time and duration of flowering; 5) the nature of the root system, an indication of the counting unit (individual, escape, partial bush, etc.).

The most significant in population studies is the question of a countable unit. Only an accurate indication of the volume of the counting unit makes it possible to compare the material of various studies. As a counting unit, different structural entities may act: a specimen of seed origin, a particular part (an autogenous origin), a clone (a set of individuals of vegetative origin), a part of an individual (shoot, partial shrub).

The population of the coenopopulation is the total number of plant species within the territory occupied by the cenopopulation. For the osseous population, there is a point scale: 1 point - from 1 to 10 copies; 2 - from 10 to 50 copies; 3 - from 50 to 100 copies; 4 - from 100 to 500 copies; 5 - up to 1000 copies. (Program ..., 1986).When the population is more than 100 specimens it is necessary to supplement the data on the coenopopulation with information on the density of the plants in it. Density, as well as other indicators (in addition to numbers), is determined by the sampling method on trial plots of different sizes.

Investigation of the age (ontogenetic) structure of the cenopopulation is carried out on transects taking into account their age status, which is convenient to combine with the study of the density of the cenopopulation.

Very important in the study of rare species is the question of self-maintenance cenopopulation. It is carried out in three ways: seed, vegetative and mixed. In the case of seed self-maintenance, the replenishment of the fraction of adult plants depends on several factors: the level of seed productivity and the yield of seeds, the emergence and survival of seedlings, the survival of adolescence (sprouts,

juvenile and immature plants). In determining the seed production, it is customary to distinguish: 1) potential seed production - the number of ovules formed per plant; 2) conditionally-real - the number of seeded seeds; 3) real - the number of full-fledged intact seeds. Seed productivity is calculated per individual, a partial shrub or shoot, and the yield is per unit area of the cenopopulation (Rabotnov, 1960).

Thus, the program for research and observation of cenopopulations of rare plant species includes:

1) the identification of cenopopulations within the range of the species or range area, the characteristics of ecotopic and phytocenotic growth conditions;

2) the study of the life form and ontogenetic development of plants, the identification of age-related conditions;

3) determination of the area of cenopopulations, abundance and density of plants in them, and at considerable sizes - density estimates in different parts of the local population or cenopopulation;

4) determination of the method of resumption of cenopopulations, estimation of seed productivity of individuals, germination of seeds, effectiveness of self-maintenance;

5) conducting monitoring observations of the dynamics of the development of cenopopulations.

Depending on the mud flows and the investigator's capabilities, it can be implemented with varying degrees of detail.

3.5 Terms of registration and separation of intellectual property rights

The scientific results obtained will be protected through innovative patents of the RK and published in the open press.

Scientific supervisor of the research –Abduova Aisulu Alshynbekovna – Chief Researcher, 04.07.1978 year of birth, Cand.Tech.Sci., Associate professor of the department “Ecology” of the Higher School “Chemical Engineering and Biotechnology” of M.Auezov South Kazakhstan State University. In 2010 she defended her thesis for the following specialties: 06.01.02 - Land reclamation, reclamation and land protection, on the topic: “Improvement of technical facilities for wastewater treatment in light industry and their further use for irrigation of tree plantations”. Research work is related to the problems of ecology and biodiversity conservation of flora and fauna of the Republic of Kazakhstan. Has a huge experience in the direction of rational use and reproduction of biological resources. (CCSES MES RK-4 and also in foreign peer-reviewed scientific journals of the Skopus-7 database)

To conduct research within the framework of the Project, the material and technical bases of the University and the Syrdarya-TurkestanRegional Natural Parkwill be used. At the university there are achievements of the scientific and technical base, computer classes equipped with computers of the latest generation and connected to the Internet, as well as modern office equipment and more than 2 million literary and electronic resources, as well as the scientific personnel necessary for the research.

The territory of the Syrdarya-Turkestan Regional Natural Park consists of 3 branches represented by several cluster sites.

1.Turkestan branch (23822,498 ha). The territory proposed for the organization of the Turkestan section of the SRNP includes sections of the Syr Darya river floodplain, which belongs to the Syr Darya province of the desert zone of Southwest and Southern Kazakhstan. The site

has a length from north-west to south-east 75 km, maximum width - 9 km. It consists of a number of cluster sites.

2. The Syrdarya branch (59900.92 ha) is located along the right and left bank of the river Syr Darya, as well as the river Arys in its lower reaches. consists of a number of cluster sites. The northern boundary begins at the Koksaraibridge across the Syrdaryariver, the southern border runs along the border of the Shardarinsky State Forestry for the protection of forests and fauna. The length of the territory along the Syrdaria River is 140 km, along the Arys River - 60 km. Formed from the forest fund lands. On the territory of the branch there are 282 species of higher plants registered, and only 261 migratory birds were recorded in this area.

3. The Boraldai branch (36 255 ha) is located at the northern end of the Boraldaytau ridge. It consists of three cluster sites, corresponding to the Boraldai, Sunga and Bugun forest dachas of the Boraldyi State Administration for the Protection of Forests and Fauna. It has favorable in all respects natural conditions and rich flora and fauna. In the village, the composition of the flora is determined about 673 species, of which more than 40 plant species are listed in the Red Book of Kazakhstan.

EXPECTED RESULTS

Based on the results of scientific research carried out within the framework of the project, the following are planned:

- publications in journalsrecommended byCCSES MES RKand also in foreign peer-reviewed scientific journals of the Skopus database, TomsonReuters, etc.

- patenting the results;

-publication of the book "Research and evaluation of decorative and rare plants in the south of Kazakhstan" in Kazakh publishing houses by agreement.

- publication of the monograph "Decorative and rare plants of the south of Kazakhstan". It is expected that a number of measures will be developed and proposed to provide practical protection for endangered species of ornamental and rare plants: ecological and biological control over the state of populations; protection of habitats of rare plants within existing protected areas; planning economic use of the territory of the region, taking into account the need for nature protection; the organization of botanical reserves in the places where the populations of rare plants grow; the conclusion of conservation contracts with land users, in the territories of which botanical objects are to be protected; licensing of collection of individual species of rare and ornamental plants; cultivation of rare species in natural conditions and culture; the repatriation of extinct species to natural ecosystems; wide nature protection propaganda.

Research materials can be used to develop methods for expert assessment and conservation of biological diversity at the level of administrative regions. Data on the distribution and status of populations will serve as a base for monitoring and the formation of a cadastre of rare and endangered species of flora in the process of keeping the Red Book. Research materials will be used in the educational process when reading lectures, conducting

laboratory exercises and field practices. On the urgency and scientific novelty, these problems are related to world priorities in the field of ecology.

The results of the work will be published in journals and reported at international and national conferences.

"Electrochemical methods of wastewater treatment"

TREATMENT OF INDUSTRIAL WASTEWATER T BY ELECTROCHEMICAL TECHNOLOGIES

Iztleuov Gani

Using electricity to treat water was first proposed in UK in 1889. The application of electrolysis in mineral beneficiation was patented by Elmore in 1904 . Electrocoagulation (EC) with aluminum and iron electrodes was patented in the US in 1909. The electrocoagulation of drinking water was first applied on a large scale in the US in 1946 . Because of the relatively large capital investment and the expensive electricity supply, electrochemical water or wastewater technologies did not find wide application worldwide then. Extensive research, however, in the US and the former USSR during the following half century has accumulated abundant amount of knowledge. With the ever increasing standard of drinking water supply and the stringent environmental regulations regarding the wastewater discharge, electrochemical technologies have regained their importance worldwide during the past two decades. There are companies supplying facilities for metal recoveries, for treating drinking water or process water, treating various wastewaters resulting from tannery, electroplating, diary, textile processing, oil and oil-in-water emulsion, etc.

Nowadays, electrochemical technologies have reached such a state that they are not only comparable with other technologies in terms of cost but also are more efficient and more compact. For some situations, electrochemical technologies may be the indispensable step in treating wastewaters containing refractory pollutants. In this paper, I shall examine the established technologies such as electrochemical reactors for metal recovery, electrocoagulation, electroflotation and electrooxidation. The emerging technologies such as electrophotooxidation, electrodisinfection will not be discussed. In addition, I shall focus more on the technologies rather than analyzing the sciences or mechanisms behind them. For books dealing with environmentally related electrochemistry, the readers are referred to other publications.

Before introducing the specific technologies, let us review a few terminologies that are concerned by electrochemical process engineers. The most frequently referred terminology besides potential and current may be the current density, i, the current per area of electrode. It determines the rate of a process. The next parameter is current efficiency, CE, the ratio of current consumed in producing a target product to that of total consumption. Current efficiency indicates both the specificity of a process and also the performance of the electrocatalysis involving surface reaction as well as mass

transfer. The space-time yield, 7_{ST}, of a reactor is defined as the mass of product produced by the reactor volume in unit time with iaM

2. Electrochemical reactors for metal recovery

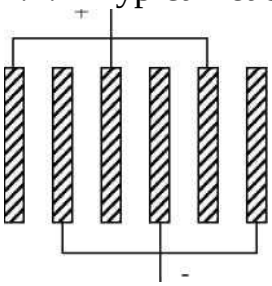
The electrochemical recovery of metals has been practiced in the form of electrometallurgy since long time ago. The earliest reported application of electrochemical phenomena in chemical subjects was supposed to be carried out by Pliny in protecting iron with lead electroplating. The first recorded example of electrometallurgy was in mid-17th century in Europe . It involved the recovery of copper from cupriferous mine water electrochemically. During the past two and half centuries, electrochemical technologies have grown into such areas as energy storage, chemical synthesis, metal production, surface treatment, etc. The electrochemical mechanism for metal recovery is very simple. It basically is the cathodic deposition as

$M^{n}+ + ne$ ^ M. (2)

The development of the process involves the improvement of CE as well as 7_{ST}.

Fig. 1. Tank cell.

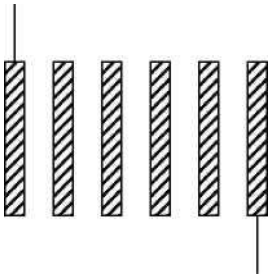
2.1. Typical reactors applied



(a) monopolar

There are quite a few types of reactors found applications in metal recovery, from very basic reactors such as tank cells, plate and frame cells, rotating cells, to complicated three-dimensional reactor systems like fluidized bed, packed bed cell, or porous carbon packing cells. Tank cells, Fig. 1, are one of the simplest and hence the most popular designs. It can be easily scaled up or down depending on the load of a process. The electrode can be arranged in mono-polar or bi-polar mode, Fig. 2. The main application of this type of reactor system is the recovery of metals from high concentration process streams such as effluents from the electroplating baths, ethants, and eluates of an ion-exchange unit. The number of electrodes in a stack may vary from 10 to 100. The water flow is usually induced by gravity.

The plate and frame cell or sometimes called filter press, Fig. 3, is one of the most popular electrochemical reactor designs. It conveniently houses units with an anode, a cathode, and a membrane (if necessary) in one module. This module system makes the design, operation and maintenance of the reactor relatively



3. Electrocoagulation

Electrocoagulation involves the generation of coagulants in situ by dissolving electrically either aluminum or iron ions from respectively aluminum or iron electrodes. The metal ions generation takes place at the anode, hydrogen gas is released from the cathode. The hydrogen gas would also help to float the flocculated particles out of the water. This process sometimes is called electrofloculation. It is schematically shown in Fig. 10. The electrodes can be arranged in a mono-polar or bi-polar mode. The materials can be aluminum or iron in plate form or packed form of scraps such as steel turnings, millings, etc.

3.4. Effluents treated by electrocoagulation

Electrocoagulation is efficient in removing suspended solids as well as oil and greases. It has been proven to be effective in water treatment such as drinking water supply for small or medium sized community, for marine operation and even for boiler water supply for industrial processes where a large water treatment plant is not economical or necessary. It is very effective in coagulating the colloidal found in natural water so that reduces the turbidity and color. It is also used in the removal or destruction of algeas or microorganisms. It can be used to remove irons, silicates, humus, dissolved oxygen, etc.

Electrocoagulation was found particularly useful in wastewater treatment . It has been employed in treating wastewaters from textile , catering , petroleum, tar sand and oil shale wastewater , carpet wastewater , municipal sewage, chemical fiber wastewater , oil-water emulsion , oily wastewater clay suspension, nitrite , and dye stuff from wastewater. Copper reduction, coagulation and separation was also found effective.

4. Electroflotation

Electroflotation is a simple process that floats pollutants to the surface of a water body by tiny bubbles of hydrogen and oxygen gases generated from water electrolysis . Therefore, the electrochemical reactions at the cathode and anode are hydrogen evolution and oxygen evolution reactions, respectively. EF was first proposed by Elmore in 1904 for flotation of valuable minerals from ores .

4.1. Factors affecting electroflotation

The performance of an electroflotation system is reflected by the pollutant removal efficiency and the power and/or chemical consumptions. The pollutant removal efficiency is largely dependent on the size of the bubbles formed. For the power consumption, it relates to the cell design, electrode materials as well as the operating conditions such as current density, water conductivity, etc. If the solid particles are charged, the opposite zeta-potential for the bubbles are recommended.

4.5. Wastewaters treated by electroflotation

Mineral recovery remains the major user of electroflotation . In water and wastewater treatment, flotation is the most effective process for the separation of oil and low-density suspended solids. Electroflotation is found effective in treating palm oil mill effluent, oily wastewater or oil-water emulsion , spent cooling lubricant wastewater from coke-production, mining wastewater, groundwater , food processing wastewater fat-containing solutions, restaurant wastewater or food industry effluents dairy wastewater, urban sewage pit waters , colloidal particles , heavy metal containing effluents, gold and silver recover from cyanide solution , and many other water and wastewaters

5. Electrooxidation (EO)

Study on electrooxidation for wastewater treatment goes back to the 19th century, when electrochemical

decomposition of cyanide was investigated. Extensive investigation of this technology commenced since the late 1970s. During the last two decades, research works have been focused on the efficiency in oxidizing various pollutants on different electrodes, improvement of the electrocatalytic activity and electrochemical stability of electrode materials, investigation of factors affecting the process performance, and exploration of the mechanisms and kinetics of pollutant degradation. Experimental investigations focus mostly on the behaviors of anodic materials, the effect of cathodic materials was not investigated extensively although Azzam et al. have found a considerable influence of the counter electrode material in the anodic destruction of 4-Cl phenol.

5.1. Indirect electrooxidation processes

Electrooxidation of pollutants can be fulfilled through different ways. Use of the chlorine and hypochlorite generated anodically to destroy pollutants is well known. This technique can effectively oxidize many inorganic and organic pollutants at high chloride concentration, typically larger than 3 g/l The possible formation of chlorinated organic compounds intermediates or final products hinders the wide application of this technique. Moreover, if the chloride content in the raw wastewater is low, a large amount of salt must be added to increase the process efficiency

Pollutants can also be degraded by the electrochemically generated hydrogen peroxide . In this system, the cathode is made of porous carbon- polytetrefluorethylene (PTFE) with oxygen feeding and the anode is either Pb/PbO_2, $Ti/Pt/PbO_2$, or Pt. Fe^{2+} salts can be added into the wastewater or formed in-situ from a dissolving iron anode to make an electro-Fenton reaction. The degradation of aniline was found to be about 95% when UV irradiation is employed also. Simply sparging oxygen into the solution also helps the removal of aniline when electricity is on . The electrically generated ozone is also reported for wastewater treatment

6. Summary

Electrochemical technologies have been investigated as the effluent treatment processes for over a century. Fundamental as well as engineering researches have

established the electrochemical deposition technology in metal recovery or heavy metal-effluent treatment. Electrocoagulation has been used industrially and demonstrated its superior performances in treating effluents containing suspended solids, oil and grease, and even organic or inorganic pollutants that can be flocculated. Electroflotation is widely used in the mining industries and is finding increasing applications in wastewater treatment. The uniform and tiny sized bubbles-generated electrically give much better performance than either dissolved air flotation, sedimentation or even impeller flotation. This process is compact and easy to facilitate with automatic control. With the invention of stable, active and cheap materials for oxygen evolution, this technology will gradually replace the conventional flotation techniques. Indirect oxidation is still a viable technology for treating toxic or biorefractory pollutants although there are concerns about the formation of chlotinated intermediates in the case of using chlorine ions or about the complicated facilities in the case of using electrically formed hydrogen peroxide or ozone. Direct anodic oxidation represents one of the simplest technologies in the pollutant mineralization provided the anode materials are stable and have high overpotential of oxygen evolution. The investigation of various materials so far shows that titanium or other noble metal-based boron-doped diamond film is the candidate for industrial application. It has the widest window for water split and is inert in tough situations. Further improvement in its stability in electrochemical application is required before its industrial acceptance.

Scientific and methodological basis for the assessment and management of mudflow risks

Tabbolat Baibolat

Dangerous exogenous processes, including mud flows, are an indispensable attribute of the mountain and foothill areas of South-Eastern Kazakhstan. At the same time, climatic conditions, water resources and landscape features of these territories make them attractive for economic development. As a result, in the process of settling people and developing their economic activities, the population and objects of industrial, agricultural, transport, socio-cultural and health facilities are exposed to negative, often destructive, effects of mudflows.

There is evidence that already in the middle of the last millennium, villages in the territory of South-Eastern Kazakhstan destroyed whole settlements, causing massive loss of life. At the beginning of the last century, the safe development of mountain and foothill territories became a state problem. Mudstone and nano-water mudflows of 1921, which brought significant sacrifices and destruction, initiated the development of measures to protect against this dangerous natural phenomenon in Almaty, and sat down 1941, 1947, 1950, 1951, 1958, 1959, 1963, 1966, 1969, past on many rivers of Ileic, Zhetysu, Talas, Kirghiz, and other mountain ranges, have shown the need for a large-scale study and solution of the problem throughout the territory of the Southeast of Kazakhstan.

Since the 50-ies of the last century in Kazakhstan, scientific research and practical measures on the problem of mudflow phenomena began to be actively pursued. As a result of the collection, analysis and systematization of data on mudflow phenomena (Figures 1, 2), general patterns of their distribution were determined (Kavetsky SP, Rauschenbach IO, Degovets AS, etc.). Scientific analysis of geological and geomorphological factors (Kolotilin NF, Bochkarev VN, Medeu AR Roninov and others) made it possible to identify the centers of mudflow formation and to perform

zonation of territories in terms of the potential for the occurrence of mudflows. The result of research on the processes of interaction of water currents with loosely clastic material in the event of precipitation and breakthroughs of glacial moraine lakes (Smirnov SP, Vinogradov Yu.B., Stepanov BS, Stepanova TS, Mochalov VP, Keremkulov VA, Tsukerman IG, Popov NV, etc.) were the mathematical models that formed the basis for the methods for calculating the characteristics of mud and nanosovide flows. To estimate mudflow hazard in real time, methods for short-term forecasts of storm and glacial muds were developed (Ryndina VR, Kirenskaya TL, Talanov EA, Keremkulov VA, Plekhanov PA, Takmagambetov G. A.). The possibilities of preventing mudflow phenomena were investigated, the principles of monitoring and instruments for monitoring the occurrence and passage of mudflows were developed (Niyazov, Stepanov BS, Vinokhod VN). Many scientists working in the field of hydrology, permafrost and other contiguous sciences (Sosedov.I.S., Seversky IV, Gorbunov AP, Cherkasov PA Blagoveshchenskii VP, etc.) made a significant contribution in understanding the nature of mudflow phenomena, the development of methods for calculating and forecasting them. Simultaneously, the development of structures of anti-mud structures (Kvasov AI, Khegai A.Yu., etc.), projects for the protection of settlements and economic objects (Niyazov BS, Zemse AE, Glukhankov PS, et al. .) their practical implementation was actively implemented. The most fruitful were the 70-80-ies, when the catastrophic mudslides of 1973,1977,1978,1980, 1982 gg. were a catalyst that accelerated scientific and practical work to ensure the safety of territories affected by mudflows. At the same time, however, it should be noted that, despite significant successes in studies of mudflow phenomena and the construction of protective structures, there was no profound synthesis of the results of scientific and practical activities. The results of scientific developments are far from being fully used in the design and implementation of anti-forest protective measures, the effectiveness of the latter has not been subjected to serious scientific analysis.

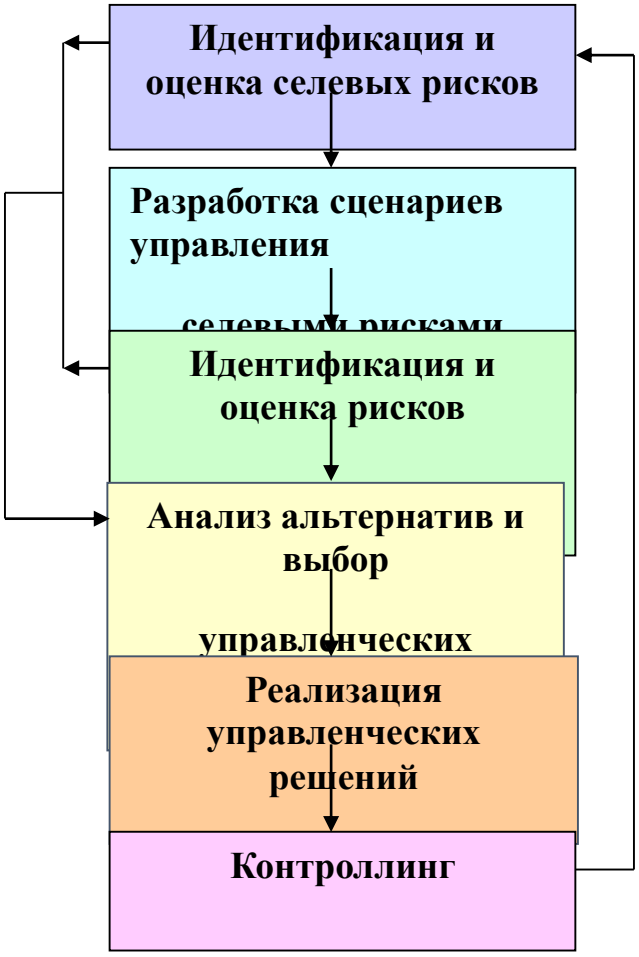


Рис. 1 Алгоритм управления селевыми рисками

The state of the problem of ensuring the security of territories affected by mudflows in Kazakhstan is not unique. A similar situation exists in the CIS countries. In the 1950s and 1980s, considerable attention was paid to the study of mudflow phenomena and methods of combating them. As a result of the scientific and practical activities of a whole galaxy of large scientists and designers, mudflow hazard maps were published, methods for calculating mudflow characteristics, mudflow forecasting techniques, construction of anti-mud structures were constructed, protective complexes were built, monitoring services were created (Fleishman SM, Sheko A. I., Herkheulidze II, Herkheulidze GI, Ivanov, Vinogradov VV, Salikhova D.Kh. and many, many others). The main result of research and engineering creativity of scientists and practitioners of the Soviet Union in general and Kazakhstan in particular is the formation of a new scientific discipline - "Selegevie".

In the 1990s, when the Soviet Union disintegrated in the CIS countries, work in this direction was significantly reduced, and in some countries practically stopped, although

the recurrence of mudflow phenomena did not decrease, and the damage caused by them only increased.

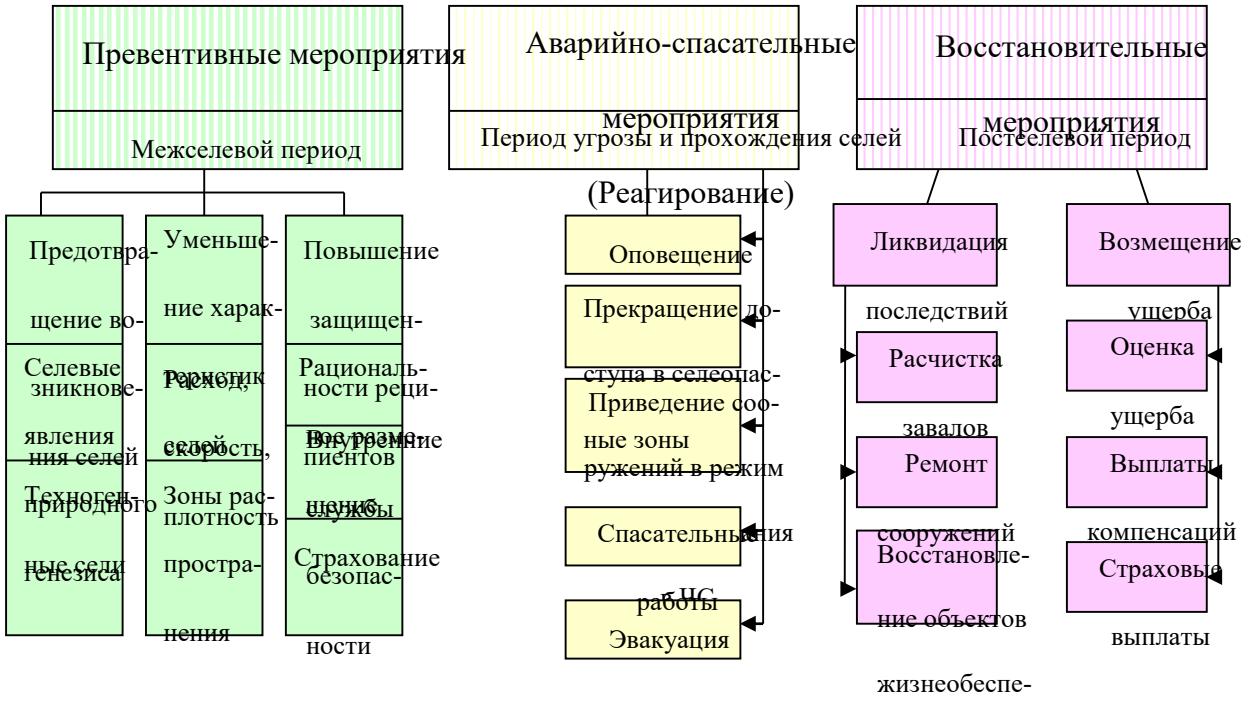


Рис.2 Виды управления селевыми рисками

By 1994, in comparison with the period 1965-1969gg. the average annual number of natural disasters has almost doubled and continues to remain at this high level. According to the World Conference on Natural Disasters (Yokohama, 1999), the number of deaths annually increases by an average of 4.3%, the magnitude of material losses - by 6%. The number of dead on Earth for 35 years from all kinds of catastrophic phenomena is 3.8 million people. According to the Russian Ministry of Emergencies (2001), natural disasters account for 25% of the total number of emergencies, the death toll is 3%, and the damage caused - 46.5%. In connection with this, the World Conference on Natural Disasters adopted a declaration recommending a new strategy for combating natural disasters. the need for a radical change in the traditional paradigm for solving this important problem has become obvious.

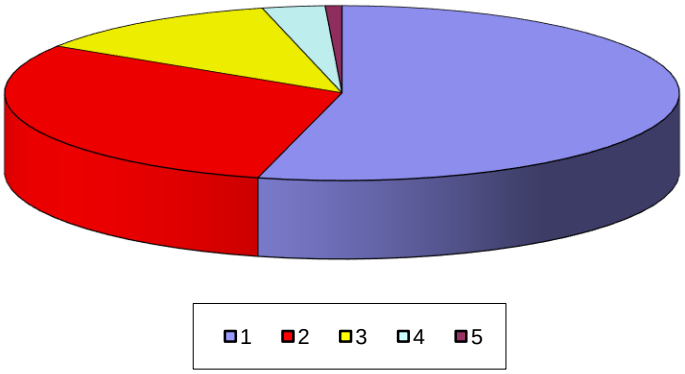
The paradigm is an integral system, a complete set of goals, values and landmarks, on the basis of which practical activities are organized in a certain field. The paradigm is based on the concept of reality. Representations about reality existing within the framework of a certain scientific and practical activity determine the content of the latter. Ideas about reality largely determine what attention is drawn to, and what is ignored or rejected. Just at a certain level of knowledge, in concrete socio-economic and other conditions, the notion of reality can become insolvent and inadequate when circumstances change. At this time, and there is a change of paradigms.

Currently, according to the proclaimed paradigm of combating natural disasters, their forecasting and warning should be the main one. International experience shows that the cost of this approach is about 15 times less than the prevented damage. The struggle to reduce damage from natural disasters should be an element of the state strategy of sustainable development of all countries.

The concepts of security and sustainable development are closely related to managing the risk of natural disasters (Figure 3). Risk management is a vital area of activity. Risk management is not only to minimize economic damage, but also to solve a wide range of tasks related to the development of measures for forecasting and preventing emergencies and mitigating their consequences. Intensification of research in these areas led to the creation of a risk theory and risk management theory - risk management. The fundamentals of risk theory and risk management are widely introduced in all areas of activity.

For the practical implementation of risk management, their identification and assessment, as well as the creation of control systems, are necessary. The solution to the problems of mudflow security should be carried out in the context of advanced paradigms. To replace the concept of combating the mudslide - "the more money is invested, the better the result", in the conditions of new economic relations, a pragmatic approach should come-effective management of mudflow risks.

The problem of management of mudflow risks was first raised in the works of Medeu A.R. He carried out an analysis of the domestic experience of anti-forest protective measures, developed the basic principles of management of mudflow processes in relation to the mudflow-prone areas of Kazakhstan; a system of managerial, scientific-applied and economic criteria for optimizing the anti-slip protection is proposed, and the concept of risk is formulated.



1 - mud, 2 - nanosovodnye, 3 - mudflow emissions, 4 - mud and nano-water, 5 – mud

Figure 3. Distribution of different types of mudflows in Ileisky Alatau

An analysis of the achievements and realities of today shows that progress in resolving issues of securing safety can not be achieved without adequate scientific, methodological, information and organizational support. Silt flows are a natural phenomenon, depending on many geomorphological, geological and hydrometeorological factors, on the one hand, which has a negative impact on the social, economic and environmental spheres of the functioning of the territories, on the other hand, and is the object of management, from a third party (Table 1).

Table 1. Distribution of mudflow phenomena of different genesis

	Settlements of different genesis	Количество, %
	Rains	61
	Breakthrough of high mountain lakes	13
	Snowmelt	5
	Melting glaciers	6
	Breakthrough of water from intraladic tanks	8
	Breakthrough of snow blocks	1
	Failure of moraine	1
	Afterseli	5
	Anthropogenic	1

The complexity of the problem of securing safety causes the need for differentiation and integration of scientific knowledge, the transformation of classical ideas, the interaction of many sciences, which allows the development of a conceptual and methodological framework for identifying and assessing mudflow risks as a basis for managing them. The development of a methodology for the assessment of mudflow risks is carried out using a synergistic approach, the creation of a qualitatively new research-based approach of various sciences based on synthesizing and aimed at reorienting cognition in accordance with a new conceptual apparatus (Fig. 4). As a result of the collection and analysis of data on mudflow phenomena and the damage caused by them in the territory of South-East Kazakhstan, the subject area of mudflow risk research has been determined.

In the course of the study, a conceptual and methodological framework for assessing mudflow risk was developed. The methodology of mudflow risk assessment, using natural scientific methods of research and based on an extensive knowledge base

on mudflow phenomena, unites the achievements of various sections of mudflow, the fundamentals of stability theories, securitology, risk and management.

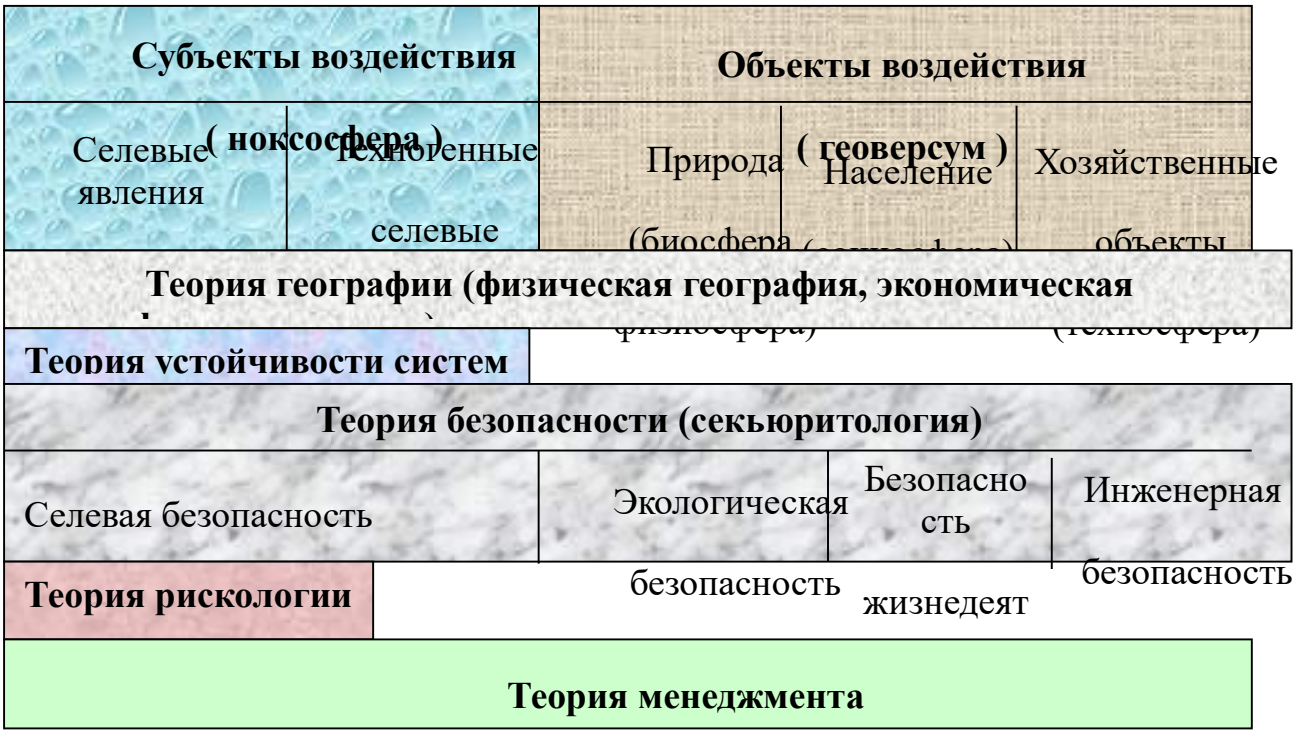


Рис. 4 Схема синергетического подхода к оценке селевого риска

The mudflow risk is the danger of negative consequences of passage of mudflows, therefore the estimation method includes blocks for determining the probability of occurrence of mud flows and their negative impacts. The main stages in the definition of mudflow risks are their identification, qualitative and quantitative assessments.

Identification of scenarios for the realization of risky circumstances with the formation of mudflows of various genesis-storm, glacial and seismogenic, are identified in identification; what risks are capable of destabilizing the situation at facilities, in regions or regions of South-Eastern Kazakhstan.

For the qualitative assessment of the risk of emergence, critical conditions for the formation of mudflow (mudstone and nano-water) mudflows and glacial mudflows are determined, regularities in the spatial and temporal distribution (recurrence) of mudflows in the mountain and foothill regions of the Ileysky and Zhetysusky Alatau, as well as in the basins of the rivers South Kazakhstan area; predicted estimates of mudflow activity.

To quantify the risk of occurrence of mudflow phenomena, a generalization of statistical data on the passage of mudflows, as well as data on seleforming factors. As examples, we estimated the risk of mudslides with the use of theoretical distribution functions (Weibulla Bernoulli, Poisson), as well as the Baiss formula, the calculation of the probability of realization of critical values of intensity and duration of rains based on the mathematical model of the random process of precipitation. calculation using a

simplified model of mudflow using the maximum intensity formula, as well as calculating the characteristics of mudflows of different types of availability on the basis of mathematical modeling of precipitation, drainage and mudflow processes for a number of mudflow basins in the Almaty, South Kazakhstan and Zhambyl oblasts.

- In the process of determining the negative effects of mudslides:
- - at the stage of identification of sources of risk, the main characteristics that determine the erosive impact of mud flows, the static and dynamic pressure exerted by them on obstacles are identified;
- - to determine the zones of direct and indirect impacts of mudflows, it is necessary to study typical scenarios for the development of risk events, the identification of negative impact zones for cases of passage of mudflows of different thickness and frequency, the zones of formation, passage and deposition of mudflows, at possible secondary emergency situations caused by the destruction of hazardous industrial, hydrotechnical and other facilities, methods for determining zones of impact, with edeny examples of determining noksosfery;
- - determination of the composition of recipients of their number of components of the environment, the population, and socio-economic facilities is carried out proceeding from the scenario of development of risk situations within the zones of impact of the actual mudflows and zones of secondary emergencies caused by them, with the definition of recipients, both mediated and mediated. Each recipient is considered from the point of view of his importance in the system "man - nature - economy", as well as in the sphere to which he belongs (biosphere, sociosphere, technosphere), his vulnerability and security are assessed. Methods for identifying recipients are proposed, lists of recipients (population and objects of economic purpose) of direct exposure to mud mud sediments and nanosovide floods in a number of mudflowable basins in mountain and foothill zones are given;
- - at the stage of qualitative assessment, the principles for classifying the negative consequences of mudflow impacts are being developed. As recipients are objects (components) of systems of different nature (sociosphere, biosphere, technosphere), the classification criteria for impact are based on a common property for all objects and systems - stability, and impact classes are determined by the degree of its violation and the corresponding consequences. Classes of impacts within norms and permissible risks (which system components manage to assimilate due to the activation of self-healing and self-regulation functions), as well as critical (crisis) and kata strophic (exceeding the limit of stability and causing changes until the appearance of irreversible processes, irreparable damage);
- - the quantitative (economic) assessment of the impact of mudflow phenomena is carried out for the components of the socio-, eco- and technosphere at market prices, takes into account losses (the cost of objects that can not be restored, etc.), costs (the cost of emergency recovery work, replacement of those withdrawn from use; etc.) and losses (lost profit, etc.);

- an integrated assessment of mudflow risk is carried out in order to select the optimal method for managing it based on estimates of the likelihood of occurrence of mud flows and damage caused by them in socio-, eco- and technospheres. Quantitative estimation of mudflow risk is proposed to be performed as follows: maximum one-time mudflow risk; total mudflow risk during a given multi-year period; annual mudflow risk. The maximum one-time mudflow risk is determined assuming the passage of the largest of the mudflows possible for a given mudflow. When assessing the total risk for any selected period of the Prospectus, the probabilities of the implementation of mudflow phenomena of different power during this period, calculated using statistical methods and mathematical modeling of mudflow processes, are taken into account. Estimation of annual mudflow risk is carried out taking into account the probability of passage of mudflow of different capacities in each current year. A qualitative evaluation is proposed to be carried out using the theory of fuzzy logic.

In general, for the implementation of the new paradigm for disaster management, the developed concept and methodological basis for assessing mudflow risks and management as a scientific and information base for a new approach to the selection and implementation of measures to reduce and prevent damage from mudflow phenomena, significantly improve their effectiveness.

Assessments of mudflow risk for the largest and industrially-urbanized river basins of South-Eastern Kazakhstan make significant adjustments to existing concepts of mudflow hazard. recommendations to protect the territories from the negative impact of mud flows significantly expand the range of ways to manage mudflow risks.

The main directions of the development of the system of management of mudflow risks open the prospects for an effective solution of the problem of ensuring the safety of the population and territories from the negative impact of mudflows.

Ecological and economic assessment of agricultural lands contaminated with heavy metals

Olga Frolova

Kazakhstan has great land resources, but the lack of a valuation of this most important part of national wealth, the imperfection of land legislation, free and depersonalized land have led to their inefficient use.

In the absence of work with agricultural enterprises to increase their agricultural production and restore soil fertility, Kazakhstan may lose up to 50% of its farmland by 2025 year due to degradation and soil erosion.

The centralized distribution of free land, ignoring the need for a market valuation of its value, led to inefficient land use in agriculture and forestry, and also led to an irrational model of urban development, for example, the location of industrial zones, as well as environmentally harmful enterprises in the central part of cities.

Ecological condition of soil has a huge impact on productivity of crops - the normative yield. It, in turn, is the initial indicator in determining the normative price of the land.

The ecological condition of the lands includes: soil erosion, aridization, degradation, chemical contamination of lands, the consequences of using pesticides.

Soil pollution – the accumulation in it of harmful substances and organisms, due to anthropogenic activity, in such quantities that lower its main quality index– fertility, as well as technological, nutritional and sanitary-hygienic value of cultivated crops, their quality.

Erosion is one of the most dangerous types of land degradation. In many cases erosion processes arise and develop under the influence of anthropogenic impact.

According to the qualitative characteristics of lands in the Republic of Kazakhstan, there are more than 90 million hectares of eroded and erosion-hazardous land, of which actually eroded - 29.3 million hectares.

Table - Areas of eroded agricultural lands on November 1, 2015, thous. ha

Name of regions	Total eroded agricult	including	Total eroded arable land	including	Degree of erosion of arable land

	ural land	eroded	deflated	affected by water and wind erosion		eroded	deflated	affected by water and wind erosion	low	medium and strong
Akmola region	571,6	562,0	9,6	–	352,2	351,3	0,9	–	317,9	34,3
Aktobe region	2 582,5	473,1	2 101,1	8,3	34,2	34,2	–	–	33,4	0,8
Almaty region	5 767,9	815,5	4 952,4	–	98,2	58,2	40,0	–	85,8	12,4
Atyra\u region	3 133,9	–	3 133,9	–	–	–	–	–	–	–
East Kazakhstan	1 292,6	426,6	864,5	1,5	247,9	235,1	12,2	0,6	234,0	13,3
Zhambyl region	2 636,7	222,7	2 414,0	–	54,3	52,7	1,6	–	52,8	1,5
West Kazakhstan	1 875,9	274,5	1 409,5	191,9	172,6	72,6	4,4	95,6	49,7	27,3
Karaganda region	960,1	200,4	759,7	–	111,3	83,2	28,1	–	95,7	15,6
Kyzylorda region	2 849,6	2,9	2 846,7	–	–	–	–	–	–	–
Kostanay region	769,9	158,7	611,2	–	93,5	63,4	30,1	–	77,5	16,0
Mangistau region	1 456,3	800,0	656,3	–	–	–	–	–	–	–
Pavlodar region	1 297,2	0,9	1 296,3	–	334,3	–	334,3	–	223,7	110,6
North-Kazakhstan	56,0	56,0	–	–	28,0	28,0	–	–	23,7	4,3
South Kazakhstan region	4 069,8	956,9	3 112,9	–	241,5	241,3	0,2	–	223,9	17,6
Almaty	0,1	0,1	–	–	–	–	–	–	–	–
Astana	–	–	–	–	–	–	–	–	–	–
Total	29 320,1	4 950,3	24 168,1	201,7	1 768,0	1 220,0	451,8	96,2	1 418 ,1	253,7

Слайд 4 Карта The erosion of agricultural lands in Kazakhstan
The largest share of eroded agricultural lands (more than 30% of their total area) is located in Almaty, Atyrau and South Kazakhstan regions. The smallest proportion of eroded land (up to 5%) in the agricultural land is in Akmola, Karaganda, Kostanay and North Kazakhstan regions.

Symbols

The share of eroded farmland from the total area in the region

- up to 5%
- 5.1-10%
- 10.1-20%
- 20.1-30%
- over 30%

Fig. The erosion of agricultural lands in Kazakhstan

According to the land balance data, as of November 1, 2015, there are 247.7 thousand hectares of disturbed lands in the republic, on which are placed dumps of overburden and rocks, tailing dumps, ash dumps, coal and mining quarries, oil fields and barns. The greatest number of the disturbed lands located in Karaganda, Kostanai, Mangistau, Akmola, East Kazakhstan, Aktobe, Pavlodar regions.

Only as a result of the activity of non-ferrous metallurgy enterprises, over 22 billion tons have been accumulated, including about 4 billion tons of mining waste, from toxic ones - over 1.1 billion tons of enrichment waste and 105 million tons of waste from metallurgical redistribution.

The area occupied by waste non-ferrous metallurgy is about 15 thousand hectares, of which 8,000 ha. of rock waste dumps, tailings of concentrating factories - about 6 thousand hectares and dumps of metallurgical plants - more than 500 hectares. The same amount of waste in the ferrous metallurgy and chemical industry.

Soil is a basic environment in which heavy metals come from the atmosphere and water environment. Heavy metals affect not only the yield of crops, but also predetermine the economic value of land.

In the East Kazakhstan region, the land is contaminated with compounds of copper, zinc, cadmium, lead, arsenic. Toxic waste is placed on landfills, which are not satisfying the sanitary and ecological requirements. Anomalies of lead cover the territory of Shemonaikha, Glubokovsky and Zyryanovsk regions. The area in the triangle between the cities of Ust-Kamenogorsk, Ridder, Zyryanovsk is the most unfavorable.

Pollution by heavy metals is associated with their wide use in industrial production with weak cleaning systems, as a result –heavy metall fall into the environment, including soil, contaminating and poisoning it

In the territory of the Glubokoe district, the main sources of agricultural land pollution are industrial, agricultural and communal enterprises.

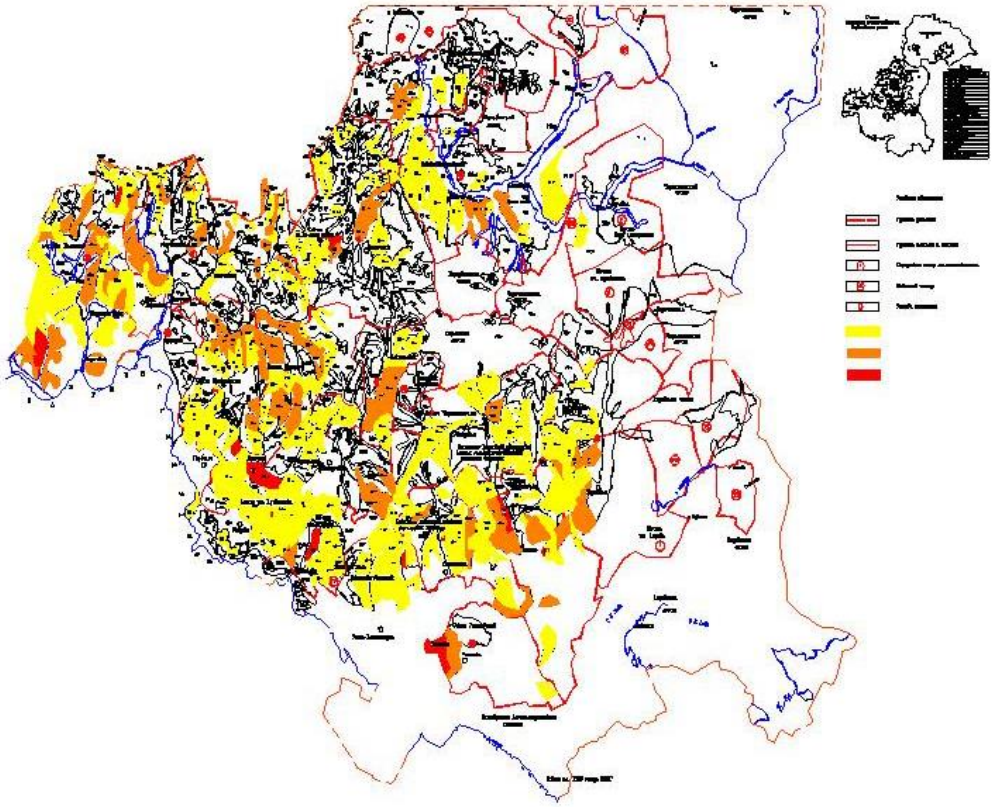


Fig. Soil map of Glubokovsky district

A significant share in the contamination of the district's soil belongs to the former Irtysh copper smelting plant.

As a result of the impact of the industrial enterprises of the former Irtysh copper smelting plant the following pollution zones were identified in the Glubokovsky District with the following metals content

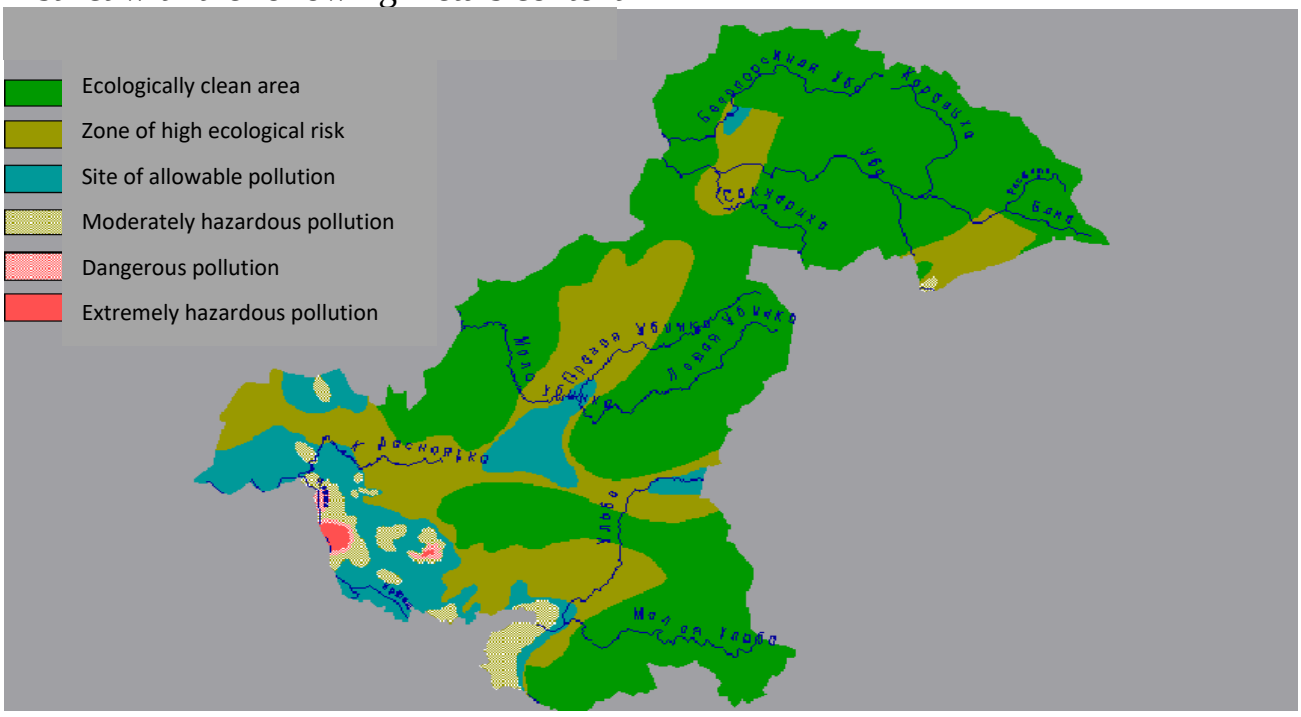
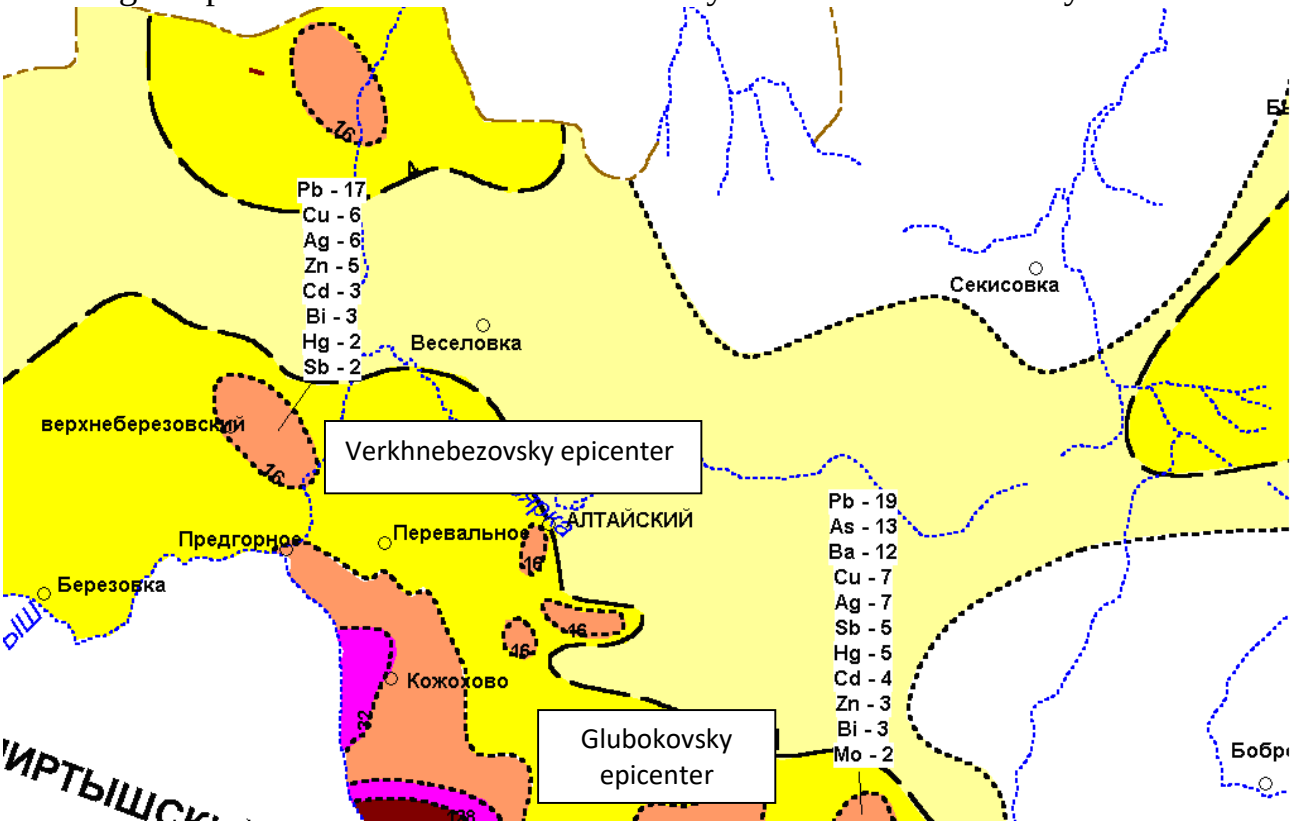


Fig. Map of soil contamination with heavy metals of Glubokovsky district



Fragment of the heavy metal contamination map

Assessment of soil resistance to polluting substances

The stability or sensitivity of soils to polluting substances should be determined in accordance with:

- humus content, quality of humus;
- biological activity;
- depth of the humus horizon;
- content of the fraction <0.01 mm, taking into account the content of the fraction <0.001 mm (the mechanical composition of the soil);
- parts of clay minerals;
- depth of soil profile.

Soil factors, affecting the distribution of heavy metals in soils

The nature of redistribution of heavy metals in soil profiles is influenced by a complex of soil factors:

- granulometric composition of soils,
- reaction of the environment,
- buffering of soils,
- organic content of soils,
- cation exchange capacity,

- sum of absorbed bases,
- existence of geochemical barriers, drainage,
- specific surface of soils.

On the scale of V.B. Ilyin identifies the following gradations of soil buffering

Table - The scale of gradations of soil buffering by V.B. Ilyin

Degree of buffering	Number of points
Very Low	10
Low	11-20
Average	21-30
Increased	31-40
High	41-50
Very high	>50

So, soil factors influence the content and distribution of heavy metals in soils, as well as their availability to plants, which in turn should be taken into account when assessing (determining the regulatory price) agricultural land contaminated with heavy metals.

Modern methods of assessing land

The cost method is based on the calculation of the cost of reproduction of the estimated buildings and structures taking into account all types of depreciation and business profits;

the income method is based on the fact that the value of the property in which the capital was invested must correspond to the current the quality assessment and quantity of income that this property is able to bring;

the comparative method is based on information about recent transactions with similar facilities in the market and comparison of the property being valued with analogs.

In Kazakhstan, the economic assessment of damage from the location of the i-th type of production and consumption waste in excess of the established standards, depending on the hazard class, is determined by the following formula

$$U_i = (F_{fact} - F_{norm}) * C_{waste} * 10 * K_1 * K_2$$

Economic evaluation of damage from the placement of the i-th type of production waste and consumption in excess of the established standards, depending on the hazard class is determined by the formula:

where U_i - economic evaluation of damage from the placement of the i-th type of production waste and consumption depending on the hazard class, tenge;

F_{fact} - the actual volume of allocation of the i-th type of production and consumption waste, depending on the hazard class in a certain period of time;

F_{norm} - normative volume of placement of the i-th type of production and consumption waste, depending on the hazard class in a certain period of time;

C_{waste}- rate of payment for the placement of 1 ton or 1 thousand m3 of the i-th type of production and consumption waste, depending on the hazard class, approved by local representative bodies for the current year, tenge;

10 - boost factor;
K_1 - coefficient of environmental hazard;
K_2 - coefficient of ecological risk.

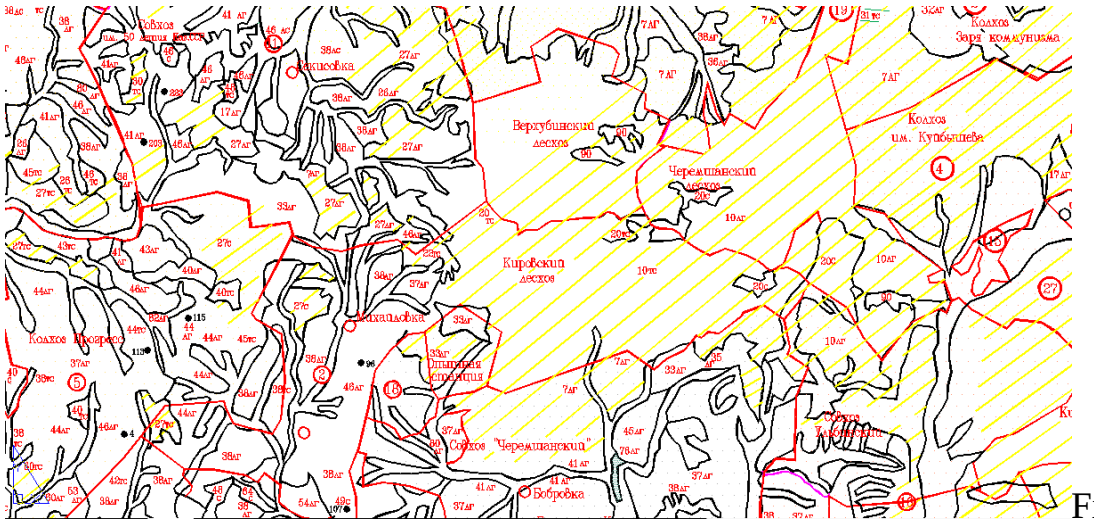


Fig. Fragment of soil map of Glubokovsky district

On the basis of materials from a large-scale soil survey, points were calculated for soil bonitetes

Table - Calculation of soil bonitet score

№ soil allotment	Content percentage	Horizons					Reserves of humus in the 0-50 cm layer,%	B ref.	Correction factors, K	B calc.	B calc.	Total area, ha
		0-10	10-20	20-30	30-40	40-50						
1	2	3	4	5	6	7	8	9	10	11	12	13
38 тс	80	6,9	6,21	5,4	4,7	4	5,44	78	1	78	74	242,8
	20	5,01	4,78	4,6	4,5	4,1	4,60	66	1; 0,9	59		
38 тс	80	6,9	6,21	5,4	4,7	4	5,44	78	1	78	74	154,7
	20	5,01	4,78	4,6	4,5	4,1	4,60	66	1; 0,9	59		
41 лг	80	6,9	6,21	5,4	4,7	4	5,44	78	0,9	70	65	55,9
	20	6,8	6,1	5,4	4,6	3,9	5,36	77	0,9; 0,63	44		
44 лг	80	5,01	4,78	4,6	4,5	4,1	4,60	66	0,9; 0,9	53	57	87,3
	20	6,9	6,21	5,4	4,7	4	5,44	78	0,9	70		
44 тс	80	5,01	4,78	4,6	4,5	4,1	4,60	66	0,9	59	63	26,6
	20	6,9	6,21	5,4	4,7	4	5,44	78	1	78		

For determine the price of land (using the example of arable land), a profitable method is used.

Слайд 19

Determination of the cost of agricultural land by income method

The initial indicators for the assessment of arable land are:

1) the normative productivity of agricultural crops (or the leading crop);
2) normative profitability of agricultural production;
3) the value of agricultural products.

Taking into account the existing structure of sowing areas in the region, the calculation of the normative yields for the assessment groups is based on the crop rotation crops used.

For each assessment group of soils, the value of the standard gross output per hectare is calculated from the formula:

$$VP_n \qquad VP_n = (U1n * P_1)UV_1 + (U_{2n} * P_2) * UN + ... + (U_{пи} * P_n) * UV_n$$

where $U_1, U_2, ...U_n$ – cost of normative gross output from 1ha(tenge);

$P_1, P_2, ...P_n$ - normative crop yield;

P_n – unit price of cultural goods;

$UV_1, UV_2, ...UV_n$ - specific weight of crop in crop rotation.

$P_{val} = \frac{P_n}{R}$

the normative profit per unit area is determined by the formula :

$$P_n = \frac{VP_n * R}{1+R}$$

where VP_n – normative profit, tenge;

R – standard value of gross output from 1 hectare;

P_n – normative profitability (30% or 0,30 fractions of a unit).

Calculation of the normative price of land by groups of soils is carried out according to the known method of capitalizing the income received from the exploitation of the land to the capitalization rate or the efficiency of capital application to the industry (adopted in the methodology of 8%):

$$C_{val} = \frac{P_n}{E}$$

where C_{val} – the normative price of a group of soils;

E – capitalization rate

The average normative price of arable lands of the district is calculated on the basis of the estimated scale of the average weighted values of the prices of soil groups in accordance with the area occupied:

$$P_n = \frac{P_1 * S_1 + P_2 * S_2 + ... + P_n * S_n}{S_1 + S_2 + ... + S_n}$$

where P_n – the average normative price of arable land in the assessed site;;

$P_1, P_2, ...P_n$ – normative price of soil assessment groups;

$S_1, S_2, ...S_n$ – areas of soil assessment groups.

As a result, tabular calculations showed that on the territory of the peasant farms under consideration, three degrees of soil buffering prevail: medium, increased and high.

Table - Determination of the degree of soils buffering in relation to heavy metals

Name of soil alloys	The humus content in the layer 0-50 см, %	Point	Physical clay, %	Балл	CO_2 carbonates, %	Point	The reaction of the environment, pH	Point	Sum of points	Degree of buffering of soils по отношению к ТМ	Carbon content, C (г)	Cation exchange capacity, %
1	2	3	4	5	6	7	8	9	10	11	12	13
Leached chernozem loamy	5,44	5	56,81	15	0,5	1,5	6,5	7,5	29	Medium	3,15	26
Leached chernozem soils	4,6	5	45,60	10	0,5	1,5	7,9	15	31,5	High	2,67	31,8
Chernozems leached by the medium	4,3	5	61,00	20	0,5	1,5	5,5	2,5	29	Medium	2,49	0,008
Deep-leached chernozems	5,47	5	45,22	10	0,5	1,5	6,38	7,5	24	Medium	3,17	25,7
Common meadow chernozems	5,3	5	50,46	15	0,5	1,5	7,78	15	36,5	High	3,07	0,014
Meadow chernozem chernozem	3,1	3,5	66,74	20	2,7	9,5	7,5	12,5	45,5	Very high	1,8	0,02

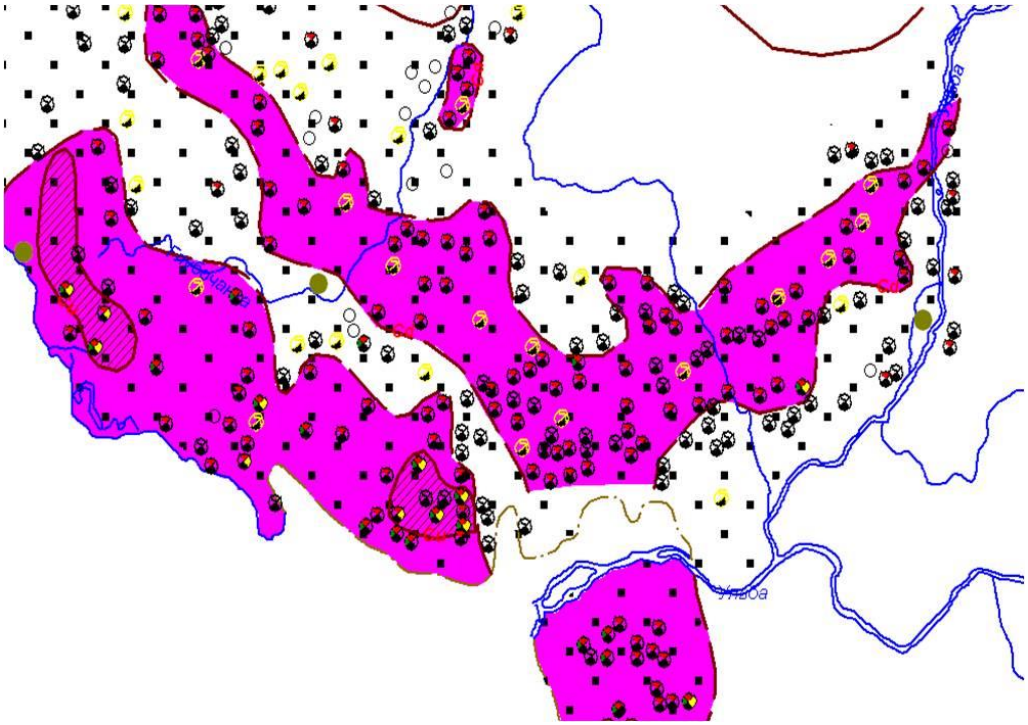


Fig. Fragment of the map of contamination of crops

High buffer (protective) ability of soils, able to transfer larger amounts of heavy metals in inaccessible compounds for plant. thereby contributing to the least contamination. Such properties are possessed by chernozem soils of leached powerful low-humus soils, and the remaining soils have medium buffer capacities.

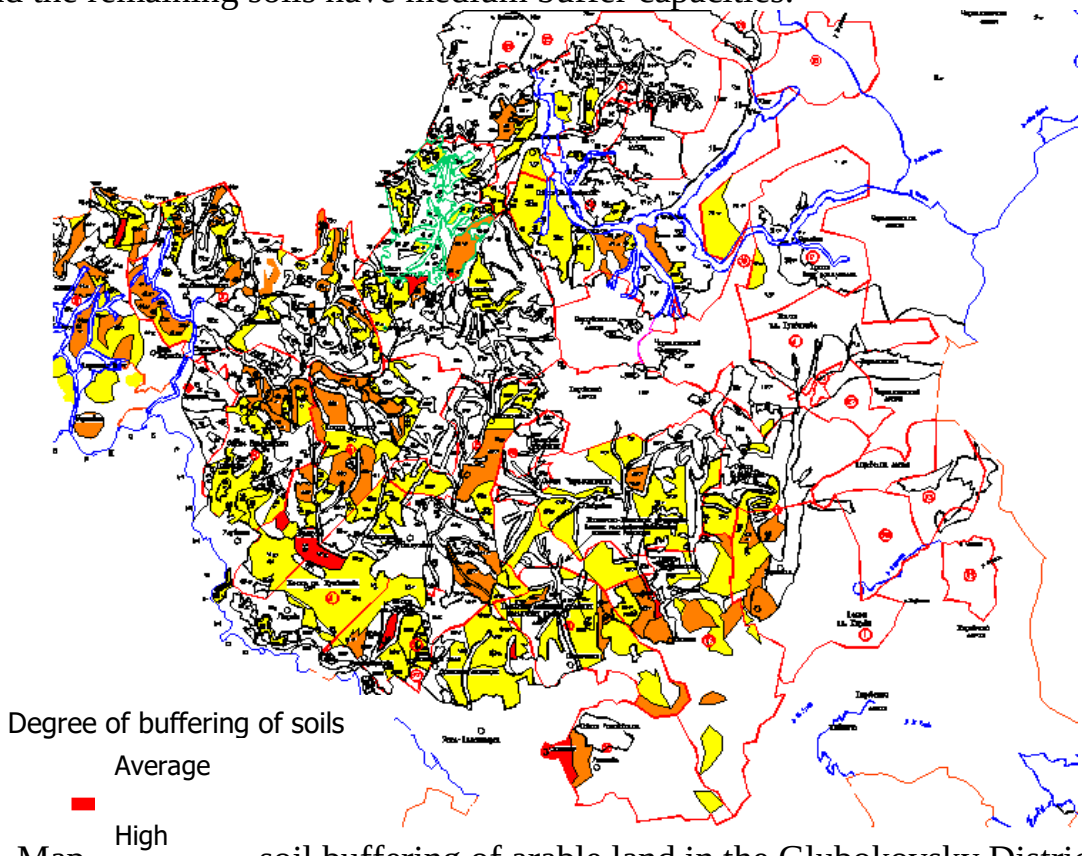


Fig. Map- soil buffering of arable land in the Glubokovsky District

To calculate th of economic damage, the following indicators are necessary:

- the actual vo acement of the i-th type of production waste and consumption depending on the hazard class in a certain period of time;
- normative volume of allocation of the i-th type of production and consumption waste, depending on the hazard class in a certain period of time;
- The rate of payment for the placement of 1 ton or 1 thousand m3 of the i-th type of production and consumption waste, depending on the hazard class, approved by local representative bodies for the current year, tenge;
- coefficient of environmental hazard;
- coefficient of environmental risk.

The amount of economic damage from land contamination with heavy metals is calculated by the formula:

$$P_{damage} = N3*P*K1*K2*K3*K4*K5$$

where P damage - the magnitude of economic damage from land pollution by chemicals;

NZ - the norm of total costs for carrying out works in full on the restoration of contaminated land;

P - area of contaminated land;

K1 - coefficient of increase in total costs, taking into account the level of inflation

K2 - coefficient, taking into account the degree of land pollution;

K3 - factor, taking into account the depth of land contamination;

K4 - coefficient, taking into account the economic importance of land in administrative areas;

K5 - coefficient that takes into account the nature protection, recreational, recreational and historical and cultural purpose of lands.

The main problems in the assessment of contaminated land are following:

the lack of a methodology for calculating emissions of heavy metals, which leads to a lack of a complete picture of what sources are being thrown out and for which they must report;

the lack of a methodology for assessing soils contaminated with heavy metals in the form of a regulatory document, where adequate corrections for pollution should be reflected. The current calculation methods allow obtaining estimates of polluting substances only with an appropriate degree of uncertainty.

strict laws and regulations in practice are not supported by real modern and complete methods for calculating all harmful substances contained in the emissions of enterprises.

Natural and man-made hazards as a factor of soil degradation

M. Mizernaya

Introduction

The extractive and processing industry is developed in Kazakhstan and the growth rates of these branches have been increasing in recent years. Large industrial projects that lead to an increase in air pollution and deterioration of ecology of Kazakhstan are under construction and placed in operation. For decades more than twenty billions tons of waste products have been accumulated in the republic, about one third of that is toxic.

In this regard, the ecological situation in Kazakhstan is far from satisfactory. Thischapter considers major factors of anthropogenesis and those branches of economy that define modern ecological condition of environment of the republic.

Environmental problems of sustainable development of the republic of Kazakhstan

The extractive and processing industry is developed in Kazakhstan and the growth rates of these branches have been increasing in recent years. Large industrial projects that lead to an increase in air pollution and deterioration of ecology of Kazakhstan are under construction and placed in operation. For decades more than twenty billions tons of waste products have been accumulated in the republic, about one third of that is toxic.

In this regard, the ecological situation in Kazakhstan is far from satisfactory.Thischapter considers major factors of anthropogenesis and those branches of economy that define modern ecological condition of environment of the republic. A considerable quantity of the power stations and heating plants of different capacities that use oil products, natural gas, and nuclear fuel, occupy large areas. The majority of power objects were constructed during the Soviet period and many of them do not meet today's ecological requirements; therefore, they heavily pollute the atmosphere and soil with gases and dust affecting flora and fauna disastrously.

Qualitatively new kind of influence of power industry on environment in Kazakhstan is the desalter of sea water in Aktau that works on a nuclear reactor.

As a result of mineral deposits development with infringement of scientific and technical rules, there is a loss of raw materials in the course of extraction, enrichment and transportation (Sokolovsk-Sarbaisk mineral management, Zhezkazgan ore-dressing and processing enterprise, Karaganda coal basin, Balkhash copper-smelting industrial complex, etc.). Occurrence of open-cast mines, mines, pits, disastrous funnels, pollution of atmospheric air because of the dispersing of extracted and dead rock in waste heaps and open-cast mines, extinction of natural flora and fauna, raised illness rate among workers and local population – are the results of anthropogenic human activity.

Kazakhstan has become the source of great attention of international companies, politicians, scientists, businessmen who are attracted to the area by gas and oil. One of the largest companies founded here is Karachaganak. This project was started in 1992, when Kazakhstan's government held tender for gas and oil extraction. Thanks to increasing of the extraction of natural resources, Karachaganak has become the leader in gas and oil industry. At the beginning of 2001 it was planned to construct a pipeline for another large project refining plant.

The new refining plant means real possibility for growth of the local economy, jobs for people and many other good prospects. On the other hand, it influences the environmental health of the local population and increasing danger of accidents. The regional Department of Environmental Protection foresees that discharges into the environment will increase three times. And what about poisonous pollutions in case of accidents and failures against which nobody can be guaranteed? That means the

increasing of environmental discharges for everything alive. We can see from the example of our neighbors, Atyrau people living near the Tengis deposit. From the beginning of the joint venture's activity - TengisShevroil (1993) 190 people died in the nearest village and it was reported that at the enterprise there were 65 deaths. Many of the people died of cerebral circulation dysfunction, cancer and heart attacks. It was mentioned in the ecologists' account that the company didn't undertake safety measures in gas burning. It was also reported that the compressor station which was put into the operation in 1997 didn't work well because of drawbacks.

Meanwhile, the environmental condition and people's health are evaluated by specialists as in danger . Inhabitants of the nearest village held unsanctioned meetings as a protest against deposit operators. In the Burlin region, the rate of disease is higher than in Oblast. Soil in 20 samples which was taken from different depths and places in the Karachaganak deposit contained less microbes than normal. From 11 soil samples taken from Bolshoi Grifon, four of them contained nothing and only two of them contained bacteria. It could be explained with the presence of oil and its influence on microbes' growth. The soil smells like oil. Microbe studies in this region report that some of them, especially microbes under the influence of Karachaganak gas began to reproduce rapidly. That's why without catching a cold you can get respiratory infections if you stay in the atmosphere polluted with sulfur substances and hydrocarbons. Useful microbes are destroyed but useless ones reproduce. Humus in this region is lifeless and nothing will grow on it.

In the process of oil extraction the level of underground and ground waters goes down and the integrity of soil-vegetable cover is broken. For example, on Mangistau peninsula, the chaotic laying of dirt roads to drilling units leads to vigorous roadside soil erosion. Besides, storing surpluses of oil in open holes can often be the reason of the soil-vegetative cover disappearance. Ground and underground waters are polluted with oil, which then flow down into the reservoirs used by the population for consumption. There are examples of the Western Kazakhstan natural gases burning in flares on oil wells that pollute the atmosphere with products of incomplete combustion of hydrocarbons.

The enterprises of ferrous and non-ferrous metallurgy use considerable quantity of water (Ust-Kamenogorsk Titan-Magnesium, Zyrjanovsk, Ulbinsk, Balkhash Copper-Smelting enterprises, etc.) in the technological process. Thus the sewage containing considerable quantities of various oils, alcohols and phenols get to the rivers and water basins, and considerable quantities of sulfurous gases and dust get to the atmosphere. Technologically in nonferrous metallurgy, it is necessary to process 50-100 tons of ores to extract only one ton of metal at concentration factories; thus, a large quantity of empty ore goes into dumps, which then is stored away and occupies large areas.

Sulfuric acid is used for the production of mineral fertilizers at the metallurgical enterprises in considerable quantities. That also pollutes the environment as an industrial drain.

However, the greatest ecological damage is caused by the emissions of gaseous substances that pollute atmosphere. In fifteen cities of the republic the level of air pollution is raised by harmful emissions. These cities include Zyrjanovsk, Aktau, Temirtau, Taraz, Petropavlovsk, Shymkent, Almaty, UstKamenogorsk, Pavlodar. High level of air pollution in these cities is a consequence of out-of-date production technologies, inefficient treatment facilities, and poor quality of used fuel. The basic polluting substances are dust, sulfur dioxide, nitrogen dioxide, hydrocarbons, phenol, lead, hydrogen sulfide, chloride hydrogen, ammonia, etc. Each of these substances in its way negatively influences people's health. Dust, for example, causes diseases of respiratory tracts, liver and blood diseases, etc. The dustiest cities of Kazakhstan are Aktau, Atyrau, Zhezkazgan, Semei, UstKamenogorsk. Disorders of the nervous system can be caused by the raised concentration of carbonic oxide in the air. Thus headaches occur, memory worsens, and normal sleep is disturbed. The high concentration of carbonic oxide is observed in such cities as Almaty, Aktobe, Karaganda, Kostanaj, Petropavlovsk, Pavlodar, Semei and some other. If there are several kinds of pollutants in the air, which usually occurs, the negative effect gets even more destructive. It affects immune system that frequently leads to oncologic diseases.

Because of the disorder of human economic activities, soil cover is exposed to considerable negative influence, such as wind and water erosion, soil pollution with household and industrial wastes. Change of the vegetative cover occurs due to not only the natural phenomena, such as fires, hurricanes, etc., but also due to deforestation and bush cutting, mechanical destruction of vegetation during construction, irrigational-meliorative and a road works. Degradation of pasture lands in Kazakhstan has reached considerable sizes due to cattle pasture, soil erosion; desertification processes became more active. Vegetation reduction in city landscapes leads to rise in temperature and air pollution in cities, therefore expansion of the area of green plantings in cities and settlements has a great sanitary-and-hygienic value. Nowadays distinctly expressed tendency of worsening of a crisis ecological situation in Aral, Balkhash, Irtysh, Kaspii regions, Rudnyi Altai, Almaty, Zhambyl, UstKamenogorsk, Shymkent, etc. is observed.

Speaking about the regions with catastrophic level of destabilization of ecosystems and geosystems in Kazakhstan present and former water areas of Aral sea, territory of Semipalatinsk nuclear testing facilities, northeast coast of Caspian sea, urban-industrial areas of Gornyi Altai: UstKamenogorsk, Ridder, Zyrjanovsk, can be named. Balkhash, Zhambyl, Zhezkazgan, Kyzyl-Orda, Temirtau, Shymkent, Almaty and Karaganda, the rivers Irtysh, Syr-Darya, Nura, Arys are regions with critical level of environmental destabilization. Aktau, Aktyubinsk, Atyrau, Semipalatinsk, Kapchagajsk and Shardarinsk water basins, lake Balkhash, Ili, Shu rivers are regions with intense level of the environmental destabilization. Regions with satisfactory level of the environmental destruction are urban-industrial areas of Kokshetau, Taldy-Korgan, Petropavlovsk, Uralsk, Ishim, Talas, Tobol, Sarysu, Ural rivers. Regions with favorable level of environmental conditions cover considerable, sparsely populated

territories of Kazakhstan: semi-deserts, deserts, mountain areas (Chigarkin A.V., 1995).

Unfortunately, the problem of radiation pollution remains. Struggle against radioactive pollution can have only precautionary character as there are no ways of biological decomposition and other mechanisms, allowing to neutralize this kind of environmental pollution. Spreading by a food chain (from plants to animals), radioactive substances get into a human body with food and can accumulate in a quantity that can be harmful to a person. Nuclear weapon testing with good reason can be called the most serious crime against the nature and humankind. From 1949 to 1962 about 200 explosions in atmosphere, and from 1963 to 1989 - about 400 underground explosions were made in Semipalatinsk's proving ground; the part of them was accompanied by emissions of radio nuclides. Inhabitants of East Kazakhstan have received the greatest dose of ionizing radiation after Hiroshima-Nagasaki and Chernobyl. The information about the sickness rate connected with radiation influence was not subject to promulgation until 1989. According to informal sources of information, the number of deaths from leukemia made ten thousand people.

In Kazakhstan there are a number of factors which form radio-ecological conditions:

- Activity of the former Semipalatinsk nuclear testing ground;
- The nuclear explosions executed for the solution of economic problems;
- The enterprises of an atomic-industrial complex;
- Extraction and processing of polymetallicores, oil and gas that increase radioactivity.

Bad condition of water resources of Kazakhstan is also recorded. Waterways of our republic are presented by near 85 thousand rivers. The largest waterways are Irtysh, Ishim, Ili, Syr-Darya, Ural, Shu, Talas, Assa rivers. Recent years have seen drying-out of the lake system. It is connected with overregulation of trans-boundary and inland basin flows and with natural fluctuations of their level.

Among the most terrible in the ecological relation there is a basin of the main waterway of Kazakhstan – the Irtysh River. Its waters are polluted with heavy metals (copper, zinc, cadmium, lead, arsenic, etc.) which get into the river with sewage.

Destroying the environment, any modern society destroys its own future. For prosperity of the future generations it is necessary to maintain ecological stability. Thorough control over the environmental situation, rationing and prevention of industrial emissions, working out and implementation of waste-free and resource-saving technologies are necessary for preservation of ecologically stable future.

With a purpose of maintenance of a stable development of Republic Kazakhstan following mechanisms have been developed:

- Financing of actions of environmental protection from the state budget, local budgets, means of nature managers, the international loans and grants and other sources;

- Organization of competition among projects about environmental protection and rational wildlife management with their possible further financing from means of state and local budgets;

- Realization of the «pollutant pays» rule, meaning that nature user bears responsibility for financing the actions for environmental protection and for indemnity of a possible ecological damage, otherwise he should refuse to carry out such activity;

- Application of rent payments principle at the taxation of interior users;

- Gradual refusal from fiscal payments for the issues of environmental protection within standards, with reduction of the list of substances, for emissions of which the payment is taken, with simultaneous increase of stimulating value of indemnity of damage for excess of the established standards, increase of rates of administrative penalties for infringement of the nature protection legislation;

- Ecological insurance of any damage to the environment, and also the organization of funds for financing of actions for the environment restoration during the elimination of the enterprises;

- Implementation of ecological taxes on manufacturing of ecologically dangerous production and/or services, with possibility of using the funds for realization of large nature protection programs;

- Inclusion of the overall cost of natural objects into economic indicators with consideration of their environmental maintenance functions, and also costs of nature protection (ecological) works (services);

- Forming and application of the tax and tariff policy stimulating reorientation of export from raw materials to products of deep processing;

- Creation and application of the system of taxes and the duties stimulating use of non-polluting technologies, the goods and services regardless of the producing country;

- Implementation of the system of trade by quotas (obligations) between nature users;

- Implementation of market mechanisms of wildlife management, including recycling and reprocessing of the industrial goods;

- Usage of the international financial and economic mechanisms in the field of environmental protection, provided by the international conventions and agreements;

- Developing stimulating measures for charitable activities in the field of wildlife management.

Thus, the system of delivery of permissions to environment pollution allows regulating environmental pollution by the industrial enterprises.

By now (in the beginning of the XXI century) the environmental problems of Asian region have reached critical point, obliging the international community to focus on them. The scope of these problems is very broad, including Semipalatinsk and Caspian region, the Aral Sea, degradation of pastures and arable land in different regions of Central Asia, water pollution from sewage and anti-desertification and drought mitigation measures. These problems affect millions of human lives, and to

date, OSCE is literally the only regional organization, which includes the most influential countries in the world, particularly those in Asia, and has an ability to assist within environmental challenges of the new millennium. Thus, the OSCE chairmanship of Kazakhstan in 2010 is an opportunity to make significant steps to solve these problems.

The objectives of agricultural development and overcoming global food crisis – stated in 2008 in the message of President to the people of Kazakhstan has made the condition of agricultural land particularly important. Since the mid-XXth century an extensive development of agriculture along with unsustainable land management technologies used in the USSR have led to loss the of significant part of fertile layer of soil. According to experts' estimations, the loss of humus amounted to about one-third of the original stock since the beginning of the virgin land cultivation. Wind and water erosion led to soil degradation, resulting in desertification of more than 65% of the territory of Kazakhstan. In addition, mass cultivation was one of the reasons for increased frequency and severity of drought, which subsequently accelerated drying up of lakes and rivers. The regulation of runoff in an arid climate conditions brought to the shortages of water in rivers and lakes in Southern region.

In this regard, the Government has taken steps to facilitate development and the use of caretaking crop production technologies. The level of support of farmers using moisture-retaining technologies is growing annually; there is also a program for sustainable management of rangeland resources supported by the United Nations Development Program (UNDP), etc.

Another question is the current and future state of the Aral Sea. Fifty years ago, which is literally "yesterday" within geologic scale, the Aral Sea was the fourth largest lake in the world. Since then the size of the lake decreased by more than four times, and the sea itself was divided into two parts - Large Aral and Small Aral. The reduction rate of water surface area indicates the fact that in the next ten-fifteen years the lake might become extinct. Most experts name an excessive extraction of water from Amu Darya and Syr Darya (the rivers feeding the lake) the main reason for this man-made disaster. Fifty years ago these rivers delivered about 60 cubic kilometers of water per year to the Aral Sea, by now this amount has been reduced to 5 cubic km. Since the 60-s much of the water of these rivers has been used for irrigation of farmland and water supply of Central Asian region. As a result, the channel of rivers now simply does not reach the dying sea.

In this respect Kazakhstan considers necessary to draw attention of the participants of the 18th OSCE Economic and Environmental Forum to Aral Sea issue. OSCE could contribute by providing permanent political dialogue and place for development of unified approaches to solve of this problem.

To date it is hardly possible to restore traditional borders of the Aral Sea. To do that the reduction of water withdrawal from rivers feeding the lake should take place, however four of the five Aral Sea Basin countries (except Kazakhstan) are planning to increase water withdrawal to meet the needs of agricultural development. In 1999

Kazakhstan attempted to restore the Small Aral Sea, located within the country's territory, by constructing a dam and thus limiting the outflow of water flowing in the direction of the Big Aral. As a result, despite the fact that in April 1999 the dam was breached, there was a rise of the level of the Small Aral Sea, which demonstrated possibility of its restoration. In 2005 Kazakhstan and the World Bank assigned $85 mln. for dam reconstruction. Within the first eight months the level of water in the Small Aral Sea rose by two meters while its area increased by 18%. Today restoration of the number of various fish species and revival of fishing is observed in the basin of Small Aral. In the near future the borders of Small Aral will reach Aralsk should the environmentalists' hope come true. It will become possible to proceed with the second phase - restoration of the Big Aral.

The consequences of the Aral Sea disaster are not limited by the irretrievable loss of the natural habitat of the oasis and many species of marine flora and fauna, climate change and loss of the whole Aral Sea fisheries cluster. Over the years the lake has been contaminated with agrochemicals washed from fields. Desiccation of the Aral Sea revealed 50 thousand square km of the bottom of Big Aral with 100 million tons of toxic dust, fine-grained salt dispersed annually not only to the regions near the Aral Sea, but also Central Asia, leaving traces in the Antarctic, Greenland and Europe. Contaminated area is not limited with the surrounding regions - sandstorms generated in the Aral Sea region, have already reached Bukhara, Uzbekistan (500 km. from the Aral Sea).

Environmentalists of Kazakhstan faced similar problem in the lake Koshkar Ata 5 km north of Aktau in Mangistau region. It is an artificial lake, formed from wastewater of Caspian Mining and Metallurgical Plant, which contains all elements of the periodic table, including radioactive waste of uranium enrichment. It is separated from the Caspian Sea by 7 kilometers wide coastal zone. In recent years the level of the lake has been declining - the lake was drying up due to inactivity of plants, supplying it with wastewater. Toxic dust has been generated on dry banks and spread within surrounding regions by wind. At the same time, the initial level of surface water in Koshkar-Ata is above the level of the Caspian Sea, which means that filling it up can potentially cause pollution of the Caspian Sea with toxic and radioactive wastes through the ground water. Thus, reduction of the water level in the lake must be accompanied by conservation of dry banks surface. Currently, groundwater at the tailings site is no longer a threat. The operations on conservation of dry banks are being implemented. Completion of technical reclamation, including water phase using a treatment plant is scheduled for 2015.

Dehumification

Desertification in Kazakhstan

Desertification is a serious threat for human welfare. Though soil degradation goes along with its systematic use by people, in recent years this process has speeded up, when population growth and prognosis of further increase require sharp rise of food production. It was estimated that from 50 to 70 thousand kilometers of fertile lands annually become unsuitable for use and the main reason for this is catastrophic phenomena – desertification. Desertification is a strong global ecological and social-economic problem. Desertification can become basic threat for successful social-economic development in many countries in XXI century under conditions of growing population of the earth, nearly complete reclamation of productive agricultural lands, and dramatic increase of technogenic load.

At present 14 million hectare out 182 million hectare of ranchland in Kazakhstan are completely out of use. The total area of degradation is more than 50 million hectare.

The reasons of desertification in Kazakhstan are both natural and anthropogenic factors.

Basic natural factor that facilitate development of desertification process in Kazakhstan is intercontinental location of the country that determines continentality and droughtiness of the climate, paucity and irregularity in the distribution of water resources that cause wide expansion of sand (up to 30 million ha) and saline land (127 million ha). Conditions for the development of soil degradation processes are also caused by disturbances of soil formation and draught affect. These natural features of Kazakhstan determine environmental resistance to human impact (according to current estimation 75 % of the country territory are subjected to the risk of ecological disruption).

Anthropogenic factors that cause desertification processes in Kazakhstan are mainly connected with such types of economic activities as ranging, farming, development of mineral resources, building and operating of industrial, military, and civil facilities, irrigation and linear constructions. Desertification is also caused by illegal wood harvesting, uprooting of shrubs and semishrubs for feeding cattle and as a fuel, by forest and steppe fires random recreationsm, dumps around human settlements, pollution of soils and underground waters with toxic substances, transport affect

Current social circumstances in Kazakhstan are characterized by annual out migration of hundreds thousand people from regions located in desert zone. Low living standards of population, malnutrition, insufficient medical care, drinking water unsuitable for use, dust and saline storms caused by disruption of ecological balance and habitat degradation became reasons for ill health, life duration reduction, low population growth indicate on demographic ill-being.

Basic types of desertification in Kazakhstan determined in accordance with criteria adopted in Desertification Convention are plant degradation, water and wind erosion of soils, soil salination

and dehumification; chemical pollution of soil, technogenic disturbances of lands and hydrological regime.

Technogenic desertification. Development of industrial production in Kazakhstan and exploitation of mineral deposits went along with building of transport and engineering infrastructure, intensive extraction and pollution of water and land resources, direct and indirect negative influence on ecosystems. Besides mentioned affects on the processes of technogenic desertification, the following factors had significant influence either – emissions of toxic substances into air basin, and there were cases of direct affectof toxic industrial emissions on vegetation.
Wind and water erosion of soils. Desertification caused by wind and water erosion of soils in Kazakhstan covered steppe, semidesert and desert landscapes. Fine soil particles are blown out and soils become sandy under the influence of wind erosion.

Dehumification and salinification of soils. The process of dehumification has been identified on all plough lands and ranchlands. Decrease of humus content is connected with irretrievable nutrient removal by alienation with harvest. Due to weak humification 4.5 million hectares of unwatered plough lands are desertificated, due to moderate humification – 5.2 million hectares, due to stronhumification 1.5 million hecteres are desertificated out of the total area of plough lands. The share of dehumificated lands is 0.7 million hectares on the irrigated lands.

Pollution of soil and ground water. The risks of chemical pollution of soils intensified dramatically in two last years. These risks are caused by specific substances from chemical cultivation of agricultural fields, disposal og industrial wastes, disposal of waste waters, atmospheric emissions in cities an industrial centers. Livestock wastes also cause soil pollution.

Pollution of ground waters is widely spread in Kazakhstan and is considered as the factor that can cause soil desertification, resalinization of soils, vegetation, deterioration of conditions of drinking water supply. The most degree of pollution is caused by enterprises of mining and mineral processing, chemical and other industries that have toxic wastes, massive irrigation, animal production units, urban agglomeration etc.

At present deflation injuriousness can be weakened on plough lands of Kazakhstan due to their reduction. However, the risk of wind erosion growing remains in arid zones of the republic especially on degraded pastures.

Vegetative cover degradation is one of the most spread and visually identified desertification processes in the form of forests, plough lands, and hay-fields degradation.

Degradation of plough lands, and hay-fields. Wide-scale plowing of virgin lands had the most negative effect and complex influence on steppe eco-systems of Kazakhstan.

Pasture load on remained virgin lands increased due to both pastures plowing that displaced livestock to low-productive tough terrain and simultaneous growing of livestock population. Plowing of most fertile lands displaced and concentrated livestock on less productive drainless saline territories including wet salt meadows of lake-side lowlands and basins. The most deteriorated pastures are those ones that are close to villages, ranchlands, milking installations, and wells.

According to the data provided by Land Resources Management Agency of the Republic of Kazakhstan 26.6 million hectares of pastures out of 188.9 hectares of their total area have the highest level of degradation that is expressesd in very strong desertification. Pastures occupied 34.8 million hectares in forest-steppe and steppe zones of the republic, and 5.6 million hectares of then are very degraded. The process of pastures degradation has tendency for increase.

It should be noted that along with population growth, industry development, urbanization that transform nature of human activities, in particular increase of agricultural industry productivity, agricultural areas on the earth surface are constantly reduced. The reduction of planet productive lands fund is also due to the process of desertification – development of desert zones due to natural processes caused mainly by people.

Air pollution

Industrial pollution is a bigger concern in Kazakstan's manufacturing cities, where aging factories pump huge quantities of unfiltered pollutants into the air and groundwater. The capital, Almaty, is particularly threatened, in part because of the postindependence boom in private automobile ownership.

The gravest environmental threat to Kazakstan comes from radiation, especially in the Semey (Semipalatinsk) region of the northeast, where the Soviet Union tested almost 500 nuclear weapons, 116 of them above ground. Often, such tests were conducted without evacuating or even alerting the local population. Although nuclear testing was halted in 1990, radiation poisoning, birth defects, severe anemia, and leukemia are very common in the area (see Health Conditions, this ch.).

With some conspicuous exceptions, lip service has been the primary official response to Kazakstan's ecological problems. In February 1989, opposition to Soviet nuclear testing and its ill effects in Kazakstan led to the creation of one of the republic's largest and most influential grass-roots movements, Nevada-Semipalatinsk, which was founded by Kazak poet and public figure OlzhasSuleymenov.. After a year of demonstrations and protests, the test ban took effect in 1990. It remained in force in 1996, although in 1995 at least one unexploded device reportedly was still in position near Semey.Once its major ecological objective was achieved, Nevada-Semipalatinsk made various attempts to broaden into a more general political movement; it has not pursued a broad ecological or "green" agenda. A very small green party, Tagibat, made common cause with the political opposition in the parliament of 1994.

Kazakhstan also faces the problem of urban pollution, particularly in its eastern cities, which receive harmful emissions from lead and zinc smelters, a uranium-processing mill, and other industries. In recent years, environmental activist groups in Kazakhstan have begun lobbying for tighter emission controls. Other environmental issues in Kazakhstan include soil pollution from the overuse of pesticides in agriculture and the increasingly polluted waters of the Caspian Sea.

The environment of Kazakhstan began to suffer serious harm during the Soviet period. The country now faces an urgent need to address the Soviet legacy of ecological mismanagement. Between 1949 and 1991 the Soviet government conducted about 70 percent of all of its nuclear testing in Kazakhstan, mostly in the north-eastern area near the city of Semipalatinsk (now Semey). Nearly 500 nuclear explosions occurred both above and below ground near Semipalatinsk, while more than 40 nuclear detonations occurred at other testing grounds in western Kazakhstan and in the Qyzylqum desert. More than 1 million of Kazakhstan’s inhabitants were exposed to dangerous levels of radiation because the Soviet government did not evacuate or even warn nearby populations. In the late 1980s Kazakhs held large demonstrations calling for an end to the nuclear testing, and in 1991 the government of Kazakhstan put a stop to the practice. However, the testing grounds, and perhaps even underground aquifers (water-bearing layers of rock, sand, or gravel), remain highly contaminated. The Nevada-Semipalatinsk Organization, which led the campaign against nuclear testing during the 1980s, has turned its attention to teaching residents of polluted areas how to avoid nuclear contamination. One of every three children born in the Semipalatinsk region has mental or physical defects, and about half the population suffers from immune system deficiencies.

Water pollution

The environment of Kazakstan has been badly damaged by human activity. Most of the water in Kazakstan is polluted by industrial effluents, pesticide and fertilizer residue, and, in some places, radioactivity. The most visible damage has been to the Aral Sea, which as recently as the 1970s was larger than any of the Great Lakes of North America save Lake Superior. The sea began to shrink rapidly when sharply increased irrigation and other demands on the only significant tributaries, the Syrdariya and the Amu Darya (the latter reaching the Aral from neighboring Uzbekistan), all but eliminated inflow. By 1993 the Aral Sea had lost an estimated 60 percent of its volume, in the process breaking into three unconnected segments. Increasing salinity and reduced habitat have killed the Aral Sea's fish, hence destroying its once-active fishing industry, and the receding shoreline has left the former port of Aral'sk more than sixty kilometers from the water's edge. The depletion of this large body of water has increased temperature variations in the region, which in turn have had an impact on agriculture. A much greater agricultural impact, however, has come from the salt- and pesticide-laden soil that the wind is known to carry as far away as the Himalaya

Mountains and the Pacific Ocean. Deposition of this heavily saline soil on nearby fields effectively sterilizes them. Evidence suggests that salts, pesticides, and residues of chemical fertilizers are also adversely affecting human life around the former Aral Sea; infant mortality in the region approaches 10 percent, compared with the 1991 national rate of 2.7 percent.

By contrast, the water level of the Caspian Sea has been rising steadily since 1978 for reasons that scientists have not been able to explain fully. At the northern end of the sea, more than a million hectares of land in Atyrau Province have been flooded. Experts estimate that if current rates of increase persist, the coastal city of Atyrau, eighty-eight other population centers, and many of Kazakstan's Caspian oil fields could be submerged by 2020.

Wind erosion has also had an impact in the northern and central parts of the republic because of the introduction of wide-scale dryland wheat farming. In the 1950s and 1960s, much soil was lost when vast tracts of Kazakstan's prairies were plowed under as part of Khrushchev's Virgin Lands agricultural project. By the mid-1990s, an estimated 60 percent of the republic's pastureland was in various stages of desertification.

The government has established a Ministry of Ecology and Bioresources, with a separate administration for radioecology, but the ministry's programs are underfunded and given low priority. In 1994 only 23 percent of budgeted funds were actually allotted to environmental programs. Many official meetings and conferences are held (more than 300 have been devoted to the problem of the Aral Sea alone), but few practical programs have gone into operation. In 1994 the World Bank (see Glossary), the International Monetary Fund (IMF--see Glossary), and the United States Environmental Protection Agency agreed to give Kazakstan US$62 million to help the country overcome ecological problems.

Soil pollution

The upper layer of the unsaturated zone of earth is the soil. Soil is the natural body made of mineral and organic constituents. It is produced by solid material recycling and complex processes of solid crust modifications. Soil offers shelter, habitat for numerous organisms and is the living medium for plants.

Enormous quantities of waste from man-made products are being released into the soil causing soil pollution. Polluted water also causes soil pollution. Soil pollution is caused due to unhygienic habits, agricultural practices and inappropriate methods of disposal of solid and liquid wastes. Soil pollution is a also caused as a result of atmospheric pollution.

In industrialized countries, soil pollution is a result of use of chemicals in agriculture, dumping of waste materials, mining, smelting of metals and also dumping of domestic refuse and solids, untreated sewage and industrial wastes.

Because of the disorder of human economic activities, soil cover is exposed to considerable negative influence, such as wind and water erosion, soil pollution with household and industrial wastes. Change of the vegetative cover occurs due to not only the natural phenomena, such as fires, hurricanes, etc., but also due to deforestation and bush cutting, mechanical destruction of vegetation during construction, irrigational-meliorative and a road works. Degradation of pasture lands in Kazakhstan has reached considerable sizes due to cattle pasture, soil erosion; desertification processes became more active. Vegetation reduction in city landscapes leads to rise in temperature and air pollution in cities, therefore expansion of the area of green plantings in cities and settlements has a great sanitary-and-hygienic value. Nowadays distinctly expressed tendency of worsening of a crisis ecological situation in Aral, Balkhash, Irtysh, Kaspii regions, Rudnyi Altai, Almaty, Zhambyl, UstKamenogorsk, Shymkent, etc. is observed.

Land legal relations in Kazakhstan
Rakhmetova Gulshat Rahmetovna

The Constitutional Council of the Republic of Kazakhstan composed by Chairman Yu.A. Khitrin, members of the Council Kh.A. Abishev, K.Zh. Baltabaev, S.F. Bychkova, A. Essenzhanov, A.K. Kotov and K.A. Omarkhanov with participation of: representative of the Head of the state - head of the sector of the Civil Law Department of the Administration of the President of the Republic of Kazakhstan A.Sh. Akkulev, Minister of Justice of the Republic of Kazakhstan O.I. Zhemabekov, deputy of the Senate of the Parliament of the Republic L.N. Burlakov, deputies of the Majilis of the Parliament of the Republic Zh.N. Abdiev and A.A. Beissenbaev, Deputy General Public Prosecutor of the Republic A.K. Daulbaev, Vice-Minister of Agriculture of the Republic A.K. Kurishbaev, Chairman of the Agency of the Republic for Management of Land Resources B.S. Ospanov, has considered in open sitting the appeal of the President of the Republic of Kazakhstan concerning checking constitutionality of the Land Code of the Republic of Kazakhstan.

Having examined materials of constitutional proceedings, having heard the report of the speaker - member of the Constitutional Council K.A. Omarkhanov, speeches of the representative of the subject of appeal and participants in the meeting, the Constitutional Council of the Republic of Kazakhstan have fixed:

That the Land Code of the Republic of Kazakhstan was adopted by the Parliament of the Republic on 19th May 2003 in accordance with paragraph 7 of Article 61 of the Constitution of the Republic of Kazakhstan without voting, and it was submitted for signature to the President of the Republic on 27th May 2003.

Examining the Land Code of the Republic in relation to its constitutionality the Constitution Council of the Republic of Kazakhstan proceeds from the following fundamental provisions of the Constitution of the Republic of Kazakhstan which must be taken as a basis for law regulation of the legislation concerning land:

1) general bases and principles (paragraph 2 of Article 2, paragraphs 1 and 2 of Article 4, paragraphs 1 and 2 of Article 5, Article 6);

2) rules governing constitutional rights and freedoms of citizens (paragraphs 2 and 5 of Article 12, paragraph 2 of Article 13, Article 14, paragraphs 2, 3 and 4 of Article 26, paragraph 1 of Article 31, Article 38, paragraph 1 of Article 39).

1. In accordance with paragraph 3 of Article 6 of the Constitution 'The land and its subsurface, water, vegetable kingdom and the animal world, other natural resources

shall be in state ownership. The land may be also in private ownership on grounds, terms and within the limits fixed by law'.

Those constitutional rules mean that in regulation of land relations the Constitution fixes supremacy of the state in determination of legal regimes of ownership and turnover of the land up to fixation of the regime of exclusive ownership of land by the state. In this case legal issues of ownership and land relations in the Republic are governed by laws and legislative acts equal to them by legal force, on the ground of general bases and rules of the Constitution of the Republic (paragraphs 1 and 2 of Article 4 of the Constitution, Resolutions No. 2/2 of 13th April 2000 and No. 4 of 23rd April 2003 of the Constitutional Council).

Such an act, in application to land relations, is the Land Code (henceforth - the Code) which is directed to creation of favourable legal conditions and guarantees for exercising by citizens of their constitutional rights and freedoms in the social-economic sphere, in particular by introduction, in conformity with paragraph 3 of Article 6 of the Constitution, of private ownership of certain categories of lands.

Paragraph 2 of Article 2 of the Constitution reads: 'The sovereignty of the Republic shall cover all its territory. The state shall ensure integrity, inviolability and inalienability of its territory'. It is stated in the Resolution No. 4 of 23rd April 2003 of the Constitutional Council on that point that the territory of the state is a space limit, within which the state exists and acts as a sovereign organisation of power. The integrity, inviolability and inalienability of the territory which comprises land, its subsurface, water, vegetable kingdom and the animal world, other natural resources are the determining terms of national security ensured and protected by the state on the basis of rules of the Constitution and international law.

The aforesaid constitutional principles are put in the foundation of legal regulation of land relations in Kazakhstan (Article 4, paragraph 7 of Article 6, Articles 7, 34, 37 and paragraph 8 of Article 170 of the Code).

General constitutional bases of development of ownership relations in the Republic such as 'state and private property shall be recognised and equally protected' (paragraph 1 of Article 6) and 'ownership shall bind over, use of it must simultaneously serve to public welfare. Subjects and objects of ownership, volumes and limits of exercising by owners of their rights, guarantees of their protection shall be determined by law' (paragraph 2 of Article 6) - are made more concrete in rules of the Code.

So, besides state ownership, the Code recognizes private ownership of land as well (Article 3, section 2). In this case the single mechanism of their protection is ensured which is based on the legislation of the Republic to be common for all the participants in land relations (Articles 6 and 164 of the Code). The following is fixed as principles and tasks of the legislation concerning land: preservation of land and prevention of inflicting damage to it; regulation of land relations for the purposes of ensuring of rational use and protection of lands, reproduction of soils fertility, preservation and enhancement of the environment; protection of rights of physical persons and legal entities and the state to land (Articles 4 and 5 of the Code). Paragraph 3 of Article 6 of

the Code stipulates that exercising by subjects of land relations of rights held by them must not inflict harm to land and other items of the environment.

Achievement of the aforesaid purposes and tasks is favoured by rights and obligations of owners and land users on use of land plots (Articles 64 and 65 of the Code) as well as terms of termination of the right of ownership or land use in case of infringement of the legislation concerning land (Article 93 of the Code). Chapter 20 of the Code contains rules directed to protection of rights of participants in land legal relations, compensation of damages inflicted by unlawful actions (omission) of other subjects, in particular by state bodies and their officials, Constitutional rules concerning non-admission of a merger of public and state institutes, concerning prohibition of imposition upon public associations of functions of state bodies (paragraphs 1 and 2 of Article 5 of the Constitution) are secured by provisions of Chapters 2 and 18 of the Code, in which legal issues of regulation of land relations are recognized as a prerogative of appropriate state bodies and they exclude solving them by non-state structures.

2. Basing on that the highest values in the Republic of Kazakhstan are the man, his rights and freedoms (paragraph 1 of Article 1 of the Constitution), the General Law approves one of the basic signs of a law state - human rights and freedoms determine the content and application of laws and other regulatory legal acts (paragraph 2 of Article 12 of the Constitution). The aforesaid rule is a conceptual basis of law valid in Kazakhstan and it is taken into consideration in the Code.

So, constitutional provisions as regards 'exercising of rights and freedoms of the man and the citizen must not infringe right and freedoms of other persons...' (paragraph 5 of Article 12); 'citizens of the Republic of Kazakhstan must preserve the nature and attitude with care to natural wealth' (Article 38); 'rights and freedoms of the man and the citizen may be restricted by laws only...' (paragraph 1 of Article 39) are reflected in appropriate rules of the Code.

Paragraph 3 of Article 6 of the Code makes those rules more concrete as inadmissibility of the abuse of land rights in relation to other subjects of land relations as well as natural resources. The legislation concerning land is directed to strengthening of lawfulness in the field of land relations, ensuring of safe-keeping and enhancement of natural resources by their rational use (Article 5, Chapter 17 of the Code).

The aforesaid provisions are secured by the appropriate law mechanism. In particular, in case of gross infringement of rules of rational use of land or such use of land which results in considerable decrease in its fertility, considerable worsening of the ecological situation, the land plot may be withdrawn from the owner or the land user (Article 93 of the Code). Rules regulating ensuring of compliance with the legislation concerning land stipulate full compensation of losses in case of infringement of rights of owners or land users at costs of the trespasser of them, fix a procedure for compensation of harm with determination of the amount of compensation. Articles 164-168 of the Code stipulate that responsibility of guilty

persons as well as protection of land rights is exercised in accordance with rules of appropriate sector laws.

The Code contains rules guaranteeing protection of rights of physical persons and legal entities from unlawful law drafting of state bodies - their acts may not restrict rights fixed by laws (paragraph 5 of Article 6 of the Code).

The necessity to determine in details by legislative acts subjective rights and obligations of participants in land relations mentioned in certain rules of the Code assumes a possibility to restrict them within the frameworks of requirements of paragraphs 2 and 3 of Article 6, paragraph 1 of Article 39 of the Constitution.

Decrees of the Parliament and resolutions of its chambers are named in paragraph 1 of Article 62 of the Constitution 'legislative acts' in the meaning of the form of acts of implementation by the Parliament, Senate and the Majilis of their law applying powers comprehensively stipulated by articles of the Constitution, which are effected by them together with legislative ones. The supreme representative body and its chambers adopt decrees on concrete subject-matters of enactment of those rules of the Constitution, and according to their law force they may not enter in relations of legal competition with laws, acts of other institutes of state power: President, executive bodies, courts and local state administration bodies. Decrees of the Parliament, Senate and the Majilis being acts of parliamentary law application, as a rule, of organizational-legal importance, have the obligatory nature.

Paragraph 1 of Article 94 of the Code stipulates that land plots used not within designation or used with infringement of legislation are to be withdrawn in accordance with the court procedure. That rule is consistent with requirements of paragraph 3 of Article 26 of the Constitution as regards 'nobody may be deprived of his property otherwise than under the court decision'; it also meets legal positions of the Constitutional Council contained in the Resolutions No. 14/2 of 10th July 2000 and No. 21/2 of 20th December 2000.

Grounds for alienation of lands for state needs are characterized by exclusiveness (Article 84 of the Code: for needs of defence, specially protected natural territories, revealing of a field of useful minerals, construction of communications of state importance, etc.), and terms of their compensation take into consideration rights and legal interests of the owner (Articles 85-89 and 165 of the Code) that is consistent with requirements of paragraph 3 of Article 26 of the Constitution ('forced alienation of property for state needs in exclusive cases stipulated by law may be conducted providing for equivalent compensation of it'). In this case the guarantee of protection of the right to court protection of rights and freedoms (paragraph 2 of Article 13 of the Constitution) are rules of Articles 88, 89, 166, 167 and paragraph 7 of Article 170 of the Code.

The Code ensures legal equality of everybody to law and the court, it does not contain rules discriminating subjects of land relations by motives of origin, social, position and property status, sex, race, nationality, language, relation to the religion,

convictions, place of residence or on any other circumstances. All its provisions correspond to requirements of Article 14 of the Constitution.

In this case the Constitutional Council notes that the Code has certain imperfections pertaining to issues of law technique.

3. The Code was adopted in accordance with the sequence and procedures fixed in Article 61 of the Constitution as well as Resolution No. 6 of 13th May 2003 of the Constitutional Council 'Concerning the Official Interpretation of Paragraph 7 of Article 61 and Paragraph 1 of Article 63 of the Constitution of the Republic of Kazakhstan' based on the Constitution's provisions.

The adoption of the Land Code on that legal base was a result of constitutional interaction in the Parliament of the executive and legislative branches of power with the use of the system of restraints and counterbalances (paragraph 4 of Article 3 of the Constitution) in accordance with paragraph 7 of Article 61 of the Constitution.

Presented for signature to the President of the Republic the Code, in accordance with paragraph 3 of Article 45 of the Constitution, was signed by the chairmen of each of the chambers of the Parliament. The requirement of that rule of the Constitution is general for any constitutional legal procedure for adoption of laws by the Parliament. It meets legal positions of the Resolution No. 13/2 of 29th May 1997 of the Constitutional Council which given the official explanation to procedural issues of application of Article 45 of the Constitution in relation to the circle of officials obliged to sign acts of the Parliament before their signature by the President of the Republic.

Thus, the Constitutional Council of the Republic considers that the Land Code of the Republic of Kazakhstan adopted by the Parliament of the Republic on 19th May 2003 according to paragraph 7 of Article 61 of the Constitution of the Republic of Kazakhstan without voting and presented for signature to the President of the Republic on 27th May 2003 is consistent with the Constitution of the Republic of Kazakhstan both by the content and the procedure for its adoption.

Being governed by subparagraph 2) of paragraph 1 of Article 72 of the Constitution of the Republic of Kazakhstan, subparagraph 1) of paragraph 2 of Article 17, Articles 31-33, 37, paragraph 1 of Article 39 and subparagraph 2) of paragraph 1 of Article 41 of the Edict of the President of the Republic of Kazakhstan, having force of the Constitutional law, 'Concerning the Constitutional Council of the Republic of Kazakhstan', the Constitutional Council of the Republic of Kazakhstan decrees:

1. That the Land Code of the Republic of Kazakhstan adopted by the Parliament of the Republic of Kazakhstan on 19th May 2003 and received for signature by the President of the Republic of Kazakhstan on 27th May 2003 shall be recognized as consistent with the Constitution of the Republic.

2. That in accordance with paragraph 3 of Article 74 of the Constitution of the Republic of Kazakhstan the Resolution shall enter in force from the day of its adoption, it shall not be appealed, it shall be obligatory in the whole territory of the Republic and it shall be final with respect to the case stipulated by paragraph 4 of Article 73 of the Constitution of the Republic of Kazakhstan.

3. That this Resolution shall be published in the Kazakh and Russian languages in official republic's printed editions.

Land reform in Kazakhstan
Roza Zhumadillaevna

The amendments made in national legislation on land use in accordance to the "100 Precise Steps" Nation's Plan made in the spring of 2016 triggered vigorous response throughout Kazakhstan society. This partly can be explained by the lack of a robust awareness raising comparing on behalf of the state authorities about the amendments to the Land Code of the Republic of Kazakhstan. Consequently, the public debate about the new norms of land use resulted in series of public protests that took place in several regions of Kazakhstan.

In these circumstances, on May 5, 2016, President Nazarbayev held the extended meeting of the Cabinet where he criticized the work of the Ministry of National Economy and the Ministry of Agriculture of Kazakhstan. All these led to the resignation of the two ministers. Following the meeting, President imposed the moratorium until 2017 on certain provisions of the amended Land Code that had caused public discontent. The decision on the moratorium, on the other hand, was publicly supported.

After the moratorium was imposed in May 2016, President Nazarbayev of Kazakhstan appointed the Commission of 75 experts on Land Reform. It should be noted that among those appointees were a number of well-known civil society activists, namely the President of the Bolatkhan Tayzhan Foundation Mukhtar Tayzhan, Chairman of the National Social Democratic Party Zharmazhhan Tuyakbay, Chairman of the "Ұlt Taғdyry" Public Association Dosmukhanbet Kushimov, political expert Aidos Sarym and others. The Commission also included the members of the both Houses of the Parliament and the Cabinet as well as the representatives of the state bodies, political parties, academia and agribusiness. Furthermore, the Commission was based on the principle of regional representation. The secretariat was established under

the Ministry of Agriculture to ensure better feedback and transparency of the Commission.

By August 15, 2016, the Commission had held five sessions in Astana and four field meetings in the regions of Kazakhstan where the representatives of civil society were also present (Table 1). The major task of the Commission was to review of and make recommendations about possible improvements of the land legislation that should be worked out via a broader and more inclusive public debate as well as because of the work conducted within the four Working Groups, established within the Commission, that would focus on economic and legal issues as well as on awareness raising, transparency and procedures.

The Working Groups held seven sessions to develop their proposals on the issues discussed within the Commission. The work of the Commission was transparent and conducted in close cooperation with the media to enhance the coverage so that the public could obtain reliable information on the progress of the discussions.

The “jerturaly.kz” web-site and the Call-center were also opened on May 14, 2016, the “1434” line is available for the people in all regions of the country. By August 13, 2016, the Call-center had received 13,851 calls related to the issues of the land reform and individual housing.

In addition to the filed meetings of the Commission, the Public Councils under the district, city and regional Akimats (local executive authorities) have been actively involved into the work aimed at raising of the public awareness on the land reform. In May-August 2016, there were about a thousand filed meetings with about 67,000 people present. The proactive work of the Commission and the involvement of the Public Councils on the grassroots level enabled to provide the condition for comprehensive public debate of the land issue throughout Kazakhstan.

2. Sessions of the Commission on Land Reform in Astana

The first session of the Commission was held on May 14, 2016 and was attended by 70 people. The opinions on the land issue of 63 participants were articulated before the Commission. The session agenda included making the proposals on the activities of the Commission itself. Thus, the Procedures of the Commission were approved at the session. The Commission came to the conclusion that it was necessary to hold its sessions on a weekly basis. In addition, the initiative to establish a number Working Groups was supported in order to improve the overall performance of the Commission.

After the first session of the Commission on Land Reform, the Ministry of Agriculture reviewed its minutes and analyzed the opinions of the participants on the issues of land reform. According to the Ministry, the land reform was supported by 40% of the speakers, 19% were against and 21% of members of the Commission abstained from expressing their opinion.

The second session was held on May 21, 2016. The main item of the agenda of the second session of the Commission on Land Reform was the rights of private ownership

and leasehold of agricultural land granted to the citizens of Kazakhstan. In addition, the heads of the four Working Groups were elected. Rector of Kazakh Agro-Technical University Akhylbek Kurishbaev was elected the Head of the Working Group on Economic Affairs. It was decided that the Working Group would include 26 members of the Commission. The Working Group on Legal Affairs of 14 members of the Commission was headed by Mukhtar Tayzhan. Murat Abenov was elected to Head the Working Group responsible for awareness raising. This Group was comprised of 16 members of the Commission. Other 16 members of the Commission joined the Working Group on Transparency and Procedural Affairs headed by Dosmukhanbet Kushimov, Chairman of the "Ұlt taғdyry" Public Association

The majority of the members of the Commission present at the session spoke in favor of granting the right of private ownership of agricultural land to the citizens of Kazakhstan and maintaining of the right of lease of agricultural land for the citizens of Kazakhstan. In addition, the Commission touched upon the issues of efficient use of land, maximum size of agricultural land plots, as well as the new cadastral valuation methods. The Commission decided to hold a series of filed meeting in the regions of Kazakhstan to collect the opinions on the grassroots level so that the Commission's proposals would better reflect people's views on the issues on the agenda.

Third session of the Commission on Land Reform attended by 62 members was held on May 28, 2016. The main item on the agenda was the lease of agricultural land by foreign nationals and foreign legal entities as well as the land ownership rights granted to joint ventures with the participation of foreign capital.

The Head of Working Group on Economic Affairs Akhylbek Kurishbaev suggested that in the case of sale or lease of the agricultural land the preferences should be given to the local farmers. Mukhtar Tayzhan, the Head of the Working Group on Legal Affairs requested the explanation of the reasons for signing the multi-million dollar agreements on cooperation with multinational companies of China. He also raised the issue of the detention of certain individuals who had participated in the rallies held on May 21, 2016 throughout Kazakhstan and proposed not to charge them. Murat Abenov, who was the Head of the Working Group on Awareness Raising suggested the establishment of a single informational platform where people could place their proposals on the land question. In his turn, the Head of the Working Group on Transparency and Procedural Affairs Dosmukhanbet Kushimov proposed to publish the information on the land ownership in Kazakhstan.

The Commission rejected the proposal to grant the right of lease of land to foreign nationals. Some members of the Commission on Land Reform stated that that they categorically objected to the right to private ownership and lease of agricultural land that could have been granted to foreign nationals or, indeed, to joint ventures with the participation of foreign capital. The representatives of the Kazakhstan agricultural business within the Commission, however, were in favor of the lease option since, in their opinion, it would attract investors to agricultural sector of the national economy and boost introduction of new technologies into the agricultural sector.

The major items of the agenda of the fourth session of the Commission held on July 9, 2016 were the maximum size of agricultural land plots, public scrutiny while determining the boundaries of the land plots allocated for individual farming and the others. The members of the Commission suggested setting the limit on the maximum size of agricultural land plots. In their opinion, the size limit for agricultural land plots that could be leased by the citizens of Kazakhstan was a issue of great significance .

In addition, the participants at the session discussed the time limit for lease of agricultural land up to 49 years. The Secretary of the Commission on Land Reform Erlan Nysanbaev stressed the need to maintain norm providing for the land lease with annual assessment procedures within the first five years of the lease and proposed to amend the Land Code respectively so that the lease of agricultural land would include mandatory annual assessment procedures.

The Head of the Working Group on Economic Affairs Akhylbek Kurishbaev proposed to toughen the punishment for the violation of the land legislation. In particular, he suggested introduction of more severe penalties in the case of the damages caused to the national interests of Kazakhstan. The other proposal of the Head of the Working Group on Economic Affairs was to open a special website so that the information on the landowners, land tenants and land plots allocation would be publicly available.

The fifth session held on August 13, 2016, focused on the questions of the Commission activities, recommendation on the amendments into the land legislation that had been put forward by the four Working Groups of the Commission as well as on the prolongation of the moratorium on certain provision of the Land Code until December 31, 2016.

The Chairman of the Commission on Land Reform Myrzahmetov outlined the main recommendations that the Commission had worked out:

• maintaining the right for lease of agricultural land granted to the citizens of Kazakhstan for the period up to 49 years with mandatory annual assessment procedures of the land use within the first five years of the lease period;

• strengthening the control over the efficient use of land;

• introduction of the procedures regulating the transfer of agricultural lands; drawing the boundaries of the pastures and hayfields located in proximity of the villages and other types of settlements;

• maintenance of the possibility of expropriation of the land plots under individual housing for public needs.

The resolutions of the Commission were recorded by the working groups with the account of the proposals made during the session of the Commission as well as the filed meetings. The Commission resolved to submit its proposals to the Parliament of the Republic of Kazakhstan. In addition, the Commission voted to terminate the work of the Commission provided that its recommendations would be approved by the President of Kazakhstan.

3. Filed Meetings of the Commission on Land Reform

The main issues discussed at a series of field meetings held by the Commission were the amendments to the Land Code of the Republic of Kazakhstan and the imposed moratorium on its certain provisions. For example, the meeting held in Akmola region held on July 3, 2016 was attended by over 250 people. The representatives from the all areas of the Akmola region had an opportunity to participate via selector connection.

The participants in the meeting expressed their positions on the amendments to the Land Code of the Republic of Kazakhstan and asked all the questions they were willing to ask. Among the questions raised in the course of the meeting were those relating to the sale of agricultural land, the land lease rights granted to foreign nationals and foreign legal entities, social issues, development of rural infrastructure, and others.

A special working group was established that included the representatives of regional administration, most reputable citizens, major agricultural producers, public associations, "Nur Otan" party members, deputies of the Maslikhat, academics, labor veterans, and lawyers. The working group task was to discuss of the amendments to the land legislation. The Activities Plan was developed for the regional working groups so that they could outreach all the areas in the region with their land reform awareness raising campaign. On June 3, 2016, there were three meetings, the two of them were held with the participation of regional Public Council and the representatives of various segments of the population, namely intelligentsia, agricultural business, Maslikhat deputies, public associations, political parties, and the media. In addition, a series of field awareness raising seminars were held in all areas of the Akmola region with the participation of agricultural producers and the representatives of local communities.

At the cabinet meeting held on June 14, 2016, Prime Minister Karim Massimov appointed the Minister of Agriculture of Kazakhstan Askar Myrzakhmetov to curate the work of the Commission on Land Reform. The Commission held its filed meeting on June 18, 2016 with broad grassroots participation in Almaty region at the premises of "Bayserke-Agro" Holding. The Chairman of the Commission on Land Reform Bakytzhan Sagintayev introduced the members to the newly appointed Chairman, Deputy Prime Minister, Minister of Agriculture Askar Myrzakhmetov.

In the course of the filed meeting, the representatives of agricultural business of Almaty region spoke in favor of the right to lease agricultural land granted to the citizens of Kazakhstan for the maximum period of 49 years, they draw the attention to the fact that not all farmers had enough money to buy land. As for land lease rights to foreign nationals or foreign legal entities, the participants to the session proposed to limit the lease period to ten years and to prohibit private ownership of agricultural lands by foreign nationals or foreign legal entities. In addition, the representatives of the local communities raised the issues of rural development, infrastructure, attracting investment in agriculture. The establishment of a specialized Agrobank was suggested as a mechanism to tackle these issues.

The Commission chaired by the Minister of Agriculture of Kazakhstan Askar Myrzakhmetov held a filed meeting in the village of Nagi Ilyasov in Syrdarya area of Kyzylorda region on July 2, 2016. Minister Myrzakhmetov enumerated the issues that had been considered earlier at the previous session and filed meetings where the Commission had been able to work out a comprehensive set of the proposals and recommendations. Minister Myrzakhmetov announced that further session and meetings of the Commission would be held in a different format with the particular amendment of the Land Code being the main item of the agenda at each of these future events. The Secretary General of the Commission on Land Reform Erlan Nysanbaev presented his report where he put forward several proposals for further discussion:

- to maintain the right of lease of agricultural land for 49-year period

maximum, and to include representatives of Public Councils, National Chamber of Entrepreneurs, and public associations into the tender committees that would decide on the issue;

- to develop and adopt the Rules and Procedures for the agricultural

land lease tenders. The Rules and Procedures shall specify the powers of the Akimats, the dates when the beginning of the tenders shall be announced by the national and regional media;

- to develop and adopt a standard lease agreement that would provide

for the rights and obligations of the land users;

- To strengthen the requirements for the efficient use of land. In

particular, the requirements on crop diversification, soil conservation, land treatment, average crop capacity (not less than 85%), production technology, environmental protection, attraction of investment and appliance of new technologies.

The other issues on the agenda were the maximum size of land plots and banning private ownership of the land located less than three kilometers from the restricted area along the state border of Kazakhstan.

The next field meeting was held on July 23, 2016 in Dosmukhamedov Atyrau State University chaired by Askar Myrzakhmetov. The main item on the agenda was the maintenance and improvement of the norms of agricultural land lease by the citizens of Kazakhstan, the allocation of the pastures land so that they would meet the needs of the local individual farmers. The participants at the meeting also exchanged their views on the issue of private land ownership for Kazakhstan citizens and land lease for foreign nationals.

In the course of the meeting, the Heads of the Working Groups of the Commission made their proposals. The Head of the Working Group on Economic Affairs Kurishbaev made suggestions for improving the norms pf agricultural land lease and for monitoring procedures. In particular, he suggested the procedure of mandatory annual assessment within the first five years after the lease agreements. In addition, Kurishbaev proposed to establish a special procedure for the land lease tenders that would involve Public Councils and the representatives of public associations as well as the National Chamber of Entrepreneurs. M. Tayzhan, the Head of the Working

Group on Legal Affairs, reported on the results of the Group's work and spoke on the issue of providing the pasture land plots to meet the needs of individual farmers.

Concluding the meeting, the members of the Commission decided to work out a single package of documents that would include all the conclusions and recommendations. The comprehensive overview of all the proposals were presented at the fifth session of the Commission on Land Reform held on August 13, 2016.

4. Commission's Key Recommendations on Land Reform in Kazakhstan

Having summarized all the proposals, suggestion and recommendations made during the work of the Commission and its four Working Groups, the Commission Chairman Askar Myrzakhmetov presented a comprehensive vision of the amendments into land legislation of Kazakhstan at the fifth session of the Commission held on August 13, 2016. These recommendations may be divided into six categories.

1. Agricultural Land Lease by Natural and Legal Persons of Kazakhstan

1.1. To maintain the rights to lease agricultural land granted to the individual the citizens of Kazakhstan and legal persons of Kazakhstan for the period of 49 years maximum.

1.2. To enhance the control mechanisms over efficient land use and over the observance of the obligations that are assumed by the land users under the lease agreements through conducted specified monitoring measures: annual assessment procedures within the first five years for all types of land use with subsequent assessment conducted every third year of the use of irrigated land and every fifth year of the use the rain-fed land.

1.3. To amend Article 43 of the Land Code of Kazakhstan so that it would provide for clearly specified regulations of land use rights related to the land plots allocated for agricultural purposes. These regulations shall specify the procedure a person, willing to lease the land, and the government agencies concerned, shall follow.

1.4. To ensure transparency of land lease; to that end to include in the tender commissions, established by local executive bodies, the representatives of the Public Councils, public associations, and non-governmental organizations. However, the suggestion to include into the tender commissions the representatives of the prosecutor's office and the media was not included in the final version of the document prepared by the Commission.

1.5. To develop and adopt the Rules and Procedures of land lease tenders that would specify the responsibilities and procedures the Akimats shall follow.

1.6. To specify the land lease periods that would depend on the volume of investments stipulated under the business plan or the production program. The decision on lease term prolongation shall be made with the participation of Public Councils and public associations, such decision shall be based on the findings of the assessment procedures of the land use and the proper execution of the terms of the lease agreement.

1.7. To develop and adopt a standard agreement on the lease of agricultural land that would specify and enhance the rights and obligations of the land users.

1.8. To strengthen the requirements of efficient land use.

1.9. To establish the norm stipulating for granting the initial right for agricultural land lease for five years period with subsequent granting the right of the land ownership provided the efficient use of land have been manifest. The decision shall be taken with the participation of local Public Councils.

2. Requirements for State Control over Land Use and Land Protection

2.1. To amend the provision of Article 14 (12(1)) on the competence of the central authorized body to monitor the legality of the decisions made by local executive bodies of the regions, cities of republican significance, capital city, cities of regional significance in the field of land legislation. Moreover, the competence of the central authorized body shall include the petition and action in courts.

2.2. To expand the list of the persons who shall have the right to initiate the assessment procedures on the legality of the decisions taken by the competent authorities.

2.3. The competence of the Akims in land regulation within the boundaries of the village and other types of settlements shall include the following: control over individual land users and prevention of illegal trade or exchange of publicly owned land and/or other illegal transactions; the right to issue binding orders on reparations in the case of violation; arbitration of administrative offenses.

2.4. In order to prevent idle land projects, to reduce the period of validity of the positive conclusions to one year.

3. Maximum Size of Agricultural Land Plots within Administrative Borders for Leasehold of Citizens of Kazakhstan

3.1 To limit the maximum size of agricultural land plots subject to leasehold to prevent emergence of latifundiums.

3.2. To endow the central authorized bodies with the competence to develop and adopt the methodology for determining the maximum size of agricultural land plots subject to leasehold of the citizens of Kazakhstan.

4. Allocation of Land for Agricultural Purposes in Close Proximity to Restricted Area along State Border of Kazakhstan

4.1. For the purposes of maintenance of national security to set the restricted area in close proximity to the state borders of the Republic of Kazakhstan; allocation of agricultural land shall be for leasehold only and the right for the land lease in the restricted area shall be granted exclusively to the citizens and legal entities of the Republic of Kazakhstan.

5. Regulations of Pasture and Hay Land Use by Individual Farmers Located within Boundaries of Villages and Other Types of Settlements

5.1. To introduce the regulations restricting the size of livestock in private ownership via making the amendments to the existing legislation in order to solve the problem of providing the rural residents with the pastures and grasslands. In addition, to introduce the ban on allocation of the pasture and grassland within the territories of villages in order to meet the needs of the population for privately owned land use for individual farming.

5.2. To amend the land legislation in order to expand the territories of villages and other types of settlements to meet the need of local individual farmers for the pastures and hayfields. To introduce the norm providing for possibility of expropriation of the land plots for the public needs in order to meet the need of the local population for the pasture and haylands.

6. Allocation of Land Plots for Individual Housing as Exceptional Case with Possible Expropriation for Public Needs

6.1. To make expropriation of land plots possible in executional cases and to introduce the norm that would provide for inclusion of the needs for individual housing construction into the public needs.

The Commission resolved that the proposals for maintenance and improvement of the norms of agricultural land lease and ownership by the citizens of Kazakhstan should be submit to the Parliament. The Chairman of the Commission on Land Reform Askar Myrzakhmetov suggested prolongation of the current moratorium for five more years, until December 31, 2021 and gave the following reasons: the need to conduct robust and comprehensive inventories of land, to collect accurate data on the quality of farmland, and to develop the proposals for the amendments into the Land Code and other relevant legislation. The Chairman suggested submission of the proposal on the prolongation of the moratorium to the President of the Republic of Kazakhstan. This initiative was supported by the Commission. According to the resolution adopted at the session of the Commission, in the case of approval by the President of the moratorium prolongation until December 31, 2021, the Commission shall terminate its work.

On August 18, 2016 President Nazarbayev of Kazakhstan held the cabinet meeting on socio-economic development of Kazakhstan and the findings of the Commission on Land Reform. The meeting was attended by Prime Minister Massimov, Head of Presidential Administration Dzhaksybekov, Deputy Prime Minister, Minister of Agriculture Myrzahmetov, President Aide, Secretary of Security Council Ermekbaev, and Minister of National Economy Bishimbayev. In the course of the meeting, President Nazarbayev praised the work of the Commission and supported the proposal to prolong the moratorium on the certain provisions of the Land Code for a period of five years. Following the meeting, President Nazarbayev gave a number of specific instructions and extended the moratorium amending his executive decree № 248 "On

Moratorium on Certain Provisions of the Land Legislation in the Republic of Kazakhstan" of May 6, 2016.

Conclusions

The work of the Commission on Land Reform was the first successful experience of the joint efforts of the representatives of state bodies and civil society. The government demonstrated its willingness to maintain a constructive dialogue in order to find the common approaches to address important social challenges. The Commission, established after the amendments to the Land Code of the Republic of Kazakhstan had been received rather negatively by the public throughout the country, provided a platform to public debate. A number of other problematic issues related to the life of rural residents and to the prospect of further development of the agricultural sector of Kazakhstan were revealed during the discussions at the sessions of the Commission as well as at its filed meetings.

In addition to the issues of lease and ownership of agricultural land, a number of other actual issues were raised in the course of the work of the Commission, for example the condition of the land available for lease or sale, evaluation of the cadastral value of the available land, efficiency of land use, investment and innovation in the agricultural sector of the national economy, restrictions on land use within the territories of the villages and other settlements, and restrictions of land lease in close proximity to the state borders of Kazakhstan. All these issues are of fundamental importance for the development of the rural areas and the agricultural sector of Kazakhstan. Therefore, their timely resolution is of particular significance for the overall wellbeing of the people of Kazakhstan.

Summing up the work of the Commission, it can be concluded that the decision to prolong the moratorium on the certain provision of the Land Code of the Republic of Kazakhstan is the most significant result of the debate facilitated by the work of the Commission. This shall provide for the opportunity to reexamine and carefully analyze all the issues related to the land question in Kazakhstan, such as land protection and its efficient use as well as the development and consolidation of the institutional foundation for private ownership and lease of agricultural land in Kazakhstan. Therefore, to find the effective solutions of the land issues in Kazakhstan, involvement of highly qualified specialists into the work thereon and ongoing monitoring of that work shall be needed.

Bubniak Andrey

Technical capabilities and management of drones for obtaining information for assessing land degradation

With the advent on the market of a large number of quadcopter and UAVs, the question arises about the possibility of their use in the Earth sciences and for the study of land degradation in particular. Their relatively low cost and ease of maintenance makes them a convenient tool for field research. You also need to point out the environmental aspect. Almost all unmanned electric batteries are used, so their impact on the environment is minimal.

An important point regarding drones is the legal and legal requirements. Each country has its own requirements and rules regarding the drones to be followed..As the number of drones increases year by year, the control bodies were forced to intervene in the sphere of UAV use. It is not uncommon for pilots to violate the rules of behavior in the air. As a result, accidents occur, falls of quadrocopters in public places, penetration into protected areas.In the airspace control center of Kazakhstan, it was noted that for coordination in the settlements in the process of security measures, as well as for flights over the controlled areas, it is necessary to coordinate actions with the State Security Service of the Republic.Drones are in great demand and popular in developed countries. In many of them, the rules of use and limitations are practically the same:

- adhere to the established height (within 100 meters);
- manage only during the day;
- do not exceed the limits of visibility;
- do not fly around crowded areas, airports, stadiums, protected facilities;
- be sure to check the condition of the device before flying.

There are countries, one of them is the United States, where a compulsory and facilitated registration procedure for drones has already been successfully carried out. It is carried out via the online interface in just 5 minutes. In the event of damage caused by a droning or violation of safety rules, it is possible to bring the owner to justice within seconds.

In my presentation I will talk about the experience of using such drones as Phantom 3 and Mavic Pro. Despite their small size, they are quite comfortable to collect information about the Earth's surface. They take up little space during transportation, which is important in conducting field research. They are equipped with video cameras that allow you to make high quality videos and photos.

Drones are managed using a remote control as well as a smartphone or tablet. The most popular program for controlling most quadcopter is the DJI program. It uses basic flight modes and parameters. For example, you can set a limit on the altitude and range of the quadcopter, parameters of video camera etc. Also, before starting the flights, it is necessary to carry out the calibration procedure of the compass.You see the position of the quadcopter and its movement on the screen. There is also an opportunity to observe which objects the qudrokoptercaptures.Unmanned aerial landing and landing can occur both manually and in automatic mode.With this program, you can also choose different flight modes.All information is recorded on the mini SD.

But this program is not enough for the purposes of photogrammetry, since it is impossible to determine the route of flight along the specified trajectories and certain overlap. For this purpose we use additional software, namely Pix 4D Capture and Altizure. These programs are free and like DJI GO can be installed on a tablet or cell phone. With the help of Pix 4D Capture , various flight parameters are set, as well as shooting of objects - the shooting height, the shooting area, the flight speed, the angle of the lens, the overlap when shooting.Likewise, shooting with Altizure takes place . This program should be used to create 3D models of the high quality.

The resulting video and photo data can be used for visual analysis, as well as for further processing using special programs for creating digital maps and 3D models.

In conclusion, it is necessary to address the problematic issues associated with the use of drones. These questions can be divided into three groups: legal, technical and natural.

Like other technical devices, drones have their own technical limitations. This concerns, first of all, the flight time. Charging a single battery is enough for a flight for 25-30 minutes. Also, sources of electromagnetic radiation affect the drones and, if possible, they should be avoided. The natural conditions that determine the conditions for the flight of drones are first of all the state of the weather. It imposes a significant

restriction on the use of drones. For example, it is impossible to fly during a rain, snowfall or strong wind. At minus temperature, the battery charge is reduced by approximately 30%.

But, despite the above problems, drones are increasingly penetrating into various areas of our lives, including Earth sciences. This is caused, first of all, by their relative cheapness and ease of management, as well as the ability to receive large amounts of data at low financial costs.As our own experience shows, mastering drone management does not take much time. And with the availability of appropriate software and simulators, this process is significantly accelerating.

Participants during practical classes

Attachment 4.

Field trip in conservative agriculture farm.

The group visited agricultural production cooperative «Aman Agro Service» which is located in South Kazakhstan area, Kazygurt region, «Kizilkiya» village. The direction of cooperative work is growing of crops, including seed production. Area of cooperative is 25100 hectares. The objectives of the visit by participants were to provide knowledge on crop production, as well as familiarization with the methods of degraded soils restoration.


КОМПЬЮТЕР И БЕЗОПАСНОСТ


ЦЕХ № 3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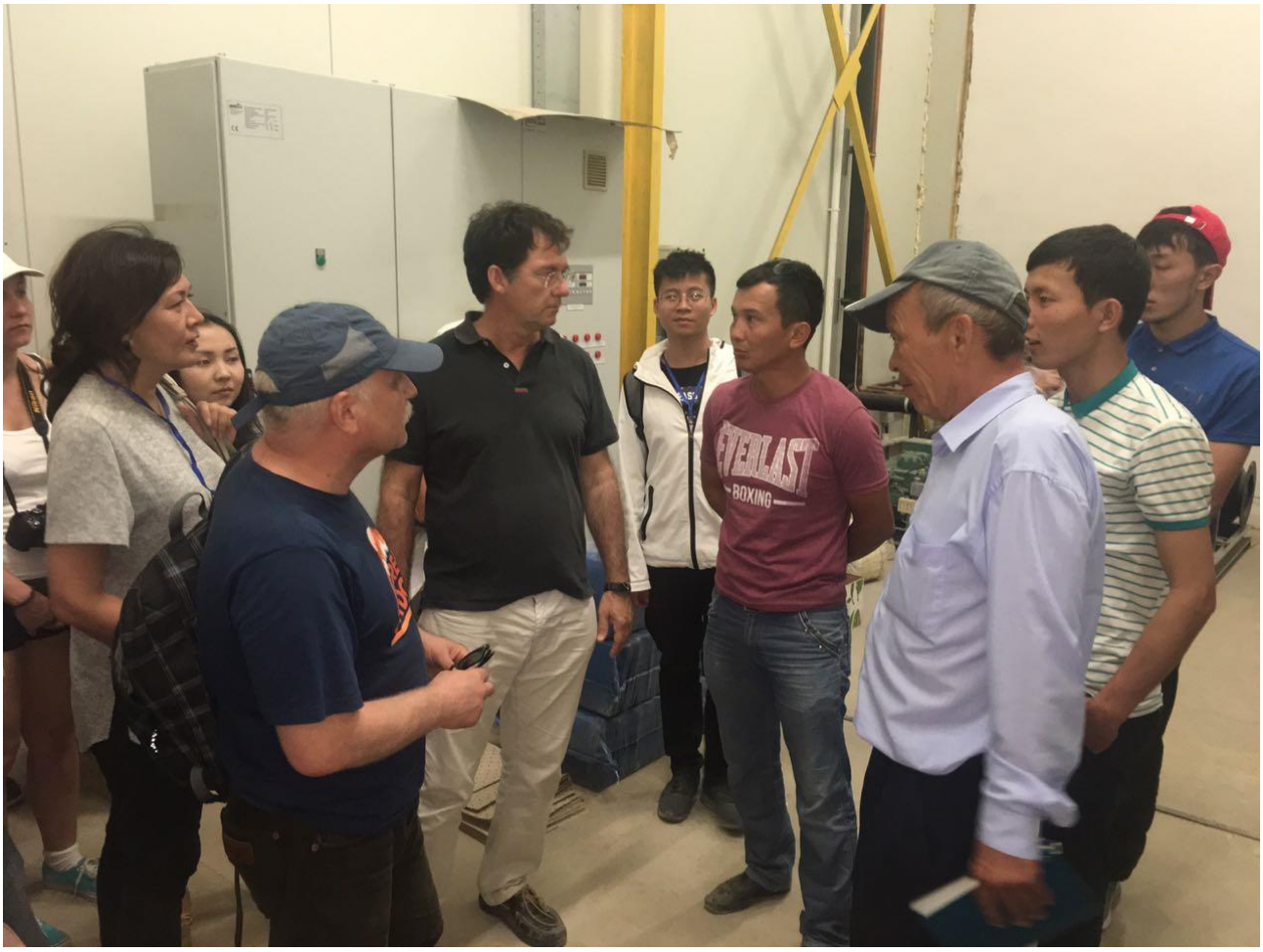
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