

## **Mountains and desertification, the social and economic reasons and consequences**

KH. A. AKBAROV, A. YU. NOGAY and A. B. RAJABOV

*Tashkent State Technical University, University st. 2, Tashkent, 100095, Uzbekistan, e-mail: Khakbarov@rambler.ru*

The population of Globe exceeds 6 milliard people. Till now the history did not know such fast rates of growth of the population. In the current times, the growth rate of world population is app. 80 million people per year. Very soon, we may await a problem of maintenance of mankind resources and especially high – quality food stuffs, fresh water, ecologically pure regions for rest and recovery of health.

In the Central Asia republics and Kazakhstan also, the history doesn't know such fast rates of growth of the population. Physico – geographic conditions of the Central Asia are very variable. In many parts, there is an intensive human activity, which has led to meso – scale changes of a climate, desertification, and air pollution at transboundary scale. (e.g. Aral sea, Fergana valley, etc.)

Desertification is one of the largest ecological, social and economic problems of the current times. Desertification is degradation of the grounds in droughty, half – arid and dry subgumed areas as a result of action of various factors, including change of a climate and activity of the people. Changes in climate cause deficiency of water resources. Other determining factor of desertification is the anthropogenous impact.

At the beginning of 21st century, people have the right to live in a healthy environment. For today, the concept of social and economic development of the society, based on irrational use of natural resources, has collided to development of healthy environment. Degradation of the nature, pollution of natural resources and atmospheres, warming of climate, soilerosion, desertification and deforestation, accumulation of huge amounts of industrial and household waste are only some phenomena of irrational activity of human society. Protection of a surrounding environment, rational use of natural resources and maintenance of ecological safety are the most actual global problems of the present.

The human being existence is connected to mountains. Any changes in mountains are quickly reflected in plains. Mountains cover the largest part of Central Asia. They offer valuable resources for man existence such as water supplies, cultivation grains, gardens, pastures, reproduction of woods and herbs, zones of a rest and tourism, a place of dwelling of rare

birds and animals as ecologically pure corners of the world, a place for religious pilgrimage, a refuge and a bastion during time of wars. A civilization on plain has begun with mountains. Mountains are everywhere a concentration of ethno, cultural, language and biological variety. Development and use of mountain territories in many aspects determine character and way of development of the world community as a whole.

Steady social and economic development and development of mountain regions, migration of people in the mountains (geology, mountain job, hijack animal industries, mountaneering, tourism, etc.) are impossible without maintenance of a normal life – activity and preservation of working capacity for people. Mountains occupy one fifth of the land of our globe, and there live 10% of the population of the Earth. Over 50 countries of the world have mountain territories.

High ranges play the vital role, being natural condensers of a moisture in droughty Central Asia. The fundamental part of a drain of the rivers making a basis of water supply is formed in mountains. A significant share in a drain of the rivers belong to the thawed snow formed at glaciers. Now, the area of glaciers is reduced, that affects the hydrology of rivers – at one side, the amount of water increases, at the other it is reduced. The degradation is caused by natural and anthropogenous factors. The global warming is connected not only to increase of temperature of the air and intensity of thawing of ice but also to desertification of territories adjoining Tien Shan. One of the negative effects of process of desertification is an increase of a dust in the atmosphere and its subsidence on glaciers, therefore the rate of thawing increased for 10 – 20 times in the recent years.

Influence of the anthropogenous factors leads to impurity of glaciers and mountain water sources. Considering importance of water resources for the Central – Asian region, the establishment of monitoring structures and sites appears to be one of the most important tasks. As well as in other Central – Asian countries, these problems also increase in Uzbekistan. and its reaction demands constant local and regional complex of ecological monitoring.

Mining manufacture, from the ecological point of view, is a heaviest manufacture, at which it is hard to find compromise between technical, economic and ecological requirements. Therefore, the development of essentially new, ecologically purer technologies is the main problem. The basic sources of pollution of natural waters are the mining and mineral processing enterprises. Superficial waters become soiled as a result of release of sewage in them.

Republic of Uzbekistan is situated in the middle part of Central Asia and lies between Amu – Darya and Syr – Darya rivers within desert zone. Uzbekistan is influenced by the continental climate characterized by cold wet winters and long dry summers. The republic has approximately 4,474,000 square kilometres of total land area and 24.5 million of inhabitants. Density of population is around 50.4 people/km<sup>2</sup>. Territory of Uzbekistan is stretched from north – west to the south – east. In the west, Uzbekistan borders to Turkmenistan, Kazakhstan, Kyrgyzstan, Tajikistan, and Afghanistan.

The territory of Uzbekistan is located in Urals – Mongolian folded belt, which is settled off the East – European and Siberian platforms. Some regions are dominated by Pre – Paleozoic sedimentary – metamorphic and magmatic rocks as well as regions filled with Mesozoic and Cenozoic sedimentary rocks. The first ones are situated on the eastern part of Uzbekistan within mountains and within Central Kyzykum Hills, the others on the western plain country and within the inter – mountain depressions of the east.

It is known that the mineral raw materials play important role in the scientific and technical progress, and they are the base of economic stability of any state. The main goal of the young independent state – Uzbekistan – is to transform itself into powerful democratic state with high standard of life and stability in economics and policy. Rational and effective usage of natural resources is the main political strategy of current Uzbekistan.

The mineral raw materials are important for Uzbekistan economics, geopolitics, independence and national security. In present and in prospect, mineral raw materials are one of the most principal factors for industrial development of the country. Mineral raw materials, geological survey, mining and metallurgical industry of Uzbekistan are the important component of Uzbekistan economics.

As the Uzbekistan president I. A. Karimov said: „ ... in the world, there are not large number of countries possessing the same natural resources like Uzbekistan. Uzbekistan takes a legitimate pride in its mineral resources where there are particularly all of the elements of Mendelejev table...“

Potential of mineral resources have been estimated totally up to US \$ 3.3 bilion. Annually in Uzbekistan commercial minerals have been mined to a total value of US \$ 6 – 7 miliard. In present mining and treatment of minerals, there have been occupied one of the leading position in economics and exert influence upon industry and agriculture. According to the mineral wealth, Uzbekistan is one of ten countries with advanced mining extractive industry. Among the mineral resources of Uzbekistan, there are deposits of coal, oil, gas, uranium, gold, silver, base metals, rare elements, salts, sulphur, gemstones, mineral waters, etc. Uzbekistan is one of the most wealthy metallogenic provinces. According to the gold reserves, republic is on the fourth place in the world and according to its mining, on the seventh place. On the base of ore actual reserves, many minings and metallurgical plants function today. Among them, there are such giant plants as Navoi mining and metallurgic plant, working on the base of the unique gold deposit Muruntau, Almalyk plants, working on the base of porphyry copper deposits Kalmakyr, Dalnee, etc. They are the components of the state concern

„Kyzylkumredmetzoloto“, Almalyk mining and metallurgical group of enterprises, Joint stock companies „Uzstroyaterial“, „Uzbekalmaz-zoloto“, „Kumur“, etc.

More than 2,700 deposits and manifestations of 100 different minerals have been discovered in Uzbekistan territory. Among them, there are 155 deposits of oil and gas, 40 deposits of gold and silver, 42 deposits of base metals, rare and radioactive elements, 15 deposits of salts, 20 deposits of gem – stone, etc. Actual reserves of gas make up to 2 billion ton. Oil and gas reserves have been estimated totally up to US \$ 1 trillion.

The main goal of this work is to discuss the impacts of mining and metallurgical plants activities on the surrounding environment and ecosystem and also to understand the negative relationship between them.

Mining and metallurgical plants influence negatively on the environment. They have caused a huge pollution of the atmosphere, soils and waters. Enormous accumulation of more than 1.5 bilion m<sup>3</sup> and processing industries represent the potential danger. The annual accumulations of waste make up 25 milion m<sup>3</sup>, 42 milion ton of tailings and 300 thousand ton of metallurgical slags. Their presence in environment leads to the pollution of air, soil and to contamination of ground waters with heavy and toxic elements (lead, zinc, arsenic, cadmium, oxides of sulphur and nitrogen, cyanides, etc.).

It is necessary to realize the volume of wastes and tailings, which deposited in area of 77,400 hectares of soil. Soils in the neighborhood of the mines and metallurgical plants are contaminated with metals and their concentrations exceed background levels of metals up to 100 – 1,000 times. The vegetation is oppressed in this area.

We give the growth of waste volumes in different years for Almalyk and Angren industrial regions (Tab. 1) as an example.

Tables 2 and 3 show the concentrations of heavy metals in waters near Almalyk industries region. Elevated concentrations of Zn, Cd, Mo, Cu, Pb were found in waters near metallurgical plants. Concentrations of toxic elements have been exceeded background level 230 – 7,100 times.

Geochemical study carried out near Ustarasay As – Bi deposits has shown exhalation of toxic vapours in the vicinity of the deposition. Early shedding of leaves and increased populations of weeds have been observed. Waters with elevated concentrations of Bi, As, S, etc. leached from industrial wastes flow into Koksui river and then into Charvak storage lake. Arsenic concentrations in some water samples ranging up to 1.5 – 3 mg/l may increase risks to the human health and the environment. Elevated levels of arsenic can be found in plants growing on contaminated soils (for example As content in plant ash reaches up to 3%).

Nitrogen has a diverse effect as well. In soil and plant samples within Almalyk mining and metallurgical plants territory, concentrations of nitrogen are relatively high (exceeding average levels from 6 to 90 times). Accumulation of nitrogen in soils is characteristic for upper horizons. (Tab. 4).

Large amounts of SO<sub>4</sub> are present in the waters of the industrial districts. Average concentrations reach 2,550 mg/l, exceeding regular levels up to 250 times. Cereals tend to accumulate higher base metals

Kind of waste	Waste volumes for a year (million ton)			
	1980	1985	1990	1995
<b>Plants of Amalyk mining and metallurgical group of enterprises</b>				
Wastes of overburden	750	1,060	1,700	2,100
Dressing tail	412	575	725	890
Slag's of metallurgical plants	4.7	7	8	9.5
Total	1,167	1,642	2,433	2,991
<b>Plants of Angren industrial region</b>				
Total	400	660	920	1,075
OVERALL	1,647	2,302	3,353	4,066

**Tab. 1** Waste volumes of mining and metallurgical plants of Amalyk and Angren industrial regions.

Composition	Limit	Sampling Localities		
		Almalyk plant district	Akhangaran cement work	Waters of marginal land
Water pH	6.5 - 8.5	6.1 - 8.2	7.9 - 8	7 - 7.8
Dry remnant	1,000	592 - 3,950	200 - 366	270 - 4,850
Chlorides	350	33 - 177	12 - 37	18 - 736
Sulfates	500	179 - 2,600	43 - 60	63 - 2,469
Ca	3.5	108 - 432	38 - 76	48 - 551
Mg	20	4 - 147	10 - 16	11 - 213
Fe	0.3	trance - 450	-	-
N of ammonia	2	0.7 - 4.5	0.1 - 0.4	0.4 - 21
N of nitrates	10	6 - 40	18 - 39	3 - 25
Cu	0.5	0.059 - 5.2	0.052 - 0.0073	0.0055 - 0.31
Zn	1	0.127 - 346	0.006 - 0.022	0.017 - 0.77
Ni	0.1	0.02 - 0.4	-	0.005 - 0.02
Cd	0.01	0.0019 - 12.1	0.0002 - 0.0007	0.0003 - 0.035
Pb	0.1	0.01 - 22.4	0.0042 - 0.0071	0.005 - 2.32
As	0.05	0.001 - 3	-	0.55 - 0.7

**Tab. 2** Chemical composition of surface waters within territories of Almalyk mining and metallurgical plants and Akhangaran cement works (range, mg/l).

Metals	Limit	Sampling localities					
		Tashkent channel	Borehole	Almalyk near lead plant	Uzbek zoloto	Almalyk waste water, zinc plant	Almalyk stream waters
Cu	0.01	0.022	0.31	0.086	-	5.2	0.3
Zn	0.05	-	0.77	3.5	-	346	0.127
Cd	0.005	-	-	0.105	-	12.1	-
Mo	0.0012	-	-	-	0.2	-	-
W	0.0008	-	-	-	0.022	-	-
Pb	0.1	-	-	-	-	22.4	-

**Tab. 3** Heavy metal concentrations in waters of Almalyk region (mg/l).

Sampling locality	Composition (%)	Horizont (cm)			
		0 - 10	10 - 25	25 - 65	65 - 125
Almalyk (Kurgashinkanbase metal deposit)	N	2.5	1.52	1.25	0.5
	S	1.2	1.56	0.37	1.3
Akhangaran (cement works)	N	0 - 10	10 - 35	35 - 60	60 - 120
	S	2	1.64	1.5	1.2
		0.25	0.19	0.06	0.15

**Tab. 4** Distribution of Nitrogen and Sulfur in soils near Almalyk and Akhangaran industrial districts.

concentrations and influence human and animal health via food. Drinking water is also strongly influenced by the local geochemistry. In the vicinity of mining and metallurgical plants, lead levels in plant ash have been exceeded from 1,000 to 10,000 times.

The total area occupied by quarries, wastes and tailings in this region is around 20,000 hectares. There is no rehabilitation of mining territories as well as decontamination and reduction of toxic wastes. Landslides and degradation of pastures has becoming more common.

The activity of mining and metallurgical plants has resulted in the activation of geochemical processes, which exert negative influence on the biosphere and change natural geochemical levels. There are no technologies present for the reutilization of wastes. Hence immediate action has to be taken for land decontamination and utilization of wastes, which have become a problem of national significance. At the present time the impact of mining and metallurgical industries on the environment and biogenesis is more significant than the natural processes of biospheric change.

In the Republic of Uzbekistan, consideration has been given to the environmental problems at present. There are some programs for the protection of the environment which include the following:

- creation of database on wastes and tails;
- creation of database on the concentration of pollutants;
- study and mapping of risk areas with increased content of heavy metals in soil, air, streams and ground waters;
- study of negative impacts of wastes and tails upon the population, vegetation, animals, soils, etc.
- pursuing technologies on general utilization of mineral raw materials, implementation of low waste technologies;
- pursuing technologies for the extraction of valuable elements from tails of gold, copper and base metal plants;
- pursuing technologies for waste treatment, creating economic plans for the development of potential technologies.

Obviously, influence of the climate on stable development is changing. Gradual increase of air

temperature on a global scale is presently considered to be an established fact. According to the last estimations, in comparison with the end of the last century, air temperature has increased by 0,3 – 0,6° C. The 1990's have been the warmest decade of the 20th century, and the 20th century has been the warmest century for the last 1,000 years. In relation to the global climate change, the global hydrological cycle becomes more active and intensity of atmospheric circulation increases. This leads to increases in natural variability of weather conditions and occurrence of significant anomalies and spontaneous phenomena. Recent global warming influences global climate system and presents a serious stress for ecological, social and economic systems and for the human health.

The influence of global warming occurs recently in all of climatic systems and is serious stressful factor for ecological, social and economic systems and for the health of human population. The climate changes are influenced by the natural factors and also by the factors of anthropogenous character in global and regional criteria. The global climate varies as a result of the various processes, which are leading to a change of streams of radiating energy inside of system. There is a high number of the theories explaining the reasons of occurring climatic changes by variations of luminosity of the Sun, parameters of an orbit of the Earth or its speed of rotation, amplification or easing of volcanic activity, change of gas composition of an atmosphere and the other factors.

However, for solving problems of improvement of using of the natural resources of mountains, it is necessary to realize, that first of all, the advisable activities of people should promote the preservation of their resources and reproduce ability of the environment. Instability and ecological fragility of ranges causes necessity of the complex account of specificity of region, especially protected natural territories.

Preservation of ecology of mountain regions is directly connected with processes of desertification. Therefore, preservation of ecological equilibrium in mountain regions of the Central Asia has a huge social and economic value in the life and activity of people occupying the Central Asia.