MINISTRY OF NATURAL RESOURCES AND PROTECTION OF ENVIRONMENT
OF THE REPUBLIC OF KAZAKHSTAN

NATIONAL STRATEGY AND ACTION PLAN ON CONSERVATION AND SUSTAINABLE USE OF BIOLOGICAL DIVERSITY IN THE REPUBLIC OF KAZAKHSTAN

KOKSHETAU, 1999

"Kazakhstan should become a clean and green country with fresh air and transparent water…"
The Strategy "Kazakhstan-2030"

The Republic of Kazakhstan plays an important role in the case of biodiversity conservation. It is the most vast Central Asian state located at the centre of Eurasia on the crossroad of ancient historic caravan ways which linked Europe and Asia. The state has a huge potential of natural resources that cased the great diversity of landscapes, ecological systems and species. Accumulated knowledge and rich experience of Kazakhstani researches let to develop the effective policy in this field.

Biological diversity, as the rest of the natural components was mostly threatened due to such problems as drying up of the Aral Sea, nuclear tests during the forty years at the Soviet testing areas, and the practice of industrial and agricultural use. Despite the social and economic difficulties of the transition period the way to ecologically safe and sustainable development is becoming one of the priority directions of the development Strategy of the Republic of Kazakhstan at present time.

Development of the National Strategy for implementation of the Convention goals is based on the "Strategy of the Republic of Kazakhstan Development until the Year 2030", where priority goals and respective objectives have been clearly identified. We believe that the diversity of the animal and vegetable world that Kazakhstan possesses shall not be lost.

Thus the Republic of Kazakhstan is facing the issue of adopting decisive measures on conservation of the biological diversity and, first of all, of the rare plant and animal species, and unique landscapes; it should use biological diversity without damage to its self-reproductive capability; and as the economy develops, to take measures on renewal of degraded ecosystems, first of all, forest, pasture, and hay harvest ones.

Paying exclusively important significance to this problem, Kazakhstan has become a Party of the Convention on Biological Diversity. With the financial support of the GEF and UNDP and with the participation of domestic scientists and consultants it has developed the National Strategy and Action Plan on conservation and sustainable use of biological diversity of the country in line with the requirements of the Convention regulations, the national specifics and the social-economic situation of the Republic.

It has given an analysis and assessment of the biological diversity status, and convincingly shown that the considerable part of the species diversity of the Kazakhstan biota located in the center of the Euro-Asian continent has a trans-boundary character. Therefore, conservation of biological diversity has a global significance and shall render a considerable impact on the neighboring countries.

The National Strategy and Action Plan propose measures on improving the management structure the legislative and standard legal basis of conservation and sustainable use of biological diversity.

Specific measures on establishing specially protected territories, environmental education and training systems, ecological tourism and others have been identified. Fulfillment of the priority strategic objectives being planned shall considerably improve conservation of biological diversity as a basis for sustainable social-economic development of Kazakhstan.

I would like to express gratitude to all the participants of the preparation of the National Strategy and Action Plan and all those who have promoted it, first of all to the Global Environ-

mental Facility and the UN Development Program. I hope that our joint efforts in development of the Strategy shall be successfully continued while implementation of the action plans on conservation of the biological diversity of Kazakhstan.

S.Zh. Daukeev
Minister of Natural Resources
and Protection of Environment
of the Republic of Kazakhstan

Kazakhstan occupies a special place in the global context to conserve biodiversity. The vast size of its territory, ninth biggest in the world, surpasses the territories of the other four neighbor states of Central Asia and is almost as large as Western Europe. In addition, Kazakhstan has a great diversity of natural conditions, ecosystems, species and also a great scientific potential and experience devoted to biodiversity and many specialists working in this sphere.

Biological diversity and also the prospects for sustainable development have been threatened and disrupted as in other countries of the CIS, but also due to such special problems as water diverted from the Aral Sea basin, changing water level in the Caspian Sea basin, Soviet nuclear testing for 40 years in Semipalatinsk and other regions, as well as agriculture, urbanization, mining and industry practices.

In spite of the social and economic difficulties of the transition period, protection of environment and, in particular, conservation of biological diversity are the priorities of state policy in Kazakhstan since independence in 1991.

The Republic of Kazakhstan signed in 1992 and ratified in 1994 the UN Convention on Biological Diversity and in 1998 completed the development of an excellent National Environmental Action Plan (NEAP) in which biodiversity is an important component.

For almost 3 years, starting from 1996, a large group of specialists worked on the development of a National Strategy for conservation and the sustainable use of biological diversity. The first part of this work was completed in the summer of 1998 by publishing the National Report of the Republic of Kazakhstan on Conservation and Sustainable Use of Biological Diversity.

This document is a part of laborious and dedicated work of the authors, consultants and the Secretariat of this project. It contains not only a large volume of information on the status of biological diversity, but also the Strategy and Action Plans for conservation and sustainable use of natural resources in the near and long term.

UNDP and the Global Environmental Facility (GEF) are pleased to have been sponsors. We sincerely look forward to full endorsement of the Report, Strategy and Plans. We shall continue our support and actions to collaborate with Government, NGOs, investors and donors in the follow-up.

Herbert Behrstock,

UNDP Resident Representative

CONCEPTUAL APPROACH TO THE DEVELOPMENT OF THE NATIONAL STRATEGY AND ACTION PLAN ON CONSERVATION AND SUSTAINABLE USE OF BIODIVERSITY

Mankind depends upon the conservation of biological diversity, and its maintenance is one of the most important problems being faced today. However, the biota is the most vulnerable to all stress factors, in particular anthropogenic activities. The world community is currently worried about the implications of scientific and technical progress, which often exerts destructive affects on mans environment. Our biota is a source of food, oxygen, clean air and a natural resource and a major regulator of the biological sphere and a connecting link between the Earth and the Sun. The well based provision in the implication of the requirements of the Convention is to understand the important role of biota.

Biological diversity is comprised of species, forms within the species and populations of all types of plants, micro-organisms and animals. The ecological systems also spread over into natural environment and sports, breeds, lines and strains being cultivated, grown or engineered by human beings.

A problem of conservation and balanced use of such an important source of life support can not be compared with any other problem that mankind has in terms of its topicality. Therefore an urgent requirement has been met to develop a scientific, but reasonable strategic approach and action plans for the conservation and balanced use of biological diversity.

The Strategy is a management skill to achieve the main goals at the least costs by thorough analysis and identification of the common situations and to identify the current priority problems and key issues for their solution. The strategy determines the general governing of the actions and is aimed at the achievement of the wide scope goals. The performance of the strategic objectives is carried out by developomg firm action plans, which envisage the terms of performance, allocation and ratio of major means - executives, material, technical and financial resources.

The action plan has to contain a set of clear measures aimed at the conservation of the biological diversity, reduction of negative factor affect on biological diversity, identification of the potential resource and the legal framework for carrying out their balanced use.

The strategy has to be flexible, easily convertible into a complex of mutually linked actions and be regularly updated in relation to the new social, economic and political reality. The plans have to prioritise in terms of social and economic importance, ecological significance, urgency, and financial and technical opportunities. They have to be divided into short-, medium and long term plans, and also those, for the performance of which their own resources are available, and those requiring donor support for fulfillment.

The implementation of the Strategy and action plans on conservation and sustainable use of biological diversity and their implementation all require careful scientific set up. The Strategy itself and the plans on its implementation should have actually become a part of the National ecology program, which in turn is part of “The National strategy for sustainable development of the country”. Only when a principle of harmonizing the economy and ecological problems are recognised by the Governemnt, will the country gain a stable environment and the conservation of the biological diversity become effective. The biological diversity is an attributive element of the development of a sustainable development and has to be included in the plans on economic development of the country.

The Strategy and action plans on conservation and sustainble use of biological diversity cover all issues of the Convention on the conservation. They have to facilitate the improvement

and support of peoples well being, productivity and diversity of ecological systems and promote objectives for the sustainable development of a society.

The planning process has to involve participants, experts from the various areas of science and industry, the public sphere and as many representatives of the local governments as possible. When the planning process of the strategy has been completed, it has then to be made available for public consultation.

The success of the Action Plan depends upon the level at which the decisions are made. As the Strategy will form part of the National Environment Action Plan which is a part of the overall general plan for sustainable development, implementation will be undertaken at the most senior government level.

The National Strategy on conservation and sustainable use of biological diversity is related to the management system and has to be a set of subsystems reflecting separate sides of management: the objectives, functions, methods, bodies, personnel, financial provision, equipment, technologies, etc. Its assignment is in elaboration and implementation of the strong measures focused on conservation and the balanced use in accordance with the demands of a society and the objective evolution laws of life on earth. The success of the management system is evaluated based on indicators and the state of the management objects. The administrative methods of natural resource management have up to now turned out to be weakly efficient. There is a current requirement for the wide scale introduction and improvement of conservation by economic motivation and the balanced use of biological diversity.

The balanced use of the biological resources require legal regulation of the relations between the resource users and owners and between the resource users and the local population, who traditionally use the biological resources on their territory. These problems need to be addressed by legislation.

Legislation has to address the following: levels of liability for the damage of biological diversity; responsibility of land owners and land users for the conservation of the biota, especially those occurring in the Red data book; the rights of local populations in respect of the biological resources located in their territory.

Initially, the fundamental accounting and analysis of the present state of biological resources needs to be assessed and a programme established for the balanced use of biological diversity. A huge job has been done in Kazakhstan in this respect, but the provision of an inventory for lichens, mosses, algae, phytocenos, zoocenoz and ethnomofauna has not been completed. Therefore one of the priority tasks is the completion of these inventories. Beside this, the social and economic evaluation of the biological resources needs to be established by development of biological resource surveys and the identification of the domestic consumption and export opportunities.

Simultaneously with the inventory listing, an evaluation of the state of the biological diversity, degree of anthropogenic degradation of the biogeocenozes and genetic erosion is necessary.

In order to conserve any species, its protection is needed, by initially maintaining its habitat and position in a system and stabilization of the community as a whole. Any species or kind of organism is historically fitting a certain community and occupies a static position in this system, performing a functional role. The species, is adapted to this system and is an integral part of it. Therefore, the more stable a system is, the stronger is the position of species and kinds, composing it. That is why the systemic approach to the conservation and the balanced use means, first of all, the conservation of the species and the kinds within the group of species in their natural habitat and the preservation of the ecological system as component of the biological diversity.

The concept gives an important significance to the problems of the balanced use of biological diversity, the issues of access to the genetic fund of other parties, who have signed the Convention, and to the legislative solution of this problem .

The balanced utilisation of biological diversity implies a withdrawal of the species in such a manner that it does not allow the lowering of an optimal number of these species in strong centres. To develop a stable stock of plants the reproductive ability has to be understood.

There are a large number of measures to maintain conservation and the balanced use of biological diversity, and in recent years great importance has been given to the creation of germplasm banks. This problem is being undertaken by environmental activities and even commerically. The genetic fund is becoming a foreign currency equivalent. Under theses conditions the less developed countries are creating their National programs for the preservation of plant germplasms to protect their own interests. Such programs are not only short term, but mainly have long term objectives to provide the genetic "sovereignty" and genetic potential for the economic and social development of the country.

Conservation of species diversity is implemented not only in-situ, but additionally ex-situ, especially when there is a real threat of disappearance of a species as the result of a dangerous natural phenomena or anthropogenic disturbance. Therefore the role of botanic gardens, nurseries, dandry parks and zoos has to be determined. The importance of introductions and transborder transfer of organisms needs to be evaluated.

Not everybody correctly understands the provision of the Convention in respect of species introduction. Article 8 of the Convention states, that the Contrating Party shall "prevent the introduction of, control of eradicate those alien species which threaten ecosystems, habitats or species". Unfortunately there are attempts to prohibit any introductions abiding by this statement alone.

Introductory material enriches the genetic fund of the country and enhances its biological resource potential. But the approach to the introduction activities should be implemented accounting for the scope of the ecological amplitude of the exotic species, their competitiveness and aggressiveness in order not to allow the naturalization and introduction in the natural ecological system.

The Convention gives an important significance to the problems of rehabilitation of the degraded systems in the elaboration of the measures on conservation and the balanced use of the biological diversity. The recovery of degraded ecological systems, phyto melioration and recultivation of the technogenically damaged lands, creation of agricultural forest landscapes and other urban and ecological systems would enable many groups of the biological diversity to be preserved.

The replenishment of the country's genetic fund is implemented not only at the expense of the introduction of selected materials, but by the genetic change of organisms using biotechnological methods. These organisms, whose competitiveness has not been studied for long, may incur huge damage to the biological diversity of a country. Therefore it is very important to carry out strict supervision of any transborder transfer of all biota, including the organisms changed by the biotechnological methods and control over the scientific developments in the area of biological technology.

State importance has to be given to the conservation of the genetic fund, creation of the germplasm banks for the rare and vanishing species and forms of the plants, banks of the micro organisms, specialized enterprises for the conservation and regular reproduction of the old local

sorts of the agricultural plants and animal breeds. Having high quality properties and being well adapted to the local conditions these sorts serve as a valuable material in future selective works.

The conservation and balanced use of biological diversity has to be undertaken for all forms within species, sorts and ecological systems and strains of microorganisms. Therefore action plans have to be carried out for a system to include all elements that are related, and those which interact closely with each other forming integrated structures.

1. NATURAL AND SOCIAL AND ECONOMIC SPECIFICATION OF THE REPUBLIC OF KAZAKHSTAN

1.1 Natural conditions

Kazakhstan (55° 26' - 40° 56' north latitude and 46° 27' - 87° 18' eastern longitude) lies between the Siberian Taiga and the Central Asian deserts. The Casspian Sea is the largest internal reservoir on the Continent and the Tien- Shan mountains the highest range which contains a wide variety of natural features (Fig. 1.1) and landscape. (Big Soviet Encyclopedia, volume II).

Climate. The climate of the republic with its vast territory, large distance from the oceans and openness from the north and south and to the west all contribute to the climate.

The hours of sunlight range from 2, 000 hours in the north up to 3, 000 hours in the south. Radiation increases southerly from 100 kcal/ sm^2 to 140 kcal/ sm^2 .

North Kazakhstan in winter is cold and long, the central part is moderately cold, while the south has a moderately mild climate, while the extreme south is mild. The average January temperature rises from - 18° C in the north to - 3° C in the extreme southern flat part of Kazakhstan (fig. 1.2 A).

The plains of Kazakhstan in summer are dry, while the north is warm, the centre very warm, and the south - hot. The average July temperature increases from 19° C in the north to 28 - 30° C in the south (Fig. 1.2.B). In the mountains the summer is short, moderately hot and in the winter, relatively warm.

A small amount of rain falls almost everywhere. In the *forest - steppe* the average precipitation is 300 - 400 mm per year., whilst in the steppe this falls to 250 mm. In the Kazakh *small hills* this increases to 300 - 400 mm, and in the semi deserts and deserts this falls to 100 - 200 mm. A particularly low precipitation (less than 100 mm per year) occurs in Pribalkhsye, in south - eastern part of Aral Sea Kyzylkum and southern Ustyurt. Between 400 to 1, 600 mm of precipitation per year falls in the foothills and mountains. In the north and centre the maximum rainfall occurs in the summer months, and in the south, in early spring (Fig. 1.2 C).

The whole territory of Kazakhstan is characterised by strong winds. In the winter, south westerly winds prevail in the north, while the south has eastern winds. In summer northern winds dominate
everywhere.

Vegetation growth occurs for 190 - 200 days in the north and 230 - 290 days in the south.

Relief. The surface of Kazakhstan' s territory is extremely diverse. The southern outskirts of Common Syrt and Pre Ural plateau (354 m) occupy the north- west of the republic. To the south from them there is a flat Pre-Caspian Sea valley. In the south- west of the republic there is a peninsula of Mangyshlak; its southern part is a salt mash valley, and its centre is occupied by the Karatau mountain range (556 m). In the south there are deep drainless cavities, the bottom of which are below the level of the World oceans and include Karagiye (132 m), Karynzharyk (70 m) and Kaundy (54 m). To the east from the Mangyshlak there is a desert plateau Ustyurt (the height is up to 340 m), edged with steep precipices - chinks. In its northern lowered part, salt marshes and sand massive are present (Sam, Asmantai - Matai, Karatulei). In the north east, the southern spurs of Ural and Mugodgars (up to 657 m) limit the Pre Caspian valley. In the north eastern direction of the Mugodgars there is a Turgai plateau (up to 200 - 400 m). In the south it opens into the Turan valley, occupied by the Kyzylkum deserts (between 53 & 332 m) and others. To the north of the Aral Sea there are the sand massif of Bolshye and Malye Barsuki and Pre-Aral Karakums.

The Western Siberian plain enters the republic's territory only on its southern borders. The central part of the republic is occupied by the *Kazakh small hills* . The separate mountain ranges of Kyzylarai (1,565 m), Karkaraly (1,366 m), Ulytau (1,133 m) and others are located within the limits of these small hills. In the south, the Kazakh small hills phase out into the most waterless deserts - *Betpak - Dala* (250 - 550 m). The sand massif of Moinkum occupies a large space in the southern direction from it. To the east from the Betpak - Dala, a vast area of Semirechye is located (800 m). Its larger part is occupied by the Balkhash cavity with the sand massif of Sary - Ishikotrau, which is bounded in the south east by the Ili cavity and in the east by the Sasyk- Kol - Alakol cavity. The majority of the cavities are filled with water.

In the east and south east are located the southern chains of the Altai (Yuzhnyi and Rudnyi), rising up to 4,506 m (Belukha mountain), and also the ridges of Saura (3,805 m), Tarbagatai (2,992 m), Dzhungar Alatau (4,463 m), Northern and Western Tien Shan: Ketmen (up to 3,638 m), Chu - Ili mountains (1, 520 m), Zailiyiski Alatau (4,973 m), part of Kungei - Alatau (4,213 m), Kyrgyz ridge (3,817 m), Talaskyi Alatau (4,488 m), Ugamskyi ridge (4,229 m) and Karatau (2,176 m).

The vast territory and diversity of the land surface (ranging from the large depressions to the highest mountain ranges) determines the heterogeneous natural conditions and rich biological diversity.

Geological composition. In the west a large part of the Caspian synecline of *the Eastern - European platform* enters the territory of Kazakhstan. The thickness of the phanerozoic layers lies between 16 - 18 km. In the middle part of the synecline cut there is a thick (4 - 6+ km) saline carrying layer containing the series of the upper and probably medium Paleozoic period. Within the limits of Ustyurt the thick (in some places containing oil and gas) sedimentary rock layers of the Mesozoic and Cenozoic periods, overlapping the ledges and cavities, formed by the Paleozoic rocks are deposited. The latter are bedded at the greater depth by the ancient foundation, transformed by the Paleozoic movements.

Among the pre- Paleozoic and Paleozoic formations revealed during major tectonic shifts, complexes can be distinguished, trapped by the folds of the Caledonia and Herzinic eras. The Caledonides create a vast ancient massif, which covers the whole north west and west of Central Kazakhstan, and northern Tien Shan. The Herzinides form the Mugodgars, the foundation of the western part of Turgai sagging, the south of the Kyzylkum desert, the Pre Balkhashye, mountains of the Dzhungar Alatau, Tarbagatai, Altai and Chingiz. In a number of places (Mugodgars, Pre Balkhshye, northern Tien Shan, Rudnyi Altai, Kalba) there are deposited the volcanic top- soils and granites of the late Paleozoic age, in some places the belts of the hyperbazits as well. The Paleozoic and more ancient layers form the folded arcs, conveyed in the south- western direction. In the Mugodgars and in the west of Central Kazakhstan they are stretched along the meridian; in the Tien Shan, Dzhungar Alatau, the east of Central Kazakhstan and Altai as well they are stretched along the latitude and in the north - west direction. In many mountain regions of Kazakhstan the most novel tectonic movements and the accompanying earthquakes are coming out energetically.

Internal waters. The relief and climatic diversity determine the heterogeneous distribution of surface waters. There are about 85,000 of rivers, out of which 90% are temporary with lengths less than 10 km.

A large number of rivers belong to the internal closed basins of the Caspian and Aral seas and the lakes of Balkhash, Tengiz, Shalkar and Karasor.

Irtysh, Ishim and Tobol are the largest rivers lying within the Ob river basin. The Ural and Emba lie within the Caspian Sea basin, the Syr- Darya, in the Aral Sea and Ili, Karatal, Aksu, Lepsy, Ayaguz within Lake Balkhash.

The rivers plains are fed by snow during the spring flood and. many of them dry out during the summer.

There are many mountain rivers in the south and east, which are fed by glaciers or snow. Their highest water flow occurs in spring and summer.

There are more than 48,000 lakes in Kazakhstan with a total area is 45,000Km^2. 94% of the lakes have areas less than 1 Km^2 , and these are mainly flooded lands and delta lakes. There are 21 lakes with an area greater than 100 Km^2 and include Balkhash, Zaisan (which was included in the Bukhtarma water reservoir), Alakol, Tengiz, Seletyteniz, Sasykkol, Kushmurun, Markakol, Ulken and Karoi .

There are more than 4 ,000 ponds and reservoirs. The majority of the lakes have no outlet, but water levels vary considerably with season and year, and the shape and size regularly change.

In many regions there are stocks of fresh and slightly salted sub-soil waters which are partly used by industrial and agricultural enterprises. The volume of sub-soil waters in Kazakhstan are estimated at 7, 000 Km^3. There are also a large number of mineral springs.

Soils. High altitude areas and other zones are characterised by specific top soils.
The clearly distinguished zones and presence of high altitude zones are characteristic of the top soils (Fig. 1. 3). In the north of the republic, a zone of black earth is located which can be divided into leached black earth, which occupies the small part of the forest - steppe zone, the regular black earth (4.5% of total soil area of Kazakhstan) and the southern black earth of the moderate dry steppe (4.9%).

Southwards of the black earths are located the chestnut soils (33.2%), which are divided into dark chestnut soils of the moderate dry steppe, common chestnut soils of the dry steppe and light chestnut soils of the desert steppe (semi desert).

Further to the south, brown and grey - brown desert soils occur. They alternate with the massif of desert sand and Takyr type soils (totalling 45. 0%). There are brown soils of the northern desert sub-zone and grey - brown soils which are referred to as the middle and southern subzones of desert zone. These soils are replace by the grey earth and light chestnut soils in the bottom hill plains and foothills of the Western and Northern Tien Shan.

At higher altitudes of Western Tien Shan, a zone of mountain brown soil is found. In the mountains of the Northern Tien Shan, Saur, Tarbagatai, the Western Altai a zone of mountain dark chestnut soil and mountain black earths are found. Next to the black earth zone in the mountains of the Northern Tien Shan, a zones of leached black earth, mountain grey forest and mountain dark coloured forest soils occur. In the western Altai in a zone of mountain meadow, black earth type and grey forest soils occurs. At higher levels in all the mountain regions, a zone of mountain meadow sub alpine and alpine soils appear.

The soils of the foot hill plains and mountains occupy 12.4% of the territory of Kazakhstan.

The range of biological diversity of Kazakhstan has been determined by its natural conditions along with its complicated landscape history, flora and fauna.

1.2. Social and economic position

Kazakhstan is divided into 14 administrative oblasts. There are 83 towns in the republic, Astana city is the capital. The population is 15. 9 million. In the north, west and east, Kazakhstan borders with Russia; in the south with Turkmenistan, Uzbekistan and Kyrgyzstan; and in the

south east with China. The proximity of important economic centres such as Povolzhye (Volga river region), Ural and Western Siberia in the north and Central Asia in the south have all contributed to the multinational composition of Kazakhstan (Fig. 1.4). These also promoted the occurrence of the closest economic relations between these regions and Kazakhstan, which have been particularly developed with the intensive use of mineral resources. It has exerted a large affect on the development and specialization of the economic branches. The central location of the territory of Kazakhstan between Europe and Asia since ancient times has made it a centre for economic, trade, cultural and political links. Today Kazakhstan continues to play a strategically important role and connecting link between Europe, Central Asian part of the CIS, the rapidly progressing Asian Pacific region, and south of the Asian continent.

For a long time the rich raw natural resources of the republic have been a major factor of the economy. At the present time the mineral resources continue to dominate the country's exports. A model though is required for the sustainable utilisation of the natural resources which currently cause great damage to the environment and similar problems are recognized throughout the world. The concept of a sustainable ecology from the view point of development, under which a contradiction between the social and economic growth, nature use and conservation of the ecological system integrity is eliminated, is an alternative to this model. This is in accordance with the principles of the UN Declaration on Environment and Development (1992).

The political changes which took place in Kazakhstan, the economic hardships of the transition from the command and management administrative system to the market one, have strongly affected the social sphere. The republic has adopted a model of reforms, which envisage macroeconomic stabilization given the social restrictions, but requires the identification of the final objectives of the transition period at minimum social loss. The difficulty in solving such a problem is due to the hard current position of all sectors of the economy.

The analysis of the human development index (Fig. 1. 5) during the five years of independence allows one to note that a rate of decline of this indicator during the last years has been stabilized. However, the value of the index may worsen in the short term, if the reforms are insufficiently adjusted in terms of softening the social stress and orientation of the republic towards harmonization of the economic, social and ecological sectors. It brings up a need to implement the measures on all environmental problems, including that in accordance with the Convention on Biological Diversity.

Based on data from the Institute for the Development of Kazakhstan, the forecasted year of maximum decline of all the main parameters of the national economy comes out at the end of 1998. At this stage of the recession (classical depression), adaptation to the market economy conditions will last for two to three years. It is envisaged that afterwards (after 2000) a large inflow of capital investment will occur leading to the revival of the economy during the period up to 2005. The rapid growth of the economy, that is "stabilization while growing" will take place during the period up to 2010. Then the real economic growth will start (Strategy "Kazakhstan - 2030").

2. BIOLOGICAL DIVERSITY

The vast territory of Kazakhstan located in the centre of Eurasia has conditioned the diversity of its natural conditions. In accordance with the landscape districting of Kazakhstan, 5 types of landscape are specified for its planes: forest steppe, steppe, dry steppe, semi desert and desert, while 7 types are established for the mountain systems: nival, mountain meadow, forest, forest steppe, steppe, semi desert and desert. Such a diversity of landscapes formed by the scope of latitude zone exposure and vertical zone, takes first place among the states of Central Asia (Fig. 1.6).

2.1 Ecological systems

Within a large part of Kazakhstan's territory an ecological system has been formed under a continental climate with a low and unsustainable humidity. Due to a latitude change of climatic zones a change is taking place, from semi arid forest steppe in the north of Kazakhstan through to cold continental semi deserts and deserts to the warm moderate continental deserts in the south. Zone ecological systems can be distinguished as the sets of the elementary ecological systems – biogeocenozes.

Kazakhstan is endowed with an enormous diversity of mountain ecological systems due to the high altitude zones. In accordance with the zone structure and the set of typical and rare ecological systems, four large mountain blocks can be specified: Western- Tien Shan (the mountains of Karatau and Western Tien Shan), Northern Tien Shan, Kazakhstan- Dzhungar and the Altai ranges (Fig. 1.7). The mountains significantly affect the adjacent foot hill plains, where special inversion types of the ecological systems are concentrated, such as foot hill deserts in the south of Kazakhstan.

The ecological systems within the limits of the latitude zones and sub zones such as the mountain ranges are characterized by clearly observed organizational features and a strange composition. The distribution of zones and square ratios by zones and sub zones is shown in the Fig. 1.8, 1.8 A, Table 1.1.

2.1.1. Natural ecological systems

Forest steppe zones

The forest steppe zone in Kazakhstan occupies not a small territory in the region of the cities of Petropavlovsk and Kokshetau – northwards from latititude 54 degrees. The flora is represented by forest (0.7 million hectares) and transformed steppes rich in various types of grass. The forests have a meliorating and soil protecting effect on the adjacent steppe plots.

In the forest steppe zone the following sub zones can be distinguished clearly:

1. **Southern slightly humid moderately warm** forest steppe. (Hydro Thermal Coefficient (HTC) = 1.3). This sub zone occupies about 1.0% of Kazakhstan' s territory and is charaacterised by tree species of aspen and birch (*comm. Betula* + *Populus tremula*), aspen forests (*comm. Populus tremula*) on the grey forest malted soils and meadow steppes on the black earth. Land use in this area includes forestry, arable, pasture (hay – mowing), and hunting.
2. **The moderately dry** kolochnaya forest steppe (Hydro Thermal Coefficient = 1.2 – 1.3). The subzone occupies about 1. 04 % of the republic's territory, and is typified by aspen and birch tree kolks (*comm. Betula* + *Populus tremula*). These steppes are endowed with *a* rich variety of grass communities and cereals (*comm*) on the black earth. Land use includes pastures, fodder lands, a small amount of forestry and hunting.

Kolochnaya forests in the forest steppe zone are represented by the deciduous trees: weepingg and fluffy birch trees, quite often kyrgyz birch tree (*Betula pendula, B. pubescens, B. kirghizorum),* aspen tree *(Populus tremula),* trees like willow and osier (*Salix triandra, S. caprea, S. rosmarinifolia, S. fragilis, S. alba*, etc.). shrub dog – roses (*Rosa acicularis, R. spinosissima),* meadow sweet (*Spiraea crenata, S. hypericifolia),* steppe cherry tree (*Cerasus fruiticosa)*, cornelian cherry tree *(Cotoneaster melanocarpa)*.

60 – 90 % of the meadow and steppe lands of the forest steppe zone are ploughed.

Steppe zones

The steppe zone occupies 110.2 million. hectares or about 28% of the territory of the republic, and is subdivided into 3 sub zones (3, 4, 5 in the Fig. 1.8, 1.8 A):

3. **The moderately drought and warm drought** (Hydro Thermal coefficient 0.8 – 1.0) feather grass and various grass steppe (20.1 million hectares or 7.4%) on the regular and southern black earth. Land use includes pastures and fodder lands.
4. **The moderately dry and warm dry** (Hydro Thermal coefficient 0.6 – 0.8) tipchakovo- and feather grass steppe (57.2 million hectares or 21.0%) with xerophytic grass species (*comm. Stipa sp.+ Festica)* on the brown and chestnut coloured earth. Land use includes pasture and fodder lands. Up to 60% of the lands are ploughed.
5. **The dry desert, moderate hot warm wood and feather grass steppe** (semi-desert) (*comm. Stipa sp., Artemisia sp. sp.)* occur on light chestnut coloured soils (32.9 million hectares or 12.1%). Land use includes fodder lands and pastures.

In the steppe zone there are 250 different types of steppe communities, established 10 wide spread formations, and described about 200 communities (associations) but the inventory at the level of the ecological system has not been finished yet.

The steppe zone of Kazakhstan has been transformed mostly by human activities. Wide scale ploughing of the lands in the period of virgin land cultivation (1954- 1960 years) has led to a complete destruction of the majority of the main plakuor types of steppes.

About 90% of the rich feather and various grass steppes and various grass valley steppes and 30% of the small hill steppes have been ploughed. 50 -60% of the dry steppes in the plain areas were ploughed and 10-15% of the small hill steppes. The remaining steppe lands in these sub-zones (stony steppe, complex steppe on the saline soils) have been significantly transformed by over grazing. The feather grass steppe have become invaded by typchakovyi (*Festuca valesiaca),* avstryisko feather grass (*Artemisia austriaca),* weeds and various grass communities.

The feather grass dominant zone contains 20 main plant communities inclduing: feather grass of Zalessky (*Stipa zalesski),* feather grass of Lessing *(St. lessingiana*), feather grass of Joann *(St. joannis),* Kyrgyz fearther grass *(St. kirghizorum),* tyrsy *(St. cappilata),* and tipchak *(Festuca valesiaca)* and oats *(Avenastrum sp*.). Spireya, karagan**,** almond tree of Ledeburocskyi *(Spiraea, Caragana, Amygdalus ledebouriana*) are the dominant shrubs.

The areas with forest cover are insignificant. Forest plants include birch and aspen tree scrub in some places with residual insular and banding massifs of pine tree forests (*Pinus silvestris)*, and willow, spireya and karagan shrubs *(Salix, Spiraea, Caragana).*

The rich various grass steppes with carrots, red feather grass *(Stipa zalesski),* endemic Korzhinskyi feather grass *(comm. Stipa korshinskyi),* oat (*Aneurolepidium ramosum, Avenastrum sp.)* and meadow steppes, shrub ecological systems, sparse pine tree forests on the granites, birch tree forests and black alder thickets (*comm. Betula pendula, comm. Alnus glutinosa)* are rare or are threatened and in need of protection. More than 38 million hectares of land has been ploughed in the steppe zones. Weeds occupy territories taken arable.

Desert ecological systems

The total area is 124.6 million hectares. The unique plants are represented along the periphery of the mountainous ranges by the communities of the ephemeroidal cereal semi-shrub and ephemeroidal shrub deserts. The ephemeroidal communities of the semi-shrubs with high grasses are called savannahoides and are spread over the plains which surround Western Tien-Shan and Karatay mountains.

Five latitude sub zones can be clearly distinguished in the desert zone:

6. **The northern steppe is dry and moderately hot** (Hydro Thermal coefficient 0.3 – 0.4) and has an area of 40.0 million hectares or 14.7% of the Republic's territory. The plants and soils are characterised by the cereal and semi-shrub type desert *(comm. Stipa Cessinggians, St. cappilata + Agropyron sp. sp.+ Artemisia Lerhiana, A. terrae-albae, + A. semiarida*) on the brown soils, and sand shrub type desert (*comm. Calligonum aphyllum, C. murex + Artemisia arenaria and others + Agropyron fragile)* on the hilly and ridging alluvium aeolian soils. Land use includes pastures and partly cut fodder lands.
7. **The medium (northern turan) very dry, hot desert** (Hydro Thermal coefficient 0.2 – 0.3) has an area of 51.2 million hectares or 18.9% of the Republic's territory. Characteristic platns of this region include semi-shrubs *(comm. Artemisia sp. Anabasis salsa, Kochia prostrata),* haloxylon *(comm. Haloxylon aphylluym; Haloxylon persicum)* and shrubs *(comm. Ammodendron gifolium and others Calligomim sp.; comm. Atragalus brachypus, A. cognatus)* on the brown, grey brown and sandy soils. Land use includes pasture, forest, firewood (haloxylon shrubs) and plant stock material which is partly irrigated .
8. **The southern very dry, hot desert** (Hydro Thermal coefficient 0.2) occupies 30.3 million hectares or 11.1% of the Republic's territory. Ephemeroidal and semi shrub plants are present *(comm. Artemisia terrae – albae + Ephemeretum)* on grey brown soils and haloxylon shrubs with ephemeroids *(Haloxylon aphylliun, H. persicum, Ammodendron conolly, Calligonum sp., Ephemerefum)* on the hilly and ridgy alluvium aeolian soils. Land use includes pastures and partly irrigated farming lands.
9. **Dry foothills and very hot desert** (Hydro Thermal coefficient 0.2) occupies 3.2 million hectares or 1.2% of the Republic's territory. Ephemeroidal plants are typical with high grass and semi- shrubs on the grey brown alluvium soils. Land use includes fodder pastures and harvesting of plant raw materials.
10. **The very dry desert of the foothills** (Hydro Thermal coefficient 0.2) occupy 11.6 million hectares or 4.3% of the Republic's territory. Ephemeroidal psammophyte shrub desert with cereals are the typical communities. Land use includes fodder lands and pastures and partly irrigated lands.

The present status of the plants and the exhaustion of their biological diversity, does not occur in the same way in different sub zones of the deserts. In northern deserts these are dominated by the worm woods *(comm. Artemisia)* and good pastures. In the vicinity of wells, farm animals erode these areas extensively and also adjacent to wintering settlements and along the routes of cattle movement. In the medium and southern desert ecosystems *(comm. Artemisia sp. + Anabasis salsa +Ephemeretum),* especially in the western part of the Republic, apart from over grazing, a number of losses have occurred which are related to technogenic impacts and unregulated road network. The plants of the sand deserts such as haloxylon *(Haloxylon)* forests, psammophyte *(Calligonum, Astragalus and other)* shrubs and psammophyte wormwoods *(Artemesia arenaria, A. albicerata, A. songarica)* deserts are destroyed because of their vulnerability to anthropological impacts. These territories are actively used as pastures. The haloxylon *(comm. Haloxylon)* forests have also been significantly transformed due to the firewood collection.

The strongest destruction of plant cover has occurred in the foothill zones. The original Kazakhstan ephemeroidal wormwood deserts are practically destroyed. These regions now contain the irrigated farm lands with the highest over pasturing due to a large population since ancient times.

The haloxylon forests occupy a large territory (more than 5 million hectares) and are classified in the forest resource. The haloxylon forests with mixtures of sandy acacia (*Ammodendron bifolium, connollyi),* boyalysha *(Salsola arbuscula),* grebenshik *Tamarix hispida, T. ramosissma),* zhuzgun *(Calligonum leucocladum, C. aphyllum, C. caput medusa, C. eriopodum)* and astrogal *(Astragalus sec. Ammodendron)* are widespread. The black haloxylon in the Kyzylkum, western part of Betpakdala, in the medium stream of Sarysu river, in the down waters of Ili river, in Moinkum all have a large operational significance. The white haloxylons (*comm. Haloxylon persicum comm.)* contain the best pastures for all year round use. Unfortunately they are cut for fuel, resulting in soil erosion.

The zaisan haloxylon (*Comm. Haloxylon ammodendron)* , the endemic spireantus communities (*Spiraeanthus schrenkianus)* and endemic systems of the snads of astragal - (*Astragalus cognatus),* zhuzgun - (*Calligonium pavlovii)*, kopeechnik - *(Hedysarum scoparium),* white waxed worn wood (*Artemisia albicerata)* are rare in the desert and need protection.

Mountain ecological systems

The mountain ecological systems have an area of over 18. 6 million hectares (about 7 per cent of the territory of Kazakhstan) and contain over 30 plant communities, dominated by woodland, shrubland and grasslands. Among them there are fir plantations (*Picea obovata, P. schrenkiana),* silver fir groves *(Abies sibirica),* larch forests *(Larix sibirica),* deciduous trees including apple *(Malus sieversii, M. kirghisorum),* apricot *(Armeniaca vulgaris),* birch *(Betula pendula, B. pubescenes, B. jarmolenkoana)* and other communitieis; the dog rose communities (*Rosa spinosissima, R. plaphyacanta and others*), barberries (*Berberis heteropoda*), archa *(Juniperus pseudosabina, J. sibirica, J. seravschanica, J. turkestanica andothers)*, and *Ephedra equisetina, Festuca valesiaca, Kobresia capilliformis* and the plants of the cryophyts of the subnival zones and rare alga “films” of the glaciers.

Nine mountainous districts and 6 groups of the high altitude zones (Fig. 1. 7) can be distinguished. The mountain ecological systems differ with the highest extents of the biological diversity, endemism and high economical value.

The size of the zones, its borders and altitude all depend on the exposure and steepness of the slope, diversity of soils, stoniness, latitude (zone) and longitude (meridian) and climatic location of the mountains.

Several mountain systems can be noted:

The northern Tien-Shan group, including Dzungar Alatau, Ketmen, Zailiyskyi Alatau, Kungey Alatau and the eastern part of Kyrgyz Alatau. In the lower part of the mountain foot hills occur the semi deserts and steppes (1000- 1200 m above sea level). At the higher level (1200 - 1500 m), aspen (*comm. Populus)* and fruit forests are to be found, which then migrate into the meadow shrub forest zone, dominated by spruce Schrenk (*Picea schrekiana)*. In the high mountains the cryophyte meadows and steppes with dwarf thickets are widespread. The subnival and nival zones occupy large territories. The apple and apricot forests (*comm. Malus, Armeniaca vulgaris)* are classified in a number of rare mountain ecological systems, while in the low mountains, forests Caucasian karkas (*Celtis caucasica) occur.*

The western Tien - Shan group includes the ridges of Karatau, Karzhantau, Pskemskyi, Ugamskyi, Talasskyi and the western part of Kyrgyz Alatau. The so called semi savannah or savannoides - a special arid type of the ecological systems with domination of the ephemeroids and high grass on the grey earth are characteristic for the foot hills. They are changed by the fragmentary deciduous xerophile forests containing apple trees (*Malus)*, hawthorn (*Crataegus)* and in some places pistachio trees (*Pistacea)*. At a height of 1000 - 1200m and up to 2500 m, a zone of arch sparse growth of three types of arch - zeravshan (Juniperus seravschanica), semi- globe shaped (*J. semiglobosa),* and turkestan (J. turkestanica) trees is located; however, the largest part of these areas at this height is occupied with the high grass meadow steppes with shrubs. At the higher levels the mountainous - xerophyte steppe communities are located, in the high mountains the specific cryophyte meadows are dominant, while the peaks of the ridges are crowned by the nival zones. The pistachio forests, walnut *(Juglans rega)* forests and unique communities were formed by endemic types of ecological communities of stoney locations and are particularly well represented in the ancient mountains of Karatau (*Spireanthus schrenkianus, Artemisia karatavica, Thesium minlwitzianum).*

The Altai group of the ecological systems. In the mountains of Altai the dry and moderately dry steppes of the low hills and foothills are changed by the shrub thickets, boreal dark pine tree (*Abies, Picea, Pinus sibirica)* and larch (- *comm. Larix)* forests, and then by the high mountain meadows. The areas of tundra ecological systems can be crossed over. The boreal dark pine tree forests and mountainous steppes are classified in the category of the rare ecological systems.

In the Saur ridge, the set of zones is similar to that of Altai, but in the forest zone only sparse pine forests occur and there is no tundra. In the mountains of Tarbagatai, the ecological systems consist of thickets of Ledebyrovskyi almond tress (*Amygdalus ledebouriana)*, and are considered rare.

Despite their small area, the mountains in Kazakhstan show great diversity of the ecological systems - from desert - foot hills to the real high mountains, reaching the nival zone. Here the largest kind diversity can be found. The ecological systems of Altai are characteristic of the mountains of Southern Siberia and nowhere else in Kazakhstan or other states of Central Asia are these found. They have a typical Siberian flora and fauna. The neighbouring ridges of Saur and Tarbagatai are the transition to the real Central Asian mountain range - Tien Shan and Dzungar Alatau.

Despite the inaccessibility compared to the lowlands, the territories of the mountain ecological systems have experienced significant anthropogenic effect - agricultural (mainly, over pasture and the cutting of wood to alesser extent - hay making), technogenic impact (road network, mining industry, construction of the cities and settlements), recreational, which are particularly intensive closely to the large cities. The ecological systems in the foothills' valleys have suffered most of all. They are destroyed to a significant extent together with the original floristic and faunistic complexes.

Water and coastal ecological systems

The territory of Kazakhstan, especially its northern part is rich in water and marsh grounds, mainly large and small lakes, which amount to over 48,000. There are many shallow saline lakes among them, the shores of which are virtually deprived of any flora and are not attractive to game waterfowl (for example, ducks and geese). However, the islands in these lakes are the ideal place for nesting of the colonial types of sandpipers, sea- gulls, terns and even such rare birds as the pink flamingo (Tengiz lake). The other lakes, especially in the steppe zone, have thick reed beds (*Phragmites australis)*, providing shelter for the numerous waterfowl, not only during the nesting period but during the moulting period at the end of summer, and during spring and autumn migrations.

Being located in the almost geometrical centre of the continent on the migration route of the water fowl from Siberia to the Caspian, from Asian and African wintering grounds, these lakes have a strategic importance for the management of game birds (Fig. 1. 9). Two lakes of Central Kazakhstan - Kurgaldzhinskye lake and Irgiz - Turgai lakes, were recognized in the 1970's to be water and marsh grounds having an international significance mainly as places of habitat for the water fowl, and are Ramsar sites (1971).

The valleys of the rivers in the steppe zones contain willow (*Salix)* and poplar (*Populus)* forests, which alternate with the various types of meadow and water and marsh systems. Forest communities in the river valleys of the desert zones are characteristic containing poplar with diversified leaves (*Populus diversifolia)* and lokh (*Elaeagnus),* willow (*Salix)* and grebenshik *(Tamarix)* thickets. The reed beds (*Phragmites australis)* occupy large areas along the lake margins. The strong anthropogenic forces (non-regulated hay making, burning, not systemic pasture, unlimited use of water from reservoirs for irrigation, ploughing of the flood lands and others) cause the formation of deserts in the valley systems.

The specific forest and meadow and saline soil ecological systems in the river valleys and lake side hollows are included in the steppe and desert zones as out- zones. Among those the willow and poplar forests with spots of meadow and meadow and marsh plants could be distinguished, that is about 300 meadow elementary ecological systems. In the deserts - the willow (*Salix)* and lokh- turang (*comm. Populus diversifolia + Elaeagnus angustifolia)* tugai forests with the thickets of grebenshik (*Tamarix)* and chingil *(Halimodendron halodendron),* and meadow cereals, including reed ecological systems. Together with the marsh systems there are noted up to 200 elementary ecological systems in the meadows. Along the coasts of lakes the meadow and marsh (reed, beskilnitzevaya) (*Phragmites austragalis, Becmania sp.)* and meadow plants are replaced by the complex ecological systems of the saline soil meadow and steppe and deserted ecological systems of the galophyte type.

The ecological systems of the flood lands (Fig. 1. 8) occupy not less than 0.9 million hectares. The total area of the river valleys and meadows is 6 million hectares. There are 2.2 million hectares of highly productive water meadows, of which 1. 3 million hectares are flood lands.

These lands are suffering from lowering of the level of the subsoil waters, drying out and salination of the soils, degradation of the meadow plants (worsening of the agro botanic composition, crop yields decrease, transformation of the hay making lands into the pasture) and the loss of biological diversity. The changes of meadow plants are particularly acute in the flood zones of the rivers Ili, Syr Darya, Chu, where highly productive reed communities have almost been lost.

In the steppe zone the highest cenotic diversity is characteristic of the meadow marshes, water and marsh plants. With a reduction or loss of surface flooding, the meadow plants become steppe like. In relation to a reduction of river flows, the meadow plants are declining everywhere, and the meadows are gradually vanishing.

The steppe valley Hydro Thermal coefficient lies between 0.5 - 1.2 and for the desert valleys between 0. 2 - 0. 5. The coastal ecological systems have an economic potential with lands used for hay, arable and recreation territories. There are 5 distinct types: the riverside meadows and tugai ecological systems, crossing the sub zones of deserts and steppes. The lake coastal ecological systems are not noted in this category.

There are rare and endemic ecological systems, which require protection and include turangovniki (*comm. Populus),* ash tree forests *(comm. Fraxinus sogdiana)*

Water and marsh ecological systems undergo significant variations in water levels and salinity. They differ by being isolated from the final drain, beside the Irtysh basin, which has exit to the Arctic Ocean. Many of them dry out periodically. The basin ecological systems can be distinguished with their native ichthuofauna, water fowls and their fodder base: benthos, plankton, alga, water coastal plants.

The Ichthyfauna of the water ecological system is represented by over 100 species.

In the majority of the basins native species are partly replaced by the acclimatized types (the Aral Sea, Balkhash - Ili and others).

The ornithofauna includes about 130 types of water fowl (43 game birds, about 20 fish eating, including 19 rare and vanishing ones). The average annual number of the water fowl is over 60 million individuals.

An inventory of the biological diversity of the water and marsh ecological systems has to be carried out. The rare and endemic species are characterized in the section “Fauna”.

2.1.2 Agricultural ecological systems

The ecological systems, created and regulated by human beings, form a special group of landscapes: ploughed lands, gardens and vineyards, forest and park plantations, soil protecting and by- road forest plots, the plantations made on lands damaged by human impact, fallow lands, improved pastures, etc. Their diversity depends on the economic activities and is determined by humans.

Pastures. The agriculture ecological systems of the ploughed lands (about 29.1 million hectares) are represented mainly by the monocenozes, in which various varieties and species of plant are cultivated with the use of different methods of agricultural techniques..

The biological diversity of the agricultural systems is determined firstly by the number of varieties of cultivated plants and weeds (floristic diversity), and by the number of various combinations among cultivated and weed type plants (phytocenotic diversity).

The large climatic diversity and soil conditions in the Republic of Kazakhstan determines the diversity of plant growth and agricultural methods in ecological systems. Along with the

plants of the northern latitudes, typical southern heat loving plants are cultivated under irrigated conditions. The major types of the cultivated plants are the following:

cereals –wheat, rye, barley, oats, corn, millet, rice, sorghum, buckwheat, pea, haricot, soy bean; (*Triticum, Secale, Hordeum, Avena, Panicum, Zea, Oryza, Sorghum, Fagopyrum, Pisum, Phaseolus, Glicine);*

technical cultures – potatoes, cotton, sugar beet, sunflower, tobacco *(Solanum tuberosum, Gossypium, Beta, Helianthus cultus, Nicotiana);*

vegetables – cabbage, black raddish, horse radish, garden radish, tomato, egg plant, carrot, parsley, dill, cucumber, onion, garlic, beet root, lettuce *(Brassica, Raphanus sativus, Armorocia rusticana, Raphanus sativus, Lycopersicon esculentum, Capsicum annuum, Solanum melongena, Daucus carota, Petroselinum crispum, Anetum graveoleus, Cucumis sativus, Allium seppa, Allium sativum, Beta, Lactuca sativa);*

melons and gourds - water melon, melon, pumpkin, vegetable marrow, patisson (*Citrullus lanatus, Cucumis melo, Cucurbita pepo, Cucurbita pepo, Cucrbita pepo);*

fodder crops – lucerne, esparcet, spring cereals, Sudan grass, mogar, chickpea, rape (*Medicago, Onobrichys, Agropyron, Sorghum sudanense, Setaria italica, Cicer, Brassica napus);*

fruits and berries – apple, pear, plum, peach, cherry, grapes, black currant, strawberry, raspberries (*Malys silvestris, Pyrus domestica, Prunus domestica, Prunus persica, Prunus cerasus, Vitis vinifera, Ribes, Fragaria, Rubus).*

The listed groups of cultivated plants in the republic are represented by the numerous types, including those received by selection in Kazakhstan, which form the intra-group diversity of the agrophytocenozes. Since 1993 more than 70 varieties of the cereals, 68 varieties of fruits and berries, more than 60 varieties of water- melon , melon and gourds, 23 varieties of potatoes have been selected and grown in districts of the republic.

The majority of the ecological systems are characterized by the presence of weed species in the agriculture ecological systems.

There are a number of wide spread weed plants from 55 families with 294 varietieis and 582 types. The families of the Compositae (104 types), cereals (64 types), crucifers, bean, borage and Chenopodiaceae (30 – 39 types of each) are represented especially wide (Fig. 1. 10).

After the cultivation of 25 million hectares of virgin and fallow lands, different types of weeds appeared and have evolved. The Sonchus-oats (*Avena fatya, Conchus)* weeds have occurred in the more fertile black earth soils, Couch grass and sedge (*Agropyrum ramosum, A. repens) are typical on the* chestnut soils of heavy loamy composition with signs of salinity. On light soils in Aktyubinsk, Kostanai and Pavlodar oblasts the shitinisto - kurai (*Salsola pestifer, Setaria glauca, S. viridis) the c*hoking up with weeds on the ploughed lands can be marked.

The destruction of the undesirable weed plants with the help of various herbicides presents danger for the choked up soils and fauna damage.

Fallow lands. At the present time due to the loss of soil humus, erosion and erosion in the ploughed lands, development of salination and desert, the 17 mln. hectares have been withdrawn from arable. On the "worthless" arable lands, rich weed plants, specific for each sub zone, are flourishing. The diversity of the fallow land plants is due to the nature of agricultural cultivation and transformation of the soils, including the use of fertilizers, irrigation, pesticides and herbicides.

The fact that many natural ecological systems in the forest steppe and steppe zones in Kazakhstan have vanished, causes a need to rehabilitate the biological diversity and restore the lost ecological systems, such as rich in various grasses feather –grass (8.5 million hectares), various

grass feather-grass (13.6 million hectares) steppes, on which the brush woods of many useful plants are essentially reducing. Some of their types were put into the Red Data Book: 21 types of food, 20 of medicine and other plants.

In the zone of the deserts the ecological systems of the nitrogen – loving plants are being formed in the fallow lands, while on the secondary salinated irrigated lands - the saline- loving types are evolving. In the process of natural recovery of the original plants during 15 – 25 and more years, they are changing from one-year to multi- year zone type. But the process of the zone soil recovery in the ecological systems after erosion and dehumusification may be very long (up to 50 –100 years) or not possible at all.

Improved pastures. The cultural pastures and hay plots, which are created by the surface and radical improvement of the low productive natural pasture lands are specific ecological systems.

Pasture and hay lands which are improved radically, prevail among the agriculture ecological systems and are more efficient as compared to that of surface.

The success of the radical improvement greatly depends on right choice of the sowed grasses. In the steppe and dry steppe zones blue and yellow lucerne (*Medicago)*, sandy esparcet (*Onobrychis)*, white and yellow melilot (*Melilotus)*, the wide spike and narrow spike zhytnyak (*Agropyron).* In the regions of the developed sheep breeding in the dry steppe zone such perennial plants as volosetz sitnikovyi (*Elymus junceus),*prutnyak *(Kochia prostrata)* are the most perspective ones.

In the improved fodder lands of the semi desert zone the main perennial fodder cultures are the following: in the north - wide spike and narrow spike zhytnyak (*Agropyron),* in the south - narrow spike, sandy and desert zhytnyak (*Agropyron),* and also mostly crop productive and long living in the cultural phytocenozes (over 10 years) lomkolosnik sitnikovyi (*Psathyrostachys juncea)*, used for creation of the improved early spring and spring pastures, and prutnyak (*Kochia).*

In the desert zone of agriculture ecological systems local wildly growing dry resistant fodder plants are spread most widely: prutnyak (*Kochia prostrata),* sandy form, teresken (*Ceratoieds papposa),* keyreuk (*Salsola orientalis),* camforosma (*Camphorosma)* - in the north, stony and sandy forms of prutnyak (*(Kochia),* teresken (*Ceratoides papposa),* keyreuk (*Salsola orientalis),* chogon (*(Aellenia subaphylla),* white and black haloxylon *(Haloxylon aphyllum* and *H. persicum),*and ephemerae and ephemeroids - myatlik lukovichnyi (*Poa bulbosa),* roof coster *(Bromus tectorum),* mortuki *(Eremopyrum)* as well.

Planted forests. Development of the forest agriculture ecological systems in the republic is due to the necessity to increase woody ness, particularly in the regions poor with forests, and to develop garden and park infrastructure (Fig. 1.11.).

In the end of last century they have started planting forests in Kazakhstan, however the forestry has got wider scope after 1948 especially in the dry regions.

Before 1993 on the territory of the forest fund there were created forest agriculture ecological systems in the area of over 1 million hectares. To prevent soil deflation on the opened bottom of the Aral Sea in the period from 1990 through 1994 the area of 17.0 thousand hectares of the phyto and forest melioration plantings of the dry resistant and saline stable types of the local flora - *Haloxylon aphyllum* and *Halocnemum strobilaceum* - have been created.

In the places where the water and wind erosion of soils was active, the protecting forest plantings were created:

- state protective forest belts (53.3 thousand hectares of 100 - 300 m width): along the Ural river in the Western Kazakhstan oblast, along the Irtysh river in Pavlodar oblast, at the southern border of the sand massive of Moinkum in Zhambyl oblast, in the Bazoiskyi massive of the ploughed lands in Almaty oblast. When they reached the age of 15 -20, the measures on their reconstruction were carried out, which enhanced their protective role and landscape attractiveness;
- the forest belts, shielding fields (95.3 thousand hectares) and pastures (42.2 thousand hectares) and protective forests in the worthless plots of the agricultural lands are carrying out important functions on weakening the erosion and deflation of the soils and microclimate improvement, promoting the growth of harvesting for the cereals and fodder by 15- 20 per cent in average. At present time due to the insufficiency of financing, lack of the economic motivation the works on development of the forest agriculture ecological systems have virtually terminated;
- the planting of the protective forests along the natural hydro geographical network, channels, water reservoirs has been carried out on the territory of total area of 1.0 thousand hectares. Because of insufficient care the planted forests are close to decay and need urgent reconstruction;
- by- road forest strips protect roads and subways (59.7 thousand hectares), rail ways (66.8 thousand hectares) from sand and snow overwhelming. The existing forest strips protect 30 per cent of all roads. During recent years the works on creation of the by- road forest strips are practically not carried out, and the existing plantings need reconstruction and recovery due to the insufficient care and voluntary cut by the population;
- the sanitary and protective plantings (212.0 thousand hectares) perform invaluable role in protecting the cities and industry centres from the strong winds, in creating the favorable micro climate and healthy sanitary and hygienic environment, in landscape decoration, improvement of the rest conditions for the population. They are presented by the natural forests and only in some oblast centres they were created artificially in the area up to 10 thousand hectares. Currently the works on creation of the sanitary and protective plantings are carried out only in the surroundings of the capital of the republic - Astana city. There they have allocated 29.3 thousand hectares of the lands adjacent to the city.

To increase the efficiency of the protective forest planting basing selection inventory of the plantings the permanent forest seed plots are allocated on the area of 1713 hectares and forest seed plantations are founded on the territory of 85 hectares.

Growing of the seedlings and saplings of major forest forming types in the forestries was carried out in 252 forest arboreta, including 100 basic nurseries, equipped with the stationary irrigation networks. At present time due to the lack of financing the significant part of the nurseries is not utilized. To provide their further operation financial resources are needed for the reconstruction of the irrigation networks, agro technical preparation of soils and provisions of the planned works.

Gardens and parks. The biological diversity of gardens including those located in the dachas' land plots, has not been studied.

The gardens in the republic mainly contain cultivated sorts of local selections, which have been breed from wild relatives growing in Kazakhstan. The assortment of the cultivated sorts of the wood and bush plants is wide. The total area of the gardens is 138.4 thousand hectares, of which 4.3 thousand hectares are forests. They are largely located on the slopes of the mountains, and within small plots of unusable lands, which are not irrigation. Significant areas of gardens

are located in southern and south eastern Kazakhstan , the main areas of fruit growing in the republic. Their major part is either privatized or rented out. A number of sorts, in particular, known all over the world, require restorative work to be done.

Thus, the garden and park plantings, including those in the dachas' plots, form a huge specific group of the cultivated ecological systems.

The protective forest strips, garden and park plantings play an enormous role in the conservation of biological diversity along with the increase of the agricultural harvesting, enhancement of fruit and berry crops. These agricultural systems provide an asylum for many types of the animals and birds, and valuable flora and micro organisms are localized and conserved within their limits.

2.2. Diversity of species

2.2.1. Flora

The rich diversity of Kazakhstan's flora may be evaluated by the number of different taxons, species and genus. Diversity also varies geographically through the natural and climatic height zones. In general, the diversity and originality of the flora and fauna in steppe and desert zones increases from west to east. However, in mountain systems an increase takes place from the north-east (Altai) to the south-west (West Tien- Shan, Karatau).

Over 6 000 species of higher vascular plants, about 5 000 species of mushrooms, and 485 species of lichens are registered on the territory of Kazakhstan. In addition, over 2 000 species of sea weeds, and about 500 species of bryophytes have been recorded in this region (Fig. 1. 12). A comprehensive inventory survey of the bryophytes and sea weeds has not been completed. It is important to note that the most complete inventory survey was performed on mushrooms and higher plants, among which 14% of species were found to be endemic, indicating the high originality of the republic's flora. Of the endemic species, it is necessary to highlight 10 mono type species: Physandra, Rhaphidolophyton, Pseudoeoremostachys, Pseudomarrubium, Botschanzevia, Cancriniella, Spiraeanthus, Pterygostemon, Pastinacopsis, Niedzwedzkia. There are many relicts among the endemic species.

As a whole, the flora of Kazakhstan's higher plants was formed on a base of subtropical vegetation during the Eocene, mesophyllous forest flora of the Oligocene, ancient middle sea flora of the Neogen, and on primordial (primitive) steppes of the Miocene-Pliocene period. A number of representatives of the past epochs have been preserved as the relicts. They are Spiraenthus, Rhaphidophyton regelii, Echinops saissanicus, Zygophyllum potaninii, and others (Eocene); Betula turkestanica, Juglans regia, Malus sievereii, Sorbus pesica, Populus talassica and others (Oligocene); Iris scariosa, Rheum nanum, Allium polyrrhizum and others (Miocene-Pliocene).

4.8 % of Kazakhstan's microflora species are endemic (Fig. 1. 13). In particular, this high endemism is evident in sphaeropsidales Kazakhstan's mushrooms, which have 3 endemic genus and 124 endemic species (12% of the species content of sphaerpsidales mushrooms).

At present 303 species of plants are included in the first edition of the Red Data Book of Kazakhstan and protected by the Government. Material has been prepared for the second edition of the Red Data Book of Kazakhstan, which will include 404 species of plants (6%), 2 species of Lycopodiales, 2 species of Filicinae, 4 species of bryophytes, 2 species of Gymospermae, 362 species of flowering plants, 6 species of sea weeds, 22 species of mushrooms, and 4 species of lichens (6 % of higher plants, 0,6 % -lower plants). All species put into the Red Data Book are classified by categories according to the IUCN classification.

I. (0) – probably vanished;
II. (1) – endangered by vanishing;
III. (2) – rare species;
IV. (3) – reducing in number;
V. (4) – unidentified;
VI. (5) – recovered.

The distribution of species to be included in the Red Data Book's second edition has been categorized in table 1. 2.

Table 1.2
Content of the Red Data Book species of the phytobyota of Kazakhstan

Taxons	Number of species	Put into the Red Data Book	Categories					
			I (0)	II (1)	III (2)	IV (3)	V (4)	VI (6)
Horsetail	8	-	-	-	-	-	-	-
Bryophytes	about 500	4	-	-	4	-	-	-
Filicinae	35-36	2	-	-	2	-	-	-
Lycopodiales	5	2	-	-	2	-	-	-
Gymospermae	26	2	-	-	2	-	-	-
Flowering plants	about 6 000	362	3	38	248	55	2	4
Sea weeds	about 2 000	6	2	2	1	1	-	-
Lichens	485	4	-	-	-	2	2	-
Mushrooms	about 5 000	22	-	4	17	1	-	-

The composition of the higher plant's flora is characterized by numerous medical, fodder, technical, food, decorative and shrub species.

Tannin plants are the most researched group of raw plant resources. More than 20 species of valuable tannin plants were identified during many years of research, and include the following: *Polygonum coriarium*, *P. bucharicum*, *Rumex tianschanicus*, *R. paulseniacus*, *Rheum tataricum, Rh. Maximowiozii.* The gross dry root weight of these species is equivalent to over 200 thousand tonnes.

Phragmites australis and *Achnatherum splendens* are technical plants of complex use.

Thickets of *Phragmites australis* and *Achnatherum splendens* have decreased since the last survey.

Malus sieversii, M Armeniaca vulgaris, Crataegus and *Berberis* are the most important amongst the food plants. Above 300 tonnes of *Malus, Crataegus* and *Armeniaca* fruits are procured annually by forestry farms.

Not less than 70 out of 450 investigated species of ethyl oleagus plants have potential for their composition and oil and species include *Artemisia*, *Hyssopus*, *Mentha* and *Achillea*.

80% of the main medical plant resources are spread through the Zailisky Alatau, Ketmen, Kungei, Terskei Alatau, Dzungarski Alatau, Kyrgyz ridge, Boraldaitau, Altai, and Tarbagatai mountains. The republic could export some of these species. Thus, the resources of *Ephedra equisetina* enable the procurement of over 700 tonne of dry resources without any damage exertion. The resources of *Glycyrrhiza glabra* and *G. uralensis* are equivalent to about 75 thousand tonnes. This suggests that there may be an opportunity to export raw materials of these species in considerable amounts. The resources of other species are sufficient to meet the internal demand for raw vegetal resources. The ordering of the procurement system and regulation of this campaign is needed only.

2.2.2. Fauna

The inventory survey of Kazakhstan's fauna has been completed for the vertebrates only, although for some classes a generalized fauna summary has been published. 835 vertebrate species inhabit the territory of Kazakhstan, which may be sub-divided into 178 species of mammal, 489 species of mammal, birds (396 species actually nest within the territory), 49 species of Rhynchocephalia, 12 amphibia species, 104 fish species and 3 species of Cyclostomata.

The following number of orders, families, genus, species and subspecies (table 1.3 and Fig. 1.14) represent taxon diversity of vertebrata in Kazakhstan.

Table 1.3
Taxon diversity of fauna

Classes	Order	Family	Genus	Species	Subspecies
1	2	3	4	5	6
Mammals	6	33	89	178	244
Birds	18	60	214	489	449
Rhynchocephalia	2	13	25	49	35
Amphibia	2	6	7	12	9
Fish	11	19	61	104	71
Cyclostomata	1	1	2	3	0
Total	40	132	398	835	808

The representatives of *Rodentia* order (82 species) amount to about half of the total species diversity for mammals, of which *Selevinia betpakdalensi,* (an endemic species and genus of Kazakhstan) is of special interest in terms of biological diversity conservation. The endemic of West Tien-Shan, the *Marmota menzbieri* is also of particular interest.

Hoof (elk, wild boar, roe deer, saiga, Siberian ibex tau-teke, maral) and rapacious (predatory) (wolf, fox, corsac fox, badger, lynx (bobcat), bear, glutton, sable, steppe and forest polecat) are among 33 species of hunting mammals. Many representatives of just these two groups have ceased to be game and have been registered in the Red Data Book amongst species endangered by vanishing.

The *Saiga tatarica* – the ancient mammal, was under threat from extinction during the early twentieth century. However, *Saiga tatarica* has been saved by scientists and producers (Fig. 1.15) and is now a principal game species. The sustainability of this mammal's population now depends primarily on the monitoring of its numbers.

More than 43 species from the 489 species of bird are hunted, and are the inhabitants of water and marsh complexes (*Anseriformes*, *Charadriiformes*, *Gaviiformes*, *Colymbiformes*, some of *Steganopoda* and *Gruiformes*). Hundreds of thousands of birds nest in the steppe and desert lakes

of Kazakhstan, millions of ducks, geese, leaf-roller weevils, curlews and other water and marsh game visit its territory during the seasonal migrations in autumn and spring.

The representatives of the *Galliformes* order (*Tetrao urogallus*, *Tetrastes bonasia*, *Lyrurus tetrix*, *Lagopus lagopus*, *Lagopus mutus*, P*erdix perdix* and *Perdix daurica*; *Phasianus Colchicus*, *Alectoric chukar*, *Tetraogallus himalayensis*, *Coturnix coturnix*) occupy the second place among the game birds. 35 species of predatory birds (*Agnila, Buteo, Falco, Circus, Accipiter, Circaetos, Pernis, Aegypuis, Gyps, Gypaetus*) and others, are inhabitants of Kazakhstan. Unfortunately, about half of these (all big eagles, falcons and vultures) have become so rare as a result of pitiless destruction in the1950-60s, that they have been put into the Kazakhstan's Red Data Book and include *Agnila chrysaetus,* which is the state emblem of Kazakhstan.

Despite the absence of the full endemic species among the birds of Kazakhstan fauna, a whole number of steppe feathery habitants is characteristic of Kazakhstan's teritory, for example *Melanocorypha yeltoniensis, Anthropoides virgo* and also *Chettusia gregaria*., which are habituating beyond the republic within the limited territory of Volga's east coast.

Of 49 *Reptilia* species, the procurement of *Agrionemys horsfieldi* (40-180 thousands pieces per year) has taken place for a long time in Kazakhstan. This practice threatened species numbers in parts of the south and south-east of Kazakhstan. The same threat exists for the poisonous snakes (*Agkistrodon halys*, *Vipera berus, Vipera ursini)* which are killed for their venom, used in medicine. The demand for poison from different spider species has also displayed a marked increase.

About 100 species of fish have been currently documented in the Republic of Kazakhstan. 15 of these fish species, new to Kazakhstan's lakes, have naturalized since their introduction some 100 years ago. The following 19 fish species are important in terms of agricultural-economic value to the republic: true sturgeons (*Huso huso*, *Acipenser guldenstadti*, *Acipenser stellatus*, *Acipenser nudiventris*, and conditionally grouped as chasticovye - *Esox lucius*, *Rutilus rutilus*, *Leuciscus idus*, *Ctenopharyngodon idella*, *Aspius aspius*, *Tinca tinca*, A*bramis brama orientalis*, *Carassius carassius*, *Ciprinus carpio*, *Hypophthalmichthys molitrix*, *Aristichthys nobilis*, *Silurus glanis*, *Perca fluviatilis*, *Perca schrenki*, and *Stizostedion lucioperca*.

The number of many species of animal have declined and also their habtitat due to anthropogenic activities. The Red Data Book of Kazakhstan, established by the Government of the Republic of Kazakhstan in 1978 illustrates this well. The data for January 1, 1998 lists 125 species (or about 15 %) of vertebrates (Fig. 1. 16) and 96 species of invertebrate, and 85 species of insect. (Fig. 1. 17).

Some of hoof animals (*Gazella subgutturosa, Ovis ammon,* especially caratauski, kyzylcumski and altaiski subspecies) and predatory animals (*Carnivara*) are among the most endangered species in the *Mammalia.* This is especially true with respect to the representatives of *Felidal* (*Acynonyx ynbatus*, *Felis caracol*, *Felis margarita*, *Uncia uncia*, *Lynx lynx*, *Lutra lutra seistanica*; among the birds – Otididae family (*Otis tarda*, *Chlamydotis undulata*, *Otis tetrax*), (*Falconiformes*), particularly big falcons (*Falco cherrug*, *Falco pelegrimides*, *Falco peregrinus*), some waterfowl and by- water birds (*Pelecanus crispus, Pelecanus onocrotalus, Bubulcus ibis, Egretta garzetta, Platalea leucorodia, Plegadis falcinellus, Oxyura leucocephela, Anas angustirastris, Melanitta nigra, Melanitta fusea, Chettugia gregaria, Numenius tenuirostris*) and others; among the fishes – the inhabitants of the Aral and Kaspi basins (*Psendoscaphirhynchus fedtsehenhoi, Aspiolucius esocinus, Acipensa nudiventris, Salmo trutta caspius, Salmo trutta aralensis, Barbus brachycephalus brachycephalus, Barbus capito conocephalus)* amongst others; among the invertebrate species – the commercial species of butterflies (*Lepidoptera* and *Coleoptera)*, are exported by amateur collectors.

About 80 thousand species of *Invertebrate* are found in Kazakhstan. They exceed the vertebrate both by the numbers of species, and biological mass, fulfilling the important role in circulation of substance in nature. They are represented mainly by the following species: mollusk (about 300 species), arthropod (more than 60 thousand including: insects – about 50 thousand species and Arachnida class - about 10 thousand species), segmented worms (more than 100 species), nemerteans (some species), Nematoda phylym (some hundred species), Platyhelminthes phylym (more than 100 species), Coclenterata (some species), sponge (some species) and Protozoa (united group of types, containing probably not less than 10 thousand of species).

Unfavourable changes in the fauna of *Invertabrata* were incorporated in the Red Data Book of Kazakhstan, within which 96 species of insects were included: 1 species of crustacean, 6 species of mollusk, and 2 species of segmented worms. It is however, important to note that these are not all species, which are endangered by vanishing. The majority of the *Invertabrata* species are very low in numbers and even small ecological changes to their biogeocoenosis could cause their dissapearance and irreversibly destroy the entire respective ecological system.

2.2.3. Microorganisms

The biological diversity of microorganisms is defined not by their morphology, but by their function. Their function is important both in the natural environment and in the human world as their rich fermentational capability has been utilised by man in many different technologies. The modern methods of microorganism excretion in artificial nutrient environments highlight only a small part the soil micro population's function. The tremendous diversity of microscopic forms though, do not generally grow in nutrient rich environments.

Microorganisms are the active participants of two global processes – turnover of carbon and nitrate, which are responsible for the life existence on the Earth. The microorganisms responsible for this mineralize organic residues to carbon dioxide. A further set convert the nitrogen in the atmosphere into forms of organic compounds.

Microorganisms are classified in the biological community, which participate in the formation and destruction of soil fertility.

The following microorganisms may be indicators of intensive transformation of organic compounds in the soil, correlated with the productivity increase: *Azotobacter chzoococcum*, *Bac.megatherium* nitrification bacteria, *Sporocytophaga mycoccoides*, *Micromonospora*.

The Regrouping in the content of microbial association occurs given the decrease of the soil fertility level as the result of prevailing mono cultures of wheat. The number of the specified microorganisms has notably decreased. The content of the *Bac*. *Mesentericus*, *Clostridium Pasteuricnum,* ray fungi (Actinomycetes) and mushrooms are increasing.

The appearance of ecological tensions in the soil (pollution by heavy metals, oil products, monoculture, salinization) is accompanied by a reduction of microorganism species diversity.

Since the utilisation of virgin and long-fallow lands for wheat monocultures accompanied by intensive mechanical proceeding of the soil, aeration, stimulated mineralization of soil organic compounds and excessive nitrification, the black earth and chestnut-colored soils of Kazakhstan have lost 25-35% of humus from their original content.

The biological fixation of nitrate is performed by the associative and symbiotic nitrate fixing microorganisms. The free living nitrate fixers are inhabitants in the plant rhizosphere, and their number is decreasing with soil culture. In the soil of the north Kazakhstan the associations of free living nitrate fixers are represented by *Mycobacterium* species. In the southerly irrigated soils different groups of nitrate fixers have been found: *Azotobacter*, *Bac.polymyxa* and others.

Nitrate fixation is performed by *Clostridium* in the flooded soils under rice. Symbiotic fixation of the free nitrate is performed by *Rhizobium* on the root tubers of wild growing and culture leguminous plants. Tubes bacteria were excreted from the tubes of lucerne, soy-bean, melilot, lilac (goat's rue) with perspective of creation the land fertilizing preparation - nitragine.

2.2.4. Fossil flora and fauna

There are many locations of palaeontological traces of Paleozoic, Leozoic, Mesozoic and Kainozoic epochs on the territory of Kazakhstan. All identified locations of fossil are unique in Kazakhstan. The Chu-Iliski mountains contain the oldest fossils discovered on Earth which are more than 420 million years old and show traces of representatives of vascular plants. This suggests that it is important to consider this territory as one of the centres of formation and beginning of the Earth's surface flora . The ancient traces in Asia of four-footed vertebrates were found in the south east of Kazakhstan which resided about 280 million years ago. A famous Karatauskoe Jurassic lake in the south of Kazakhstan, contains very rich traces of insects (about 500 species are defined), plants, and also fish, crocodile, flying pterosaur with wool cover (which lived about 150 million. years ago).

There are locations with plants remains, sea and terrestrial rhychocephalia of Jurassic and cretaceous periods and also paleoflora and mammals of Kainozoi. The largest numbers of dinosaurs and cretaceous plants, which were unusual for Asia, are located in the north-east of the Priaral. The representatives of the fossil flora and fauna give a possibility to answer many questions about change processes of plant biological diversity and animals of past geological epochs, reasons and factors of mass vanishing of groups and appearance of the new ones.

Some locations have already been lost as a result of human economic activities in Kazakhstan. Many have vanished under stone, whilst rocks with animal and plants traces have been used for building materials, and destroyed in the construction of roads, populated areas etc.

The main locations of Paleozoic, Mesozoic and Kainozoic plants and animal traces areas follows:

- Chu-Iliski mountains (the ancient plants on the Earth);
- Kuldenentemir (cretaceous flora with angiosperms);
- Takyarsor (Eocene subtropical flora with palms) and other;
- Erzhilansai, Altyn-Shokysya (Turgai forest leaf falling flora);
- Utegen (the ancients latest-carbon -earlier perm vertebrata animals in Asia);
- Shah-Shah (dinosaurs and other vertebrata animals and plants of cretaceous period);
- Aulie (flying Jurassic pterosaur, crocodiles, insects and plants);
- Kushmurun, Priozernoe (mosasaurs and other cretaceous sea rhynchocephalia);
- Karaturgai, Aktau (indricoteria fauna (giant rhinocerus indricoteri-the most big mammals on the Earth);
- Pavlodar ("Great-African fauna (giraffes, ostrich and other).
- At present there are about 225 main locations with flora and surface fauna traces of vertebrates of Paleozoic, Mesosoic and Kainosoic epochs in Kazakhstan. Among them there is one with traces of Paleozoic vertebrate representatives and about 100 species of plant. There are traces of fauna representatives in 36 locations, and flora of Mesosoi and Kainosoi in 126 locations.

At present only three locations are protected: two of them are located within the limits of Aksu-Dzhabaglinsky preservation park, and one is a monument of nature in the city of Pavlodar. Some of those that are unprotected have partly or completely vanished due to natural and anthropogenic factors. There are also world famous locations among these, which have vanished com-

pletely: Galkino (Uspenskoe) with traces of Jurassic insects, vertebrata and plants; Kuldenentemir was the first location of the cretaceous plants.

At present there is a need to undertake special research to study the safety of Kazakhstan's flora and fauna of the past geological epochs and to undertake measures for their protection.

3. IDENTIFICATION OF GENERAL TRENDS IN THE CHANGES OF THE BIOLOGICAL DIVERSITY

3.1. The main reasons and manifestations of the exhaustion processes of biological diversity

The impoverishment of the fauna and flora and degradation of ecological systems has become the main ecological consequence of man's impact on the natural environment. At the present time 125 species of vertebrate, 96 species of invertebrate and 287 species of supreme plants have been put in the Red Data Book of Kazakhstan.

The exhaustion of the natural biological diversity of fauna occurs as a response to the disappearance of local species populations and a reduction of habitat and quantity, diminishing the phytocoenosis activity and reproduction capability.

During last few tens of years a number of species have not been found in the territory of Kazakhstan implying that they have most probably vanished by the present day. The following can be included in this number: *Dryopteris mindshelkensis, Stroganovia robusta, Prangos equisetoides, Dorema karataviense, Acantholimon minshelkense, Mattiastrum karataviense, Eremostachys pectinata, Orobanche karatavica, Centaurea kultiassovii* in the Southern Kazakhstan, and *Adisnthum capillus- veneris, Berberis karkaralensis, Betula kyrgyzorum, Anemonoides caerulea, Paris quadrifolia, Alnus glutinosa, Pteridium agnilium, Gymnodenia conopsea, Dacsylorhisa fuchsii, Distamnus angustifolius* in the Central Kazakhstan, *Arenaria potaninii* in the Eastern Kazakhstan.

Nineteen species are threatened with extinction in the near future and includes : *Stipa anomala, Allium caespitosum, Tulipa regelii, Juno almaatensis, Populus berkakarensis, Atraphaxis teretifolia, Silene betrakdalensis, Cachris herderis, Ikonnikovia kaufmanniana, Niezwedzkia semitschenskia, Rubia cretaceae, Cryptocodon monocephalus, Artemisia cina, Ferula iliensis, F. sugatensis* and a number of others. 19 species in the Eastern Kazakhstan and 9 species in the Central Kazakhstan can be classified in this category. All the above mentioned endemic genus available in Kazakhstan can be included in the given category. The fact that some of the species have turned out to be located in eroded lands of ecological systems, has caused great concern. *Spireanthus schrenkianus* serves as an outstanding example of this. Two well-known large populations of this relict, endemic, mono type genus undergo an extraordinary anthropogenic burden. The rocket fuel used in the activities of the military institution located in the suburbs of Saryshagan poisoned the Betpacdala population; the Karatau population lived in a heavily polluted pasture many years ago. These examples support evidence about the erosion of the floristic genetic fund at the species level.

The transformation of flora in the direction of xerophytisation has occurred in the steppe and mountain regions. The attack of the adventive species along with the degradation of the floral cover is being observed. Thus, out of 64 species of plants, 60 per cent of which are "southern" elements and found in the dumps of Karaganda's coal mining basin. The species of the subtropical and tropical origin such as *Amaranthus blitoides, A. retroflexus, Hibiscus trionum, Medicago sativa, Nonea lutea, Zygophllum fabago, Peganum harmala, Beta vulgaris, Chenopodium botrys* have become quite usual in the composition of the degraded flora in the steppe and mountain regions. The particularly intensive inflow of the adventive species and their expansion has been noted during the last decade. The *Ecballium elaterium*, *Bidens frondosa* have been discovered in the Eastern Kazakhstan and Preirtyshie, the *Amaranthus spinosa, Artemisia annua, A. tournefortiana, Egiron annuus,* and a number of others are found more frequently.

In general, the escalation of the adventive plants from the south to the north is more intensive than in the opposite direction. This trend supports the first disappearance of the mezophytic genus suggesting that the total flora xerophytisation is in the process of deserting.

The adventive plants not only become competitors to the local species in their use of abiotic resources, but often interbreed and form hybrids which may show signs of dominating over the newcomers.

Many natural landscapes with rich and diversified fauna have been preserved in Kazakhstan, but nevertheless during the last decades the fauna of the republic has undergone significant changes under the influence of anthropogenic factors.

Due to the mass ploughing of the virgin lands, the sharp reduction in areas of natural vegetal cover, the erosion of soils, technogenic and agricultural contamination, the fauna of the sub - soil and in -soil insects (*Insecta),* bugs *(Arachnoidea),* birds (*Aves),* animals (*Mammalia)* and other groups of animals have suffered significantly. The fauna of the steppe zone has been destroyed by about 80 per cent in the northern regions of the republic. A similar situation has evolved in the steppe zone of Tein Shan and its foothills. Due to land cultivation, demanding the wide use of the pesticides, over pasturing and fire, many species of the insects phytofague, - wild bees (*Apoidea),* which pollinate the plants, predatory and parasite arthropods - (*Arthopoda),* reptiles - (*Reptilia), birds (Aves),* and animals (*Mammalia)* have become sparse and in some places have disappeared. Many species of animals (including the endemic ones) have reduced in habitat numbers and are becoming potential candidates for the Red Data Book of Kazakhstan due to over pasturing in the uplands of Tien -Shan, Dzhungar Alatau and Tarbagatai, and the deserts of Taykum, Moiynkum, Saryesik - Atyrau.

The structure of the zooceonosis has changed as a result of anthropogenic impacts in addition to the break down of species structure. This has lead to a subsequent reduction in the total number of animals. The eurybiotnic lamellate species (many of which are agricultural and forest farm pests) have experienced a marked increase in number. Large changes to the fauna have occurred throughout the suburbs of large industrial centres, particularly within the territories of military firing ground and throughout regions of mineral extraction.

Man's response to desertification has in many cases resulted in unfavourable changes to the faunal status of Kazakhstan. The provision of water supplies by artesian wells has transformed the appearance of the desert, creating numerous micro lakes near self-outpouring wells. Animals use the wells as water holes, which subsequently facilitate and strengthen poaching. Resource development has had a significant impact on the fauna during the construction of roads, pipelines, electricity cables, etc. These works create conditions for extraneous elements to penetrate the natural landscape, potentially resulting in adverse impacts on indigenous fauna.

- The impoverishment of the fauna as a whole reduces the opportunity to use zoological resources in the future as a sustainable resource.
- An overall reduction in insect numbers and other *Invertebrate* species is most likely to be associated with a significant decrease in game – dependant on insects and *Invertebrates* as a principal food source. This would have serious economic consequences.
- Changes to the zoocoenosis structure resulting in accelerated population numbers of eurybiotnic lamellate species, many of which are pests, is likely to result in profit loss for agribusinesses such as crop farming, forestry, fisheries and hunting.
- Depletion of soil invertebrate fauna is likely to result in a decrease of soil fertility and a subsequent deterioration of the soil's natural regulating processes. This could result in a reduction of agricultural productivity.

– A decline in the number of insect pollinators is likely to cause significant problems for the agricultural sector. A reduction in the gross number and species structure of insect ethnomofagues is directly related to the flourishing of pests, which have become increasingly resistant to pesticides. This has resulted in the accelerated use of pesticides to maximise agricultural yields and compensate for losses. However, chemicals have only a temporary effect, many of which contaminate the local environment.

Unfavourable changes to the fauna of Kazakhstan have been reflected in the Red Data Book, in which a list of rare and endangered plant and animal species has been given. The following 40 species and subspecies of *Mammal* have been included in the Red Data Book (third edition): 56 – *Aves,* 10 – *Reptilia,* 3 – *Amphibia,* 16 – *Osteichthyes,* 1 – *Cyclostomata,* 85 – *Insecta,* 2 – *Araneinae,* 1 – *Crustacea,* 6 – *Mollusca* and 2 – *Annelida*. However, this is not a complete list of endangered species.

Due to intensive ploughing of the land during the period of 1954 – 1960 significant changes occurred to many ecological systems in Kazakhstan. The transformation of forest regions resulted in the formation of steppe zones (Fig. 1. 18, 1.18A). The rich motley and feather grass steppes (*Stipa zalesski, Herbae stepposa plurimae) (*8.5 million. hectares) and motley and feather grass steppes (*Stipa zalesski, Herbae stepposa)* (13.6 million. hectares) have suffered particularly from plugging of the land. 90% of the plain territory and 30% of the small hill lands have been ploughed. 50 – 60% of dry steppes within the plain territory (52 million hectares) are ploughed compared to 10 –15% in the small hills. The rest of the steppe lands within the sub zones, such as stone and complex steppes on saline hill slope soils have been transformed significantly. Due to over-pasturing of the feather grass steppe environment, significant losses to biological diversity occurred.

The vegetation of the mountain steppes has also experienced considerable changes since unploughed plots of land became exposed to the over-pasturing and hay mowing. 41% out of 123 associations in the Zailiskiy Alatau are transformed uplands.

Changes to vegetal cover and the depletion of its biological diversity are not occurring in the same way throughout the various desert sub -zones. In the good pasture lands of northern deserts, which are predominantly feather grass (comm. *Artemisia),* the hearth like (localised) over pasturing has been observed around the wintering, settlements. The hearth-line may be compared to over pasturing along the routes of cattle movement. In the central and western deserts (salted for many years) several forces were found to be operating. In addition to over-pasturing, infringement is related to the technogenic and non-systematic organisation of the road network (especially in the west of the republic), and the over regulated river drainage network and haloxylon cut off. The vegetal cover of the sandy deserts has been particularly damaged. The sand deserts *(comm. Aropyron fragile, Artemisia)* when over pastured often transform into one-year deserts *Artemisia seorapia, A. l eucodes. Anisatha textorum, Ceratocarpus uticulosus)* subsequently shortening their seasonal use and fodder nutrition potential further.

Urbanisation and intensive agricultural development of the foothill zone has infringed greatly on the vegetal cover. Kazakhstan' s original ephemeroidal and worm wood deserts have practically been destroyed.

Unique communities such as *Spireanthus schrenkianus* in the mountains of Karatau, and *Niedzwedzkia semiretcheskia* in the Chu -Iliyskyi mountains, are the subject of great concern due to over pasturing. Their location beyond the protected territories exasperates this.

Significant changes to meadow plants occurred within the flood plain and deltas of the Ili, Syr Darya, Chu, and Talas. The highly productive reed communities *(comm. Pramites australis)*

have degraded in the region. Meadow vegetal cover has become steppe like due to a reduction in the duration and frequency of surface flooding. A number of these transformations are represented by the following stages: *(comm. Elytrigia repens + Poa pratensis, comm. Poa angustifolia, Carex stenopphylla, comm. Festuca valesiaca).*

Due to restricted drainage, the meadow vegetal cover has become universally degraded, and the diversity of meadow vegetation has deteriorated. At present meadow diversity has been reduced to 121 communities, while xerophyte plant cover of the abandoned river flood plains in the desert zones is dominated by 35 ceonosis.

The community yields have decreased 10 - 15 times (from 15 - 40 to 1. 5 – 2 quintal/hectare) throughout the desertification process.

A decline in the sub-soil water level in the flood plain of the Syr Darya river has negatively affected the growth rate of the black haloxylon. Over 200,000 hectares of forest allocated to agricultural production have suffered particularly as a result of this process, resulting in over intensive land-use for the natural resources available. The widespread destruction of forest areas has taken place over many decades, and has significantly altered the biological diversity of the region. The habitat of the forest - steppe zone, which is represented mostly by the birch quanted (point distributed) forests - *(Betula pendula, B. pubescens)* with mixtures of the willows and aspens *(Populus tremila, Salix)* is under notable threat. The flood land forests in the north-western Kazakhstan have become increasingly degraded due to frequent violations of the hydrology regime.

The haloxylon forests of the desert zone *(Haloxylon aphyllum, H. persicum)* have been reduced from 10 to 5 million hectares. Tugai forests of poplar trees (*Populus diversifolia, P. pruinosa, P. talassica),* areas of willow forests, tamarisks, and white ash bands forming narrow strips along the rivers, are threatened by anthropogenic pressures such as hay mowing, non-systematic pasture development, and the erection of water reservoirs and irrigation nets. Desertification has encroached on their significant land coverage. Projects designed to reduce the flood plain, eliminate irregular surface flooding, and to lower the level of sub soil water, are presently under way.

Ploughing of the steppes around the forest massifs for virgin land cultivation, has negatively impacted the forests and steppe zones. In the majority of cases, fields were ploughed up to the extreme edge of the forest, while small by size forests units were grubbed up and ploughed. This led to changes in the hydrological regime and regime of the mezolowerings, in which the forests of these zones were formed. The regular aerial spraying of agricultural fields with herbicides, carried out in former times, significantly altered the regions biological diversity. Beside this, forest cuttings held for many decades in birch tree forests *(Betula comm.),* were located on the basis of their verdure reproduction, which resulted in the development of less productive plants.

The steppe pine forests are exhausted due their intensive cultivation in the past and from natural and anthropogenic fire disturbances. Coniferous forests of the Preirtyshie were subjected to stress from fall-out radio nuclides as a result of tests at the Semipalatinsk nuclear weapon site. The implication of this impact for forest ecosystems has not yet been investigated. Over the course of two centuries, large areas of the coniferous forests in the Turgay region and other regions of Central Kazakhstan have been completely destroyed.

Mountain forests have experienced pressure from the over pasturing of cattle, which resulted in the degradation of species and their natural reproduction cycles, which provided sub-soil cover. This deterioration resulted in a net reduction of forest density and changes occurred within the conifers and valuable leafy and shrub species. This is particularly evident in the forests of the Eastern Kazakhstan oblast, where the timber industry has operated for many years. Over the years, extensive logging of forest areas violated forest conservation requirements.

In the Zailiyiskyi Alatau during the last 100 - 150 years, the lower margins of the pine tree zone has increased to 200 metres, whilst in Dzhungar Alatau this has increased to 100 metres. In Talaskyi Alatau the ecological habitats of the apple and hawthorn *(Crataegus)* and in some places the *Juniper* have been completely altered by the Aksu and Mashat river processes.

The flood plains of the tugai forests, especially their relict biogeoceonosis turangi, have deteriorated as a result of river regulation and drainage, subsequently violating their requirements for consistent development, namely a regular nutrient supply. The most extreme anthropogenic impact on the tugai forests has been the removal of significant areas for agricultural use and the subsequent salination and contamination of the land with chemical poisons. This reduced the tugai forest area, and altered the composition forests left remaining.

Large-scale fires have significantly impacted the forests. By 1997 these fires resulted in the partial and complete destruction of more than 230,000 acres of forest (Figs. 1. 19, 1. 20).

Pests and diseases exert a destabilising impact on forest ecological systems and their sustainability. Diseases are recorded to be resident in between 40,000 and 140,000 hectares of forest each year. During mass reproduction phases, forest contamination by pests may increase to 350,000 – 400,000 hectares a year. The disturbance of many thousands of hectares of forest has been associated with insufficient forest protection measures. A lack of financial support assigned specifically to this issue is thought to be the principal reason for this. Enthomologic pests are the most threatening to Kazakhstan's forests: gipsy moth (*Portheria dispar)*, bordered with moth (*Bupalus piniarius,* L. lavra pine looper), flat bugs (*Aradidae family)*, ilm weevils (*Curculionidae family)* and ilm spring - tails (*Collembola order),* fox -coloured sawfly (*Neodiprion sertifer),* star like and pine false webworm (*Acantholyda erythrocephala* ,L.), apple moth (*Yponomeuta malinella Zeller, Lyonetia clerkella, L.),* leaf skeletonizer (*Anthophila pariana, Clerck)*, moth; out of diseases - Cladocera suborder, butt-rot fungus (*F. annosus*), coenangiosis, *Urdenales order of Conifers needles,* bacterial crowberry (*Empetrum nigrum* L.).

Technogenic contamination, resulting in the slowdown and ultimate failure of forest species' biological functions, pose a serious risk to the forests. The drying out of the relict Ridder millet of Leninogorsk city in Eastern Kazakhstan oblast serves as an example of this deterioration.

The nature and consequences of technogenic impacts on biological diversity are evaluated on the basis of the following degrees: strong, moderate, weak; for the individual zones (habitats) which have been affected and the summary complex. The largest summary indicators have been marked for the Northern Caspian region, where the oil industry has developed, resulting in a direct threat to the biological diversity of the flora and fauna. Notable levels of air pollution have contaminated zones adjacent to the industrial regions of Pavlodar, Karaganda and Southern Kazakhstan oblast (Taraz, Shymkent).

A protocol for conservation decisions defining margins for technogenic impacts on biological diversity (Table 1. 4) needs to be established along with their summary affect. A reduction in the marginal acceptable limit of known impacts must be constructed. Reporting the lack of rehabilitation measures implemented for ecological systems in damaged regions would highlight the severity of the pressure on biological resources from industrial activity.

Table 1. 4.

Technogenic impact on the biological diversity

Factor	Types of impact	Recultivation
Deposit exploration and development		

Extraction of oil and gas	Contamination of the water cavities, soils, sub soil water, atmosphere	Lacking
Coal extraction	Change of the habitat conditions (preventing lake formation and other)	Partial
Extraction of uranium group ores	Accumulation of the radio nuclides in the biota	Partial
Extraction of other minerals	Contamination of the environment, change of the conditions for the soils and subsoils	Partial

Processing industry

Total area of the damaged lands – 180 thousand of hectares

The amount of the exhausts to the atmosphere: 8 million. tonnes. (1990), average density is 3.3 g/sq. km

Rock and slag putting – offs	Creation of new, including toxic habitat	Phytomelioration
Atmosphere exhausts	Effect on gas exchange, geochemical abnormalities, contamination, increase of the CO_2 content, change of soil processes , destruction of unique objects (pine tree forests, juniper covers)	Lacking
Drains	Contamination of the water objects	Biological and mechanical purification

Waste storage near the populated settlements

(total amount 20 billion. tonnes, up to 1 billion. tonnes annually), of which 84 million. tonnes of toxic wastes;

1,0 – 1,7 million. tonnes per 1 sq. km)

Waste storage	Toxic evaporation, infection dissemination	Limited Purification
Storage	Contamination of the subsoils, biota infection	

Industry - transport infrastructure

Lengths of the road ways – 100 thousand km, oil and gas pipelines– 21 thousand km,

Electricity transmission lines – 458 thousand km, enormous number of the unpaved occasional roads – sources of deserting

Road ways	Width of the operational zone 20 m	Settlement and spreading of the weed species of the flora:	Partial phytomelioration
Electricity transmission lines	5-50 m	The weeds which accumulate heavy metals, rodents which disseminate the plague, transit of infections; infringement of the rest and migration routes of the animals; effect of the electric and magnetic irradiation	Lacking
Oil and gas pipelines	5-10 m	Endanger of the emergency situations: gas leakage, oil spill over	Lacking

Channels and water reservoirs	0,1 – 2 km	Infringement of the natural habitat of the species, change of the original species	Natural recovery

Contamination of water sources

Up to 5 cubic km of irrigation water is dropped off

Drop off the irrigation water	Accumulation of heavy metals, pesticides, herbicides, defoliants etc;	Lacking
	Increase of salt content and quantity of biologically contaminating substances. The ability of rivers to recover from this is exhausted	Lacking

3.2. The priorities for conserving biological diversity

Kazakhstan's national strategy with respect to biological diversity is to fully conserve the total biological diversity of the country. However the approach to conservation objectives for sustaining biological diversity of the flora, fauna, and agricultural systems depends on a number of indicators: **their vulnerability, current status, economic value** and **adaptability trends**. In determining the strategy for achieving objectives for biological diversity a number of criteria have been considered. More than 100 experts have participated in this work.

23 groups of ecological systems (landscapes) within five large areas have been defined: the forests, steppes, deserts, and mountains, water-cavities and rivers. The following vulnerability criteria were used: **capacity for biological diversity** (very low, moderate, medium, high); **economic value** (lacking, weak, medium, high); **vulnerability to external impacts** (lacking, weak, moderate, strong); **degree of damage** - desert evolution, degradation, loss of fauna and others (lacking, weak, moderate, strong); **reduction of biological diversity** (with the same grades); **protection rating** (good, moderate, weak, lacking); **recreational potential** (lacking, weak, moderate, strong), **ecological importance** (lacking, weak, medium, high). When average grades for ecological systems were calculated, sufficiently reliable results were found (Table 1. 5). The results defined the following grade distribution: requires urgent actions - 14 - 15 grades; medium-term actions - 12 13 grades; long-term actions - 7 -11 grades.

Table 1. 5

Priority Identification Results

Ecological systems	**Express – analysis**		**Sequence of actions (basing the refined data)**
	Evaluation in grades	**Sequence of actions**	
Forests			
Forest steppe birch tree quanted (point distributed) forests (*Betula* + *Populus*)	13	2	2
Band and insular millets	14	1	1
Conifer mountain forests	13	2	1
Wild fruit forests **(Malus *and others*)**	14	1	1
Haloxylon desert forests *(of Haloxylon aphyllum, H. persicum, Hammodendron)*	13	2	1

Tugai flood land forests	15	1	1
Upland sparse forest	11	3	1
Steppes Drought steppes on the black earth	14	1	1
Dry steppes on dark chestnut and light chestnut soils	12	2	2
Desert steppes on the light chestnut soils	13	2	2
Steppe shrub thickets on the plains and small hills	11	3	3
Deserts Detritus and stony deserts	7	3	3
Loamy	9	3	3
Sandy deserts	11	3	3
Alkali soil deserts	9	3	2
Foot hill deserts	12	2	1
Mountains Upland alpine and subalpine	11	3	3
Middle land	12	2	2
Low hills and small hills	13	2	2
Water cavities Lakes	14	1	1
Rivers	15	1	1
Artificial water basins	13	2	2
Water and marsh lands	14	1	1

Note: Sequence of actions:
priority – 1
medium-term – 2;
long-term – 3

On the basis of results from the analysis, forest and water basins emerged to be of the highest priority. Among the forests, a priority has been identified for the band and insular millets, mountain wild fruit forest and tugai flood-land forest in the deserts. All remaining forests have been classified in the medium-term protection category. In the steppes, the drought motley and feather grass ecological systems located on the black earths have been identified for primary protection. The desert ecological systems were prioritised. Only the foothills and *Haloxylon* ecological systems have been selected as targets for medium term protection, although some of them were classified under the long-term protection category. As long-term scientific field-studies indicate, the medium-term method is not always reliable. The loss of biological diversity and degradation of the vegetal cover (desertification, in particular), has resulted in a significant reduction of productivity. This has promoted an escalation of critical ecological situations in the south of the republic. This serves as evidence that a revision is required of the protective priorities for some desert ecological systems and their components.

Specialists have refined their priorities through assessing the relative vulnerability of units within the sub and mountain zones. The wild relatives of cultural plants, animals and transit species, which have the international trans-border significance are also to be taken into account (Fig.

1. 22). Habitat maps have been used in the Red Data Book. Vulnerable ecological systems and their associated species have been linked to their protection status, which served as a main criteria of the selection: (e.g. the endemic and relict species, rare and vanishing species, communities with diminishing or limited habitats, and those experiencing strong anthropogenic impacts).

The essential advantage of using this approach was in compiling a series of distribution maps. More than 1,200 biological entities were classified within three categories of protection: Critically endangered (priority) - short term; endangered - medium term actions; vulnerable - long term actions. Of these, 169 objects were of short-term priority (Table 1. 6), and 165 requiring medium-term actions.

Biological diversity issues of trans-border significance (Fig. 1. 22), such as findings of the Paleorelicts and abundance of the endemic and relict species of flora and fauna is an issue for independent study.

The summary results of the sub zone analysis indicated the following areas to have high levels of biodiversity: the mountains (324 species) and real medium deserts (251 species). These areas contain a significant number of endangered species and ecological systems that need to be protected and managed by a soft regime. The rare communities of the forests do fall into this number.

For the forest ecological systems, the protection categories as specified by the legislation (Forest Code) are retained in the established legal order of forest use and protection. However, within this context rare flora communities of the forests are specified separately.

The categories of protection for plant species

For vascular plants, the identification of priority species is based on the Red Data Book, which includes species endangered by extinction. The map -scheme (Fig. 1. 23) and legend contains 100 species of flora included in the Red Data Book. The species in the legend are ascribed to three categories of danger. Out of 28 critically endangered species (and 40 habitats), 22 of the species in this group are present in the mountains.

The analysis of the flora species may be seen as an original interpretation and approach to the protection status. The map gives the point habitats of endangered species. For many of them a refining and confirmation of the findings is needed.

Protection categories for vegetation

Vegetation communities form the main component of ecological systems and may be classified within a number of sub zones. Endangered communities of flora are divided in the Red Data Book between 4 broad subdivisions: forests and sparse forests, meadows, steppes, and deserts. Within these geographical types the zone, sub zone or mountainous (zone), and edaphic variants are denoted (Fig. 1 24). Their distribution is provided (see map).

The endangered flora communities have been grouped by categories according to their protection rating. This was based on the community's sensitivity to the following variables: habitat scarcity, habitat reduction, relict nature of the communities and their dominants, overburdening with the anthropogenic impacts (over pasturing, land plugging, etc.).

On the basis of the above classification the following communities were summarised as follows:

Of 79 communities subject to protection 33 are critically endangered, 25 are endangered, and 21 are vulnerable;

The specified communities comprise 22 forests, 11 valley and 6 mountain ecological systems; 27 desert communities, 12 of which are flora formations; 11 meadow ecological systems with plain and mountain meadows;

The largest number of endangered ecosystem communities is found in the desert zones.

The protection categories of the vertebrate animals

Analysis of the first volume of the Red Data Book of Kazakhstan (1996) enables the following conclusions to be drawn. Of the 101 vertebrate species exposed to anthropogenic impacts, 32 species and subspecies have been included in the first category "critically endangered": 7 species of fish, 16 species of birds, 9 species of mammals. Within the second category "endangered" 29 species were classified: 7 species of fish, 1 species of amphibians, 1species of reptile, 15 species of birds, 5 species of mammals. Within the third category "vulnerable" 40 species were classified: 2 species of fish, 1 species of amphibian, 1 species of reptile, 15 species of birds, and 16 species of mammals.

The map - scheme of hearth distribution over the territory of Kazakhstan (Fig. 1. 26) shows that endangered and vulnerable species in the republic are particularly evident in certain regions, and include the following: three mountainous regions (Western Tien -Shan, Northern Tien -Shan and Southern Altai); three desert areas (Ustyurtskyi, Balkhash - Alakol and Zaisan) and three steppe regions. The steppe regions are dominated with water and marsh type species (Tengiz - Kurgaldzhinskyi, naurzum - Turgai, Ural -Caspian). This demonstrates again, that the mountainous, desert, water and marsh ecological systems have the highest priority for the conservation of the biological diversity of Kazakhstan, especially with respect to vertebrate animals.

Protection categories of invertebrate animals

The given list and map scheme of invertebrate distribution (Fig. 1. 26) comprises 96 species, 11 of which are critically endangered, their numbers are particularly low and are on the verge of extinction. The endangered species (40) are relatively large in numbers, but their habitats are small and broken. Given the unfavourable circumstances these species may come close to disappearance. The vulnerable species (45) have the largest habitat coverage. However, this area is contracting as a result of various negative factors. In a number of places vulnerable species become increasingly rare and some populations disappear altogether.

The rare and vanishing category includes endemic and relict insect species. Arachnida, annelid worms, and molluscs may be seen on the map – scheme legend, which is included in the Red Data Book. This book is due to be published.

At the present research stage endangered and vulnerable invertebrate species are not found in the forest steppe. However, 34 species were found in the steppes, 76 species in the deserts, 40 have been recorded in the mountains, and 7 within river flood plains, valleys, lakes and coast systems.

Protection categories for the wild relatives of the cultural plants and local breeds of animals

The wild relatives of farmed plants and animals have been found spread over in the republic. These undoubtedly need careful conservation management. They form a reserve and base for prospective selection works.

The fruit and berry species are specified as being among the relatives of the cultural plants: 65 species of trees, shrubs and liana, of which 9 have been put into the Red Data Book (Fig. 1. 27). They are classified as being "critically endangered". There are 56 species, which are endangered and vulnerable.

Of the fruit and berry plants, the most valuable resource for selection can be found in the apple and apricot trees of the mountain forests. The Kazakhstan wild apple tree has the richest diversity of form, dominated by large fruits, which differ slightly from the cultured variety.

There is little data on the wild relatives of agriculturally cultivated plants from which the endangered species may be selected. However, many cultivated plants originated in central Asia and the hearths of ancient civilisations are found within the territory of modern Kazakhstan. It is the native land of many of fruit and berries, field and vegetable cultures, developed through natural selection of local species. Therefore among the flora of the country the wild relatives of cultivated plants present a special interest because they serve as a reserve for obtaining and improving many plants, especially those which are drought resistant and sustainable during the winter.

From the wild relatives of the field and vegetable cultures, 150 species of the following genus may be interesting from a selection perspective:

	Genus	**Number of species**	
1.	Buck wheat	*Fagapyrum*	1
2.	Melon	*Melo*	2
3.	Capers	*Capparis*	1
4.	Linen	*Linum*	11
5.	Onion	*Allium*	103
6.	Lucerne	*Medicago*	16
7.	Noot	*Cicer*	2
8.	Oats	*Avena*	4
9.	Rye	*Secale*	1
10	Barley	*Hordeum*	10

The distribution of local breeds of animals and their wild relatives is given in the Map - scheme (Fig. 1 28). There are only 9 species of domestic animals' wild relatives. The most dominant is the mountain sheep – Pamir argali (*Ovis ammon)* and 6 sub species. The *Cersus elaphys sibiricus* or the Siberian mountain goat (*Capra sibirica)*, is also dominant. Asiatic wild ass *(Equus himionus)* and the subspecies of Pamir argali have also been out into the Red Data Book of Kazakhstan.

A vulnerability assessment of species and communities has been carried out only for the main controls on biological diversity. Endangered and vulnerable species of the staghorn *Evernia* lichens, mushrooms, red seaweed and a number of other living representatives including the Protozoa, have not been identified for two reasons. Firstly, the inventory survey of biological diversity was incomplete and secondly an appropriate database system was not available. It however serves as a basis for incorporating fundamental inventory research with forthcoming biological diversity strategies. The refinement of ecological vulnerability monitoring and the study of species diversity contraction will serve as a major objective for ecological monitoring in the future.

II. NATIONAL STRATEGY FOR CONSERVATION AND BALANCED USE OF BIOLOGICAL DIVERSITY

1. Goals and tasks of Strategy

The principal strategic goal of the global convention is the conservation of biological diversity and to achieve an economic gain through the balanced use of its components. This goal also undertakes to identify the relative contribution of the convention's parties (including Kazakhstan) to a global strategy.

For the Republic of Kazakhstan the Convention on Biological Diversity incorporates not only the problems of protection and balanced use, but also that of biological diversity restoration. A significant loss of resources through land degradation has occurred in over 60% of the republic's territory.

The tasks of the Convention are being implemented by the National Strategy which is based on the Development Strategy for the Republic of Kazakhstan up to the year 2030, which states that Kazakhstan has to have a clean and green country with fresh air and clear water. This will only be achievable if the whole diversity of the biota with its main functions of the self regulation and self recovery are conserved.

The national strategy section "Ecology and Natural Resources" for the long term presents plans for the conservation of diversity for the flora and fauna (monitoring, rationale use, reproduction and protection). The development of specially protected natural territories based on ecological distribution is due to be completed before 2010.

1.1. The Main Goals of the National Strategy

- In-situ conservation of biological diversity.
- Accounting for and socio-economic assessment of the country biological capacity and its balanced use in the legal framework.
- Expanding the genetic fund, and providing genetic independence and biological security of the country.
- Establishing conditions for conservation of the genetic fund of agricultural crop varieties, in particular, of agricultural animals and making agricultural land more productive.

Strategic goals are stipulated by the Convention requirements, but their implementation depends on the existing economic, political, legal, and institutional prerequisites. Under modern conditions of environmental destabilization the ecological policy should envisage a sparing, optimally balanced use regime, and establish conditions for renewal of the lost biological resources.

In line with the Convention regulations, the state – a Convention Party should improve the nature use strategy, give assessment of a biodiversity status, and reveal dangers for species and ecosystems existence resulting from anthropogenic impacts.

1.2. National Strategy Objectives

For fulfillment of the Convention on Biological Diversity requirements and in line with the country sustainable development strategic plan, the National Strategy is envisaging fulfillment of a range of priority objectives, among which there are:

- assessment of the status and specifics of biological diversity, as the eternal value and overall property of mankind;
- revealing and liquidating the danger for existence of species and ecosystems as a result of an anthropogenic impact;
- using the state sovereign rights for it resources, especially for their unique objects, and responsibility for their conservation;
- identification of the traditional dependence of local population on conservation and rational use of biological diversity including agrobiodiversity, for the purpose of satisfying the population needs in food, health, fuel-construction, raw material, business, technical, recreation, and other resources;
- identification of the optimum conditions for environmental rehabilitation and reducing greenhouse effects as a result of the increase of CO_2 (carbon emission) while biological diversity conservation;
- development of a legal framework for exception and conservation of bio-resources, establishing a balance of economic and social ecological benefits while non-exhaustive use of biological resources at the regional, national, and local levels;
- reduction of the dangers for and ensuring conservation of biological diversity;
- improvement of the coordination system for activities regarding the biological diversity issues;
- ecological reconstruction and rehabilitation of infringed ecosystems;
- providing for the local population and public non-governmental organizations awareness of the biological diversity conservation and balanced use issues.

The National Strategy objectives of conservation and sustainable use of biological diversity require a consistent on-going action for solving some issues. The action plans with definite deadlines and work scope should be developed accordingly.

Solving the task of reducing the dangers while providing for biological diversity conservation is very important. The nature protection legislation plays an important role in particular for fulfillment of the Law of the Republic of Kazakhstan "On Environmental Protection" that is aimed at ensuring environmental security.

Reducing the dangers of an indirect and direct anthropogenic impact is wholly dependent on the intensity of land user practices, law observance by the population and all the links of economic activities management.

Legislation and ecological education of the population should envisage rational, non-exhaustive grass cutting, grazing and stocking up of wood and zoological resources, and collection of raw materials, in particular, with regard to wild relatives of domesticated plants and animals, as an invaluable source of the genetic fund and national riches.

Improvement of the nature use management system is one of the objectives to be solved. The issues of conservation and reproduction of biological resources, standards and volumes of their components withdrawal from nature should be based on recommendations and developments of research organizations, monitoring, numbers, and regulations of international agreements and conventions.

For the purpose of improving activities on biodiversity conservation in the global context, development and active participation in international programs and inter-governmental agreements are required.

The national strategy and action plan on biodiversity conservation is one of the most important components of the national environmental action plan (NEAP). In its turn the NEAP is an

instrument for implementation of the long-term strategy 2030 “Environment and Natural Resources”.

Adoption of the Strategy 2030 is creating objective conditions for successful implementation of the Convention regulations on biological diversity.

2. STRATEGIC AGENDA FOR CONSERVATION ACTIVITIES AND BALANCING BIOLOGICAL DIVERSITY WITH ECONOMIC DEVELOPMENT

2.1. Conservation of the biological diversity in-situ, ex-situ

Conservation in-situ

The main task of conservation of the biological diversity is first of all the conservation of the whole diversity of the flora and fauna micro-organisms and their ecological systems as well in the historically formed natural conditions not allowing the losses.

The ecological system is a community of living organisms coexisting in the concrete conditions. Every species in this system occupies its certain niche and therefore does not enter a cruel competition with the other co-habitants, and at the same time is well adapted to the conditions of the physical environment. Therefore the conservation of the ecological system in its original shape is the most efficient and meets the requirements of the natural laws of the structural arrangement and functioning of the biological atmosphere.

The whole system of the strategic approaches and plans of actions is aimed at the conservation of the biological diversity mostly in their natural form and assumes the elaboration of the efficient facilities to carry them out, the development of a number of legal, economic mechanisms, improvement of the structure of management, financial provision, elaboration of the normative and legal framework.

The establishment of the specially protected natural territories is the most efficient measure to conserve the rare endemic, vanishing species, unique and standard plots (Fig. 2.1). A tradition of the development of the specially protected natural territories in Kazakhstan lasts over 70 years: in 1926 in the Western Tien-Shan the first in Central Asian region reserve plot "Aksu - Dzhabagly" had been created.

In accordance to the Law of the Republic of Kazakhstan "On the Specially protected natural territories" dated July 15, 1997 13 types of such territories are specified: state natural reserves, including the biosphere ones; the state national nature parks; the state nature parks; the state nature memorials; the state reserve zones; the state natural reserves; the state zoological parks; the state botanical gardens; the state dendrological parks; the forest of the specially protected territories; water cavities of special state significance or specific scientific value; water lands having the international importance; the plots of subsurface, representing a special ecological, scientific, cultural or other value.

Currently in Kazakhstan there are functioning 9 reserves, 4 national parks, 60 reserve plots, 24 nature memorials of the republican jurisdiction, 3 zoological parks, 5 botanical gardens, several dendrological parks; 3 water lands are admitted to be of the international importance in accordance with the list of Ramsar Convention (1971), and 150 water cavities are defined to have the state significance. This is a network of drastically differing by their protection regime territories, which covers about 3% of total territory of the country. However, the summary area of 9 reserves, *in which a whole natural complex* is being protected, is only 0.3% of the territory of Kazakhstan (see Table 2.1).

A special role of the reserves besides the implementation of the strict reserve regime is that many year and multi profile research investigations of the biological diversity are held in these reserves. Both the reserve researchers and numerous research expeditions carry out these scientific investigations. Above all in each reserve they keep a mandatory "Nature annals", in which they annually include the major indicators on the position of all components of the protected ecological systems providing an opportunity to track the natural processes having place in the nature plots, isolated from the economic activities.

Table 2. 1

Existing natural reserves of Kazakhstan

No	Reserve name	Date of establishment	Area, thousands of hectares	Administrative oblasts	Main landscapes
1	Aksu-Dzhabagly	1926	75. 094	Southern Kazakhstan.	Mountain, forest
2	Almatynskyi	1964	73. 342	Almatynskaya	Mountain, forest
3	Barsakelmeskyi	1939	50. 000	Kzyl Orda	Deserts
4	Western Altaiskyi	1992	56. 104	Eastern Kazakhstan	Mountain, forest
5	Kurgaldzhinskyi	1968	243. 138	Akmola	Water lands
6	Markakolskyi	1976	75. 040	Eastern Kazakhstan	Mountain, forest, lakes
7	Naurzumskyi	1934	87. 694	Kostanai	Lakes, steppes, forest
8	Ustyurtskyi	1984	223. 300	Mangystau	Desert
9	Alakolskyi	1998	12. 3	Almatynskaya	Water lands

In the reserves of Kazakhstan the mountainous ecological systems of Tien-Shan (the reserves of Aksu- Dzhabagly and Alamatinskyi) and Altai (Markakolskyi and Western Altaiskyi reserves) are represented most satisfactorily. The ecological systems of the steppe lakes (Kurgaldzhinskyi and Nurzumskyi reserves; in the latter the most southern in Kazakhstan millet on sandy soils is protected) are represented in less extent. The ecological systems of the zone steppe on the territories of the Kazakhstan's reserves are practically lacking. The matter with the deserts and semi deserts , which cover more than a half of the territory of Kazakhstan, is even worse: in two reserves existing in this zone (Ustyurtskyi and Barsakelmeskyi) only a small part of the diversity of the desert ecological systems is represented.

The representation volume of the vertebrate animals (by a number of the species) on the territories and water areas of the Kazakhstan's reserves is shown in the Fig.

Out of 178 mammals of Kazakhstan 140 (78.6%) are protected in 9 existing reserves. 22 species of these 140 are put into the Red Data Book of Kazakhstan (1991), or 61.1% of total list of mammals in this book. There is no unambiguous answer whether this quantity is sufficient to conserve these species or not. For such species as *Erinaceus aethiopicus, Ainonyx jubatus, Mellivora capensis*, which are available only in the Western Ustyurt and Mangyshlak, one Ustyurt

reserve is quite sufficient. For the living in the same place *Ovis orientalis arcal* the existence of two more reserves in addition to the named one in the same region is a reliable guarantee. But for the *Ovis ammon,* major mass of which is concentrated in small hills of Central Kazakhstan, the existence of one or two Tien Shan reserves, on the territories of which there reside only a few scores of only Tien Shan sub species, are obviously insufficient. It is a need to have reliably protected reservates in the habitats of **each** sub species (altaiskyi, Kazakhstan, karatauskyi, kyzylkumskyi, Tien Shanskyi).

The mountain reserves in a whole provide the protection of such rare animals as *Tineia uncia, Ursus arctos isabellinus, Lynx lynx, Martes foina*. For the desert mammals such as *Gazella subgutturosa, Egnus hemionus, Felis manul, Felis caracal, Vormela peregusna* the protected territories are obviously insufficient.

The same can be said about the mammals, which are not put in the Red Data Book : the desert species are being weakly protected since there is the only reserve for the vast zone in its western part (Ustyurtskyi) plus a small reserved island Barsakelmes in the Aral Sea, which currently is suffering from the ecology catastrophe. Even *Saiga tatarica* is not protected reliably despite that it is available in four reserves: there is not a single sufficient by scope protected reservate in the places where these valuable ungulates may have their kittens.

In the reserved territories there cannot be met 37 species (21.1%) of the mammals including 12 species put in the Red Data Book! These are the residing in the valleys of the Ural river *Desmana moschata, martes martes, Mustela lutreola*, and living in the sands of the Volga -Ural region the *Spalax giganteus.* There is not a single reserve in this region of Kazakhstan for them.

The many of the typical representatives of the desert teriofauna *Cardiocranius paradoxus, Salpingotus crassicauda, S.pallidus, S.heptneri, Phodopus roborovskii, Lagurus luteus* and even the endemic species of Kazakhstan *Selevinia betpakdalensis* have turned out to be beyond the reserved territories. The Red Data Book endemics of the Western Tien -Shan *Marmota menzbieri* is not found on the territory of the reserve of Aksu- Dzhabagly, although it lives only few kilometres from its southern - western borders. The numerous (dated beginning 1940!) proposals of the specialists on incorporation of this territory into the limits of the reserve are not implemented till nowadays.

Out of the mammals not included in the Red Data Book the lack on the territories of the reserves of such characteristic for the desert habitants as *Allactopodius bobrinskoi, Pygerethmus platyurus, P.zhitkovii*, *Paradipus ctenodactylus, Eremodipus lichtensteinii* is quite demonstrative. The single sea mammal - *Phoca caspica*, is protected only partly by so-called protected territory in the northern part of the Caspian Sea; for the reliable protection of it a real sea reserve (may be inter state one), the water area of which would be completely withdrawn out from the use, is needed.

In a whole to conserve the biological diversity of the mammals class in Kazakhstan creation of the reliably protected reservates in the various types of the deserts (sandy. loamy, loess, detritus and stony, saline soil) each having its own characteristic set of background mammals, is needed. A special attention has to be paid to the western region, including the valley of the Ural river.

Out of 489 species of birds available in different seasons on the territory of Kazakhstan, the largest interest present those having their kittens here, that is nesting. This amounts 396 species (81%) in Kazakhstan. The protected reserves are called to protect them in the first turn, since the migratory birds spend major part of the year in the places north- and southwards of our republic and are the temporary visitors in Kazakhstan.

In the Kazakhstan's reserves 346 species of birds are nesting, that is 87.4% of total number of the nesting birds in the republic. 39 species of them are rare and endangered by disappearance, that is 76.5% of all nesting in Kazakhstan Red Data Book birds. However small number of them can be viewed as sufficiently provided with the protected territories. These are *Aquila* chrysaetus and *Bubo bubo,* which nest in 6 out of 9 Kazakhstan's reserves, and the *Phoenicopterus resus*, as well, the only colony of which, the most northern in Eurasia, is protected in the Kurgaldzhinskyi reserve. Probably there is enough protected territories for the *Gypaetus barbatus*, *Neophron percnopterus* and *Myophonus caeruleus.*

There are obviously insufficient protected territories for the *Pelecanus crispus*, *Platalea leucorodia*, *Plegadis falcinellus*, *Otis tarda*, *Chlamydotis undulata*, *Otis tetrax*, *Ibidorhyncha struthersii*, *Pterocles orientalis* and other birds put in the Red Data Book.

The 50 species of birds, which are not presented at all as the nesting ones in the reserves of Kazakhstan do deserve a special attention: *Pelecanus onocrotalus, Ardeola ralloides, Egretta garzetta, Ciconia ciconia, Anas angustirostris, Melanitta deglandi, Porphyrio porphyrio, Larus relictus, Pterocles orientalis, Podoces panderi* (these 10 species are included in the Red Data Book of Kazakhstan), *Buteo hemilasius, Aquila clanga*, *Columba eversmanni, Otus brucei, Caprimulgus aegyptius* and others.

The representatives of 31 species of the reptile (63.2% of herpefauna of Kazakhstan) are found in the reserves of Kazakhstan. The Red Data Book species of the reptile are especially weakly represented on the territory of the reserves of Kazakhstan - only three species out of 10, moreover, each of the species is represented only in one reserve - *Ophisaurus apodus* and *Coluber rhodorhachis* in the reserve of Aksu -Dzhabagly; *Elaphe quatuorlineata* - in the Ustyurt reserve. To conserve the genetic fund of the reptile in Kazakhstan it is necessary to create a number of deserted reserves: in the sands of Kyzylkum (only here the largest lizard *Varanus* griseus resides), in the sands of the Southern Prebalkhashye, in the loamy desert of Betpac Dala, in the stony deserts of the Northern Prebalkhashye, deserts of the Ili valley and Zaisan pit.

Out of 12 residing in Kazakhstan amphibian on the reserve territories only 6 can be found. The most interesting representative of this class of the vertebrate animals - the endemic of the Dzhungar Alatau - *Ranadon sibiricus* cannot be met on the reserve territories. It needs a creation of the specialised reserve.

Out of 104 species of fish in the waters of the Kazakhstan's reserves only 23 reside (22.1%), what can be explained by the insufficient number of the reserves, specialised on the hydrocoenosis conservation. The intensive economic use and lack of the water cavities, in which only an aboriginal composition of fish fauna would be conserved, complicate the matter of the reserve establishment. Acclimatisation of fishes in Kazakhstan has reached an enormous scope. In the majority of water cavities the acclimatizants constitute from 50 to 80% of the fish fauna composition. The most important measures to conserve the rare species of fish would be a creation of

new water cavities for the separation of rare aboriginal fish species and the establishment of the large sea reserve in the Caspian Sea. It is also needed to assign a status of the protected objects to a number of small rivers and unique lakes with the original composition of the hydrobionts.

In a whole the existing at present time reserves are far from ensuring the conservation of the unique floristic and faunistic diversity in Kazakhstan. Therefore in 1975 the Academy of Science of the Republic of Kazakhstan has proposed the first Perspective plan of the scientifically reasoned network of the reserves, and in 1978 a work was completed over the compilation of "Development and location scheme for the objects of the nature and protected fund of the Kazakh SSR up to 2005", which had incorporated national parks, reserve plots and nature memorials in addition to the reserves. Although this scheme, which was elaborated within the short time, had a lot of shortcomings and underdevelopments and has become obsolete under new economic conditions, its major proposals in respect of creation of new reserves remain true at present time.

At present time the Ministry of Ecology and Natural Resources of the Republic of Kazakhstan elaborates a new "Scheme of the development and location of the specially protected natural territories" accounting for the assumptions of the public and local organisations. The scheme envisages the short term actions (which are given in this document), the medium term actions (Table 2.8) and long term actions (being worked out).

Table 2. 2

The projected reserves in Kazakhstan

No	Name of reserve	Area, hectares	Co-ordinates	Main landscapes
1	Betpacdalinskyi	600 000	46^{o} 05' N /70^{o} 20' E	Desert (loamy)
2	Dzhungarskyi	252 000	45^{o} 52' N /81^{o} 00' E	Mountain
3	Ermentuaskyi	40 000	51^{o} 30' N /73^{o} 20' E	Steppe
4	Zaisanskyi	95 000	47^{o} 55' N /85^{o} 00' E	Desert, water, mountains
5	Karatauskyi	40 000	43^{o} 50' N /68^{o} 35' E	Mountains (relict)
6	Kentskyi	44 500	76^{o} 15' N /49^{o} 10' E	Small hills
7	Kyzylkumskyi	105 000	44^{o} 25' N /64^{o} 00' E	Deserts (sandy)
8	Pribalkhsahskyi	210 000	45^{o} 53' N /74^{o} 15' E	Delta, sands, turanga
9	Syntasskyi	189 000	46^{o} 50' N /57^{o} 40' E	Steppe and forests
10	Syrdariynskyi	29 800	42^{o} 45' N /68^{o} 50' E	Tugai –deserts
11	Tarbagataiskyi	31 900	47^{o} 25' N /81^{o} 40' E	Mountain forests, steppe

12	Turgaiskyi	183 000	48° 45' N /62° 10' E	Water lands
13	Central Kazakhstanskyi	44 700	48° 00' N /72° 30' E	Steppe

The sequence of the establishment of the reserves will be specified by the Plan of actions on the conservation and the balanced use of the biological diversity. Unfortunately, the rates of establishing the reserves in the republic are very low: during last 20 years (1978 -1998) only 4 reserves have been founded - Ustyurtskyi, Markakolskyi, Western Altaiskyi and Alakolskyi. The main reason of this is disagreement of the local authorities to withdraw the lands out of the economic use and lack of the economic mechanisms of their motivation. Given the forthcoming privatisation of the lands in Kazakhstan new approaches to prereserve the lands for the reserves, necessarily including the economic measures are needed.

The establishment of the new reserves, shown in the Table 2, shall not only enhance the protected reserved area of Kazakhstan by 1. 885 million of hectares (0.7% of the republican territory), but will also enable to set a real protection for the significant part of the landscape and biological diversity of Kazakhstan.

There is only one **state reserve zone** in Kazakhstan so far - the water area of the northern part of the Caspian Sea, assigned for the conservation of the biological diversity of the water ecological systems and the most valuable resources of the sturgeons (*Acipenseridae family)*. This zone differing from the reserve is not an institution as it does not have infrastructure and staff - not only guard, but the administrative staff as well.

The state zakaznik is defined by the Law of the Republic of Kazakhstan "On Specially protected natural territories" (1997) as specially protected natural territory with the specific (ordered) protection regime or that of regulated economic activities assigned to conserve and reproduce one or few objects of the state natural reserved fund (the Law, Article 49). The lands of zakazniks are not withdrawn from the users and the protection of the objects is carried out in the course of the economic activities - by restricting the scope and timing of this or other types of works.

Out of the currently existing in Kazakhstan 60 zakazniks, which occupy the area about 6 million of hectares, the largest are - complex Almaty in the mountains of the Sailyiskyi Alatau (181.8 thousand of hectares), Karoiskyi and Prebalkahsskyi zoological ones in the delta of Ili river (509 and 503 thousands of hectares), Turgai zoological one in the lower reaches of Turgai river (348 thousand hectares), Lepsiskyi and Verkhnekoksuiskyi zoological zakazniks in the mountains of Dzhungar Alatau (258 and 240 thousands of hectares), Smirnovskyi zoological in the Northern Kazakhstan oblast (204 thousands of hectares), Aktau - Buzachinskyi and Karagiye-Karakolskyi zoological in Mangistau oblast (170 and 137.5 thousands of hectares). It will be reasonable in further to transform many of them (for example, Turgaiskyi and Lepsinskyi) into the reserves, others - (for instance, Karkaralinskyi, Rakhmanovskiye klyuchi) - into the national parks.

The state nature memorials are "specially protected natural territories with the reserved regime, assigned for the conservation in the natural shape some of the objects of the state natural

reserved fund" (the Law, of the Republic of Kazakhstan "On specially protected natural territories" , Article 43). The land users, under whose responsibility they have been transferred by the authorities, carry out the protection of the nature memorials. Out of 24 existing in Kazakhstan nature memorials the Charyn ash grove in Almaty oblast, Kokshetau massive, "geese perechet" in Pavlodar oblast and others have the largest importance for the conservation of the biological diversity. Quite often the separate objects - rock, cave, waterfall and other are the state nature memorials. The wide spread tradition used in the western countries to announce the separate biological objects (for example, the nests of large predatory birds or some trees) to be the state nature memorials is not applied in Kazakhstan so far, although there is such a need, for instance in the respect of the nests of the rare species of birds, *Ciconia ciconia asiatica,* 10-15 pieces of which has remained.

The state national natural parks (SNNP) are the "specially protected natural territories, having a status of the nature protection institution and being differentiated by zones depending on the protection regimes, assigned for the multi profile use of the natural, historical and cultural complexes and objects, possessing the special ecological, recreational, scientific or other importance" (ibid., Article 41). A number of zones may be specified on the territory of the state national natural parks: the zone of the reserve regime, ordered regime, regulated economic activities, regulated tourist and recreation utilisation, tourist and visitor servicing, limited and traditional economic activities, administrative and economic. Thus, the state national natural parks comprise the elements of all preceding specially protected natural territories, however the reserve zone itself (the core) in it occupies only a small part of the territory.

There are 4 national parks functioning in Kazakhstan in the area of about 677.9 thousands of hectares (see Table 2. 3), the reserve core in these parks in total is about 200 thousands of hectares.

Table 2. 3

The national parks of Kazakhstan

[1]	Name	Date	Area, hectares	Main landscapes
1	"Altyn –Emel"	1996	209. 6	Desert (stony, loamy)
2	Bayanaulskyi	1985	50. 7	Small hills (Lakes, pine tree forests)
3	Ile –Alatauskyi	1996	181. 8	Mountains (pine tree forests, uplands)
4	"Kokshetau"	1996	135. 8	Forest and steppe (lakes, pine tree forests, steppe)

In a whole the national parks of Kazakhstan are still in the emerging stage, what can be seen from the dates of their establishment. In the park of "Altyn- Emel" the desert flora and fauna, including such rare species from the Red Data Book as *Gazella subgutturosa, Chlamydotis undulata, Eqnus hemionus,* are well represented, while the *Tineia uncia, Lynx lynx, Gypaetus barbatus, Aquila chrysaetus, Ibidorhyncha struthersii* are represented in the Ile- Alatauskyi park.

Out of the proposed for the creation state national natural parks the Karkaralinskyi in Karaganda oblast and "Iliiskya dolina" in Almaty oblast are the most important for the conservation of

the biological diversity. In the latter oblast in addition to the existing park of "Altyn -Emel" there has to be incorporated the remained part of the middle flow of Ili river with well developed ecological systems of the sandy desert and the unique nature formation - canyon of the Charyn river with the relict ash grove, which currently has a status of the nature memorial.

The wetlands having the international significance in terms of habitat of the game water fowl (this is a full name of this type of the specially protected natural territories , defined by the Ramsar Convention) during last decades have been represented in Kazakhstan only by two lake systems - Tengiz -Kurgaldzhinskyaya (Kurgaldzhinskyi reserve) and Irgiz -Turgaiskaya (Turgai zoological zakaznik, which is planned to be converted into the reserve). In 1996 following the initiative of the Kazakhstan' s specialists ornithologists and presentation of the Ministry of Ecology and Natural Resources the bureau of Ramsar Convention had adopted a decision to classify the Alakol lakes, located at the border of Almaty and Eastern-Kazakhstan oblasts of Kazakhstan, into this category. The most prospective in this sense water cavities are the following: Nauzrum lake system in Kostanai oblast, lake Balkhash with delta of Ili river.

In total the area of the Specially protected natural territories of the various status in Kazakhstan amounts about 3% of total territory of the republic, that is absolutely insufficient for the conservation of the ecological balance and the biological diversity . Currently further work is being carried out to expand the net of the natural reservates, unification of them in a system with single nature protection tasks and programs to track the position of the biogeoceonosis and dynamics of their development.

Conservation of the forest biological diversity in -situ in the genetic reservates

The currently operating system of forest farming in the republic has an exclusively important significance in the matter of conservation of the biological diversity in-situ.

The history of forest farming development amounts over 100 years. The protection, recovery and ensurance of the balanced inexhaustive use of the forest resources are the priority trends of its activities. The forest resources involve the biological resources of about 70% of all higher plants of Kazakhstan and over 75% of hunting species of animals.

In addition to the reserves and national parks the real protection of the biological diversity and targeted its recovery in the natural environment (in-situ) is carried out today practically only on the territory of the forest fund. It is provided by the assignment of its territory under the responsibility of the concrete forest (forest- hunting) farms, forestries and care centres with the respective personnel of the state forest and huntsman guards, by the systematic recording by the services of these divisions the stocks of main biological resource types, performing the reproductive, care and biotechnical works, constant control over the use of the biological resources, system of the regular forest inventory surveys and forest arrangement design.

The scientifically grounded system of farming, accounting for the priorities of the protective role of the forests within the every natural zone and the principles of inexhaustiveness of nature use has been worked out for the forest ecological systems.

In the forests of the first group there are specified the categories of the protection degree of the forests, which determine the regime of their use. To preserve the biological diversity 53 forest genetic reservates are specified in the area of 38.5 thousands of hectares, located mostly in the

Kazakh small hills, mountainous Altai and millets of PreIrtyshya basing the main forest forming species of Kazakhstan: *Pinus silvestris* (18 units on the area of 18063 hectares), *Abies* sibirica (11 - on 1531 hectares), *Betula pendula* (8 - 3439 hectares), *Larix* sibirica (5 - on 470 hectares), *Pinus* sibirica (3 - on 752 hectares).

Along with this there are lacking the reservates in the west of Kazakhstan, where in the flood lands of the Ural river there are growing the highly productive clean plantings of the *Querus* robur or mixed with *Ulmus* laevis and *Populus tremula*, with the underwood of shrubs. The specification of such reservates in the lower reaches of the Ural and Emba rivers in the highly productive plantings of turanga (*Populus diversifolia)* or black poplar (*Populus nigra)* will be reasonable. The specification of the reservates on the vast territory of the Aktyubinsk oblast, including the Mugodzhar mountains, where on the kashtan soils of the loamy and susand mechanical composition the numerous species of the willows (*Salix)* and *Populus* with the mixture of the *Betula pendula* and various shrubs grow, is necessary.

Extremely insufficient number of the reservates are specified in the aride zone of the south and south -east of the republic, foot hills and mountains of Dzhungar and Zailiiskyi Alatau. The creation of the genetic reservates in the following forest regions deserves a special attention:

- on the plateau of Ustyurt - in the plantings of *Haloxylon aphyllum* with the mixtures of the numerous representatives of zhuzguns, including endemic zhuzgun *(Calligonum cristatum)* and other shrubs;
- in the Priaralye - in the plantings of *haloxylon persicum, Halimodendron halodendron,* the numerous representatives of the genus *Salix, Tamarix* and others;
- in Kyzylorda oblast, including the valley of the lower flow of Syr Darya river, in the plantings of the *Populus* and *Haloxylon,* with involvement of *Ephedra strobilacea* , *Salix hypericifolia*) and other shrubs;
- in the desert Betpac Dala and northern Prebalkhashye sandy steppes in the plantings of *Haloxylon aphyllum* with mixtures of *Spiraeanthus Schrenkianus*, *Ephedra inyermedia*, *Anabasis*, *Tamarix*, *Atraphaxis* and others;
- in the sands of Moiyn Kum in the plantings of *Haloxylon aphyllum*, *Populus pruinosa* with mixtures of *Calligonum Dubjanskyi*, *Ephedra lomatolepis*, *Arthrophytum balchaschense*, *Astragalus brachypus*, *Dendrostellera arenaria* and other shrubs;
- in the sands of Tau Kum, Sary Ishik Otyrau, tugais along the rivers of Ili, Karatal, Aksu, Lepsy in the plantings of the numerous species of *Populus*, *Haloxylon*, *Salix*, *Calligonum* and others;
- in the sand massive of Zaisan region in the Eastern Kazakhstan oblast in the plantings of *Haloxylon ammodendron;*
- in the richest by floristic composition foot hill, mountainous and uplands zones of Dzhungar and Zailiiskyi Alatau with numerous rare and vanishing, endemic fruit trees and shrubs of genus : *Malus*, *Armeniaca*, *Rosa*, *Berbeuris* and others, widely represented *Picea Schrenkiana*, and at the upper borders of forest *Juniperus*.

Besides this it is necessary to do the following to improve the activities on in-situ conservation of the forests:

- adjust the system of the economic use of the forests accounting for the ecological districting and ecological requirements;
- work out the optimal area norms of the forest care centres, numbers of the forest and huntsman guard accounting for the natural, zone, landscape and ecological districting of the territory to strengthen the protection of forests
- strengthen the activities on assigning the plantings beyond the limits of the forest fund and reserve hunting fund under the responsibility of the peasantry farms and other users, and introduce the system of benefits and privileges for the land and biological resource use to motivate the protection and rational inexhaustive use of these biological resources;
- improve the system of monitoring the forest ecological systems basing the geographical information system -technologies.

The overall worsening ecological situation requires new approaches to solve the acute problem of the conservation of the biological diversity and the genetic fund of the alive nature as one of the most important laws of the ecological balance provision. The operational collection and analysis of the information on the course of the nature processes and phenomena, timely tracking of the emerging degradation processes of the nature ecological systems and undertaking of the timely measures on their prevention are needed.

The high requirements to the level of the scientific investigations in the system of the protected natural territories, having first of all the monitoring, analytical nature, demand, that they have to be equipped with modern technical devices, and in first turn with the computer hardware, sufficient quantity of the optical and measurement instruments, field facilities, transport vehicles. All this is lacking in the reserves and the specially protected natural territories so far.

The personnel problem is quite acute. Very low level of the wages, hard dwelling conditions, lack of the medical service together with the isolation of the scientific and cultural centres do not provide the highly qualified specialists any motivation to live and work fruitfully in the conditions of the Kazakhstan's reserves and national parks. There is no school so far in the republic for training the specialists for the reserves. The beginning for the creation of the respective faculties and departments in the higher and vocational education institutions has been laid down only in 1984 in Kazakhstan, and a lot of hardships including financing, arises on the path of successful solution of this problem. To increase a level of the functioning of the natural reservates, motivate the specialists in the development of the reserve matters it is necessary to work out a system of the international contacts of the specialists, involvement of the employees of the protected natural territories of Kazakhstan in the international forums on the environment protection, set an exchange of the specialists.

To solve the problem of the conservation of the biological and landscape diversity of rich nature of Kazakhstan there is a need to ***speed up*** the works on expansion of the scientifically reasoned network of the specially protected natural territories in all landscape zones, giving the main priority to the establishment of the ***reserves as standards*** of certain landscapes and ecological systems and as one of the decisive terms of stabilisation of the ecological position in the republic. Accounting for that during last years due to the sharply increased rates of active changes in Kazakhstan's environment in the result of impacts of direct and indirect anthropogenic factors, there exists a real danger of the irreversible transformation of the vegetal communities and habituating animal complexes, the elaboration of the plan of creation of the network of the specially protected

natural territories has to be approached with the accounting for the importance of the conservation of not only the rare objects (species, sub species, etc.) , but of total diversity of the flora and fauna communities, the whole ecological system, as well.

In 1993 the Ministry of Ecology and Natural Resources of the Republic of Kazakhstan and Union on nature protection of Germany (NABU) have made an agreement on creation of four biosphere reservates (this name is more correct) in Kazakhstan:

- in the Western Tien Shan (the reserves of "Aksu- Dzhabagly" and future Karatauskyi);
- on the border of the steppe and semi desert zones (Naurzum reserve and Turgai zakaznik);
- in the south-east of Almaty oblast (Almaty reserve);
- on Altai (Markakolskyi and Western -Altai reserves).

Since the August of 1996 the works are under way to create the first in Kazakhstan biosphere reservate on the basis of Kurgaldzhinskyi and Naurzum reserves.

The strategy incorporates the elaboration and improvement of the preventive measures on introduction of the alien species, which endanger the ecological systems, habitats and species, discovery and destruction of such alien species.

The alien species are the species, which are lacking or have never resided in this region or this ecological system. Introduction of the alien species in some cases is able to change radically or even destroy the respective ecological system.

In Kazakhstan there are well known cases of very rapid increase of the numbers and wide habitat development of some alien species of the plants and animals, especially those of the weed plants, pests of the agricultural and forest farms, carriers of disease infections for the human beings and domestic animals, which come as a rule into the republic from abroad (for example, Colorado beetle - *Leptinotarsa decemlineata Say,* San Jose scale - *Quadraspidiotus perniciousus,* rag weed - *Ambrosia artemisifolia,* Indian female hemp - *Cannabaceae family* and others).

As an example of the radical transformation of the ecological system under the impact of the alien species introduction in Kazakhstan may serve the change of the hydrofauna of Balkhash lake after the fries of pike-perch, chub, and sheat- fish have been introduced in it. It has led to the disappearance of the aboriginal species of fish, like marinka and naked osman, sharp reduction of the numbers of perch fish and essential lowering of the level of the biological productivity of the ecological system. Such changes in the ecological systems have taken place in many other water cavities of Kazakhstan as well after the acclimatisation of new fishes in them.

The acclimatised american mink (*Mustela vison)* has crowded out and absorbed the aboriginal mink (*M. lutreola)* through the interbreeding in Kazakhstan.

For the birds the story of the acclimatisation of maina and large tomtit in Almaty is well known. The former has practically crowded out everywhere the regular starling and has occupied the large territory of Kazakhstan, expanding its habitat naturally; the second has occupied beside a city the whole zone of the leafy macro slope of Zailiiskyi Alatau, having significantly squeezed the aborigine - azure tit (*Parus cyanus)* which has become quite rare species.

The voluntary targeted introduction is carried by some citizens and institutions, which are not specialised in such profile of activities. As an example of such an introduction is the imports by the citizens of Kazakhstan of very diversified plants almost from all parts of the world for their dachas and by-house plots of land. When introduction has such a form no control over the impacts of the alien species on the ecological systems is being carried out, and no measures to prevent the negative implications of the introduction are foreseen.

Up to present time there is no a single state program of the introduction works in Kazakhstan, and there is practically no co-ordination among the institutions and persons, spontaneously or independently dealing with the imports or acclimatisation of the valuable species of the alive organisms.

There is some legal framework in the republic aimed at the prevention of the introduction of the alien species. There are the respective articles in the Law "On protection and use of the fauna" and in the Law "On environment protection", which have to be used as guidelines by the organisations dealing with the introduction and acclimatisation of the sup surface species of animals, fish and plants.

Only the quarantine service of the plants is under the state control. It is incorporated in a system of the Ministry of Agriculture of the Republic of Kazakhstan.

The following documents stand as the guidelines for the activities of the agencies on state quarantine:

- The Degree of the Cabinet of Minister of the Republic of Kazakhstan "On transformation of the State Inspectorate on quarantine of plants under the Gosagroprom of the USSR for the Kazakh SSR into the Chief State Inspectorate on quarantine of plants under the Ministry of Agriculture of the Republic of Kazakhstan" dated August 13, 1992, Number 676;
- The agreement "On co-operation between the Governments of the Commonwealth Independent State member - state in the area of the quarantine of plants" dated November 13, 1992;
- The Degree of the Cabinet of Minister of the Republic of Kazakhstan "On measures on arrangement the phyto sanitary control at the borders of the Republic of Kazakhstan" dated August 13, 1992, Number 676;
- Regulations on the protection of the territory of the Republic of Kazakhstan from the quarantine pests, diseases of the plants and weeds, approved by the Ministry of Agriculture of the Republic of Kazakhstan, dated November 2, 1993;
- Bilateral inter - state Agreements on the quarantine plants;
- Single international quarantine documentation, recommended by the FAO (Food and Agricultural Organisation);
- A single for the CIS states "List of the quarantine objects", dated November 13, 1992, which is based on the similar document of the European and Mediterrian organisations on the protection of plants (EMOPP);
- The unified standards acting on the territory of the CIS countries.

Unfortunately not all activities on prevention of the introduction of the alien species are regulated by the enabling normative regulations. The measures on the responsibility of the persons and institutions for the unauthorised targeted and occasional introduction of the alive organisms are developed quite weakly.

Thus, the solution of the problem on prevention of the alien species introduction is possible by the improvement of the legal framework, elaboration of the theoretical basis and methodologies of the addressed introduction, improvement of the quarantine service, wide scope propaganda of the knowledge in the area of the plant quarantine and introduction of the species, and by implementing state control over these activities.

Under the contemporary conditions of the transition period of the republic' s economy, under emerging new market relations a particular danger for the natural ecological systems and some their elements comes from the spontaneous (occasional) introduction. Therefore there is a need to develop the measures on prevention of the introduction of the alien species and enact a strict control over it.

The following is needed for this purpose:

- the essential improvement of the quarantine service - development of the international cooperation, elaboration of new standards, rules and recommendations to prevent the imports of the alien species, improvement of the methods to destroy the dangerous species and propaganda in the area of the plant quarantine;
- the elaboration of the measures on responsibility of the legal entities and physical individuals for the unauthorised introduction or for the creation conditions enabling the occasional introduction of the harmful alien species;
- analysis of the experience in the implementation of the acclimatisation works in Kazakhstan, accounting for the international expertise in elaboration of the instructive materials on acclimatisation;
- establishment of the monitoring for the most important ecological systems in Kazakhstan, which involve the introducents, and carrying out of the ecological expertise of the economic and scientific projects on the introduction and acclimatisation of the organisms;
- improvement of personnel training for the quarantine service and carrying out of the introduction and acclimatisation works;
- profound scientific investigations on identification of the regularities in the ecological changes of the bioceonosis under the impact of the introducents.

Conservation ex - situ

Conservation ex - situ is viewed as the exclusively important part of the general strategy of the reliable conservation and balanced use of the biological diversity. The significance of the conservation ex- situ is especially high for the rare and vanishing species of flora and fauna. This allows saving a certain share of their genetic fund from the destruction. Moreover, basing this an artificial reproduction of the rare and vanishing species and their reintroduction in the natural habitats become possible to increase the numbers of the populations and restore the damaged ecological systems. Some of the flora and fauna species included in "The Red Data Book of Kazakh-

stan" need conservation ex - situ. The conservation ex - situ is an effective way of the using the genetic fund of the wild relatives of the agricultural plants and animals in the process of selection. The botanical gardens, dendraries, zoological parks and collections of the world cultures in the scientific research institutions carry out the major function in the conservation of the biological diversity components beyond the places of their habitats.

In Las - Palmas in the Canary Islands on November 26 - 30, 1985 the International Union on the nature and nature resources protection (IUNNP) has held a conference on discussions of the activities of the botanical gardens in view of the World strategy of the nature protection and worked out a program document - a "Strategy of the botanical gardens on flora protection". The major goal of the Strategy is mobilisation of the efforts of the botanical gardens in the world on the conservation of the flora diversity on the planet, prevention of phytogenetic erosion. The Strategy recommends that every garden would declare its commitment on the flora conservation and accept the international standards on their maintenance.

Solution of the problem on the conservation of the genetic diversity of the flora world is both in the area of the natural ecological system protection and establishment of the banks of the genetic fund of the cultivated and wild species. The artificial reserving of the flora genetic fund can be achieved by the biotechnological methods and by the currently prevailing genetic fund conservation via creation of the collection of the alive plants and their seeds.

The particularly rare species of the plants or populations are subject to first turn conservation ex - situ via growing in the botanical gardens. One botanical garden is not able to grow the whole diversity of the rare plants endangered by the disappearance. And soil and climatic conditions of one botanical garden can not be favourable for all species as well. Therefore it is necessary for the botanical gardens to specialise in the growing, conservation ex - situ, experimental study of the biological properties and opportunity to make cultural those rare species, which are abandoned in the activity zone of that very botanical gardens.

The establishment of the reserves, zakazniks, national parks undoubtedly play invaluable role in the conservation of the biological diversity, but it does not solve completely the existing problem. There is no possibility to establish the reserves and zakazniks in every place, where the rare plants are growing, moreover, if these species populate the limited territories and are located in the zones of high economic activities. The additional measures in this case can be in the introductive tests of the vanishing species of flora and introduction them into the culture, the search of new habitat locations for the acclimatisation in the places, where the territories are not subject to the economic activities in accordance to the plans of economic development.

There are 7 botanical gardens in Kazakhstan: the Chief botanical garden in Almaty, Karaganda garden in structure of the Institute of Phytochemistry, Altai botanical garden in Leninogorsk city, Zhezkazgan garden in Zhezkazgan city, Iliiskyi in Bakanas settlement, Mangyshlak experimental botanical garden in Aktau city, Turkestan one in Turkestan city. The construction of the botanical gardens has been initiated in Kyzyl - Orda, an erection of the Akmola botanical garden is intended in Astana - a new capital of the Republic of Kazakhstan. Beside this, there are dendraries in the settlement of Issyk and Shymkent city. The botanical gardens and dendraries have the largest in Central Asia collections of the local and world flora. The collection fund includes 4 012 ornamental, 1 985 wood, 987 tropical and subtropical, 794 fruit and berry, 572 technical, 495 medicine and 257 fodder species and forms of plants. The bank of germo plasma of the

rare and vanishing species in the Chief botanical garden (Almaty) has 235, the Altai botanical garden - 150 and Karaganda botanical garden - 50 species.

The rich collection of the introduced breeds of the wooden and shrub plants is available in the dendry parks of the Institute of grain farming (Shortandy city) and Institute of the forestry and agricultural forest melioration (Shuchinsk city).

This richest collection, compiled during long years by the efforts of scientists is a national wealth, phytogenetic fund of a country.

The establishment of the germo plasma bank (gene bank) is an exclusively important part of the measures targeted at the conservation ex - situ of the biological diversity components, in particular of the rare and vanishing plants. The germo plasma bank is created in the form of a bank of seeds, bank of pollen, bank of cellular and tissue cultures, bank of deoxyribonucleic acid (gene library). In any case creation of the germo plasma bank has to be viewed as a significant supplement to the traditional methods of the conservation of the rare and vanishing plants ex - situ in the form of alive collections.

The seed bank ensures the long term reservation of the samples of the germo plasma in a viable state for the enormous number of the genotypes.

In case the seeds loose their germination fast the bank of cellular and tissue cultures is used to conserve the genetic fund of such species of the plants. In principle, the bank of cellular and tissue cultures may serve for the cryogenic conservation of the germo plasma of practically any type.

At the Institute of the flora physiology, genetics and bioengineering there have been worked out the methods of the massclonal reproduction and creation of the bank of the cellular and tissue cultures of the cereals and beans, and a number of the wildly growing plants including some species of the rare and vanishing plants of the *Tulipa, Allium, Korolkowia* and other genuses.

With the occurrence of the vanishing species problem the role of the zoological parks as breeding places and in a number of cases - as last shelters for some rare species of animals have become increasing. The role of the nurseries for breeding some particular species or groups of species of animals has increased as well. Along with the conservation of the breeded animals the majority of them have become engaged in production and commercial activities - the numerous snake and *Falconidae* nurseries.

Evaluating a role of the zoological parks and nurseries in the conservation of the rare species of animals one has to note three issues needed to be solved:

1) the elaboration of the methodology of the artificial breeding and growing under bondage conditions of these animals;
2) meeting the demand of the zoological parks and nurseries in these rare animals, which would decrease the scope of withdrawals of these species out of the natural environment;
3) putting back into the natural environment the species breeded and grown up under the bondage conditions.

The zoological parks perform also the cultural and educating role. There are three zoological parks in Kazakhstan. The oldest zoological park is an Almaty one, established in 1937. It has the largest experience in breeding animals, including the rare species from the Red Data Book of Kazakhstan. In different years there have successfully been reproduced such rare species of Kazakhstan' s fauna as *Tinea uncia, Cervus elaphus bactrianus, Ovis ammon, Eqnus hemionus, Hystrix indica, Cygnus cygnus Linnaeus, Ciconica ciconica asiatica, Larus ichthyaetus Pallas, Platalea leucorodia Linnaeus.*

The particularly large success was achieved by the Almaty zoological park in breeding the rare species of predatory birds. From one couple of bearded vulture (*Gypaetus barbatus)* in 1972 - 1990 there have been grown up 11 nestlings, two of which gave successfully acclimatised in Alps where they were released in accordance with the Program on conservation of this rare species in Austria. In 1984 in Almaty zoological park there has been established a small nursery of the predatory birds, in which during the period from 1985 through 1996 over 100 nestlings have been grown up (of 7 species): falcon - baloban (50 nestlings), *Falco pelegrinoides Temmincr* (1), *Haliaeetus albicilla linnaeus* (15), *Aquila rapax Temmincr (*11), *Aquila chrysaetus* (2), *Neophron percnopterus* (1), *Bubo bubo* (23). In 1995 in the zoological park there were 200 species of the predatory birds, classified under 42 species; of them the representatives of 17 species have started to be reproduced, and 10 species have successfully grown up their nestlings.

Out of rare animals put into the International Red Data Book, but residing beyond the limits of Kazakhstan (Africa, Southern and Eastern Asia, Southern America) the following animals have been reproduced in Almaty zoological park for many times: *Pantheta tigris, Panthera onca, Panthera pardus, Panthera pardus, Ursus tibetanus, Bison bonasus, Eqnus pizewalski, Capra falconeri, Elephas maximus, Eqnus grevyi, Papio hamadryas, Aix galericulata, Falco biarmicus, Haliaetus pelagicus, Bubulcus ibis, Baliarica pavonina.*

In 1985 when the Kazakhstan zoological parks have joined a targeted complex program "Protection of fauna of Kazakhstan", each of them was offered to specialise in the breeding of the rare animals from the Red Data Book of Kazakhstan: Almaty zoological park - that in predatory animals (predominantly cat family) and predatory birds, and some of the rodents, reptiles and semirechenskyi frog tooth ( ) from Amphibia; for the Karaganda zoo - ungulates and *Anthropoides virgo;* for the Shymkent zoo - local rodents (*Hystrix indica, Marmota menzbieri)* and *Otis tarda, Chlamydotis undulata, Otis tetrax)*. Such a specialisation is seen logical now as well from the point of view of the climatic and other conditions for keeping and transportation of the animals.

Out of few existing in Kazakhstan nurseries the single one specialising in the breeding of the rare species is a falcon nursery "Sunkar", established in 1989. In 1990 it had purchased from Almaty zoo the uterine species in the amount of 13 falcons (10 balobans and 3 jer - falcons (*Falco rusticolus)*). This private enterprise on breeding the wild populations of the falcon - baloban has grown up 222 nestlings, of which 81 were released free during the period from 1990 through 1996 in Almaty oblast. However the fate of the released nestlings remains unknown, therefore the outcome of such releases unfortunately cannot be estimated.

For the zoological parks of Kazakhstan to perform successfully their functions on the conservation of the biological diversity of the aboriginal fauna it is needed to solve a number of organisational issues and create certain conditions, the main of which are the following:

- define a status of Kazakhstan' s zoological parks as nature protection institutions;
- improve the material supplies of the zoological parks to the level enabling them to deal with the issues on breeding rare and endangered by disappearance species of Kazakhstan' s fauna;
- improve the legal framework of the zoological park activities and the nurseries existing on their base;
- actively incorporate the zoological parks of Kazakhstan into the scientific programs on conservation and restoration of the rare species of animals, which are carried out by the scientific and nature protection institutions.

To conserve the micro-organisms with the useful properties a need occurs to look for the ways of long term reservation of the viability and maintenance of physiological activity of some cultures. The objective of the storing the micro-organisms is to keep the stabilisation of the useful properties of the micro-organisms at the original level, to minimise the opportunity of splitting of their signs and development of clones, strains differing from the original ones.

During three decades beginning from 1960s at the Institute of microbiology and virology of the Ministry of Science - Academy of Science of the Republic of Kazakhstan the investigations on influence of the storage conditions and terms on the viability and conservation of the useful properties of the micro-organism cultures, which have the production value, have been carried out. The methods of conservation and reactivation of the micro-organisms, enabling to conserve during many years their valuable physiological and biochemical properties have been worked out. They are quite diversified: bacterial cultures are dried out by the liophylization in order to transfer them into anabiotic state. The mushrooms and ray fungi (*Actinomycetes)* are conserved largely in the physiological solution, soil, sand, under the layer of liquid paraffin, in the media of the enhanced content of potassium chloride NaCl.

The representatives of large taxons have their own specific peculiarities while being conserved in the collections.

Creation of conditions to conserve the micro-organisms ex - situ in the country of resource origin

The micro-organisms, involving prokaryotes (bacteria and archebacteria) and eukaryotes (micelle mushrooms, yeast, microscopic sea weeds, protozoa) are recognised to be a significant component of the biological diversity. They are available in all ecological systems, carrying out important and sometimes unique functions (nitrogen fixation, nitrification, denitrification, cheomlythothrophic fixation of CO_2). The formation of soils, conservation of the atmosphere gas balance are also related to their activities. Photothrophic micro-organisms are the primary products for the oceans, up to 40 per cent of global photosynthesis occurs with their involvement. Genetic and metabolic diversity of the micro-organisms is used in medicine, industry, and agriculture. In relation to this the duly attention is paid by the Convention on the biological diversity to the studying and conservation of the diversity of the microbe world.

In Kazakhstan in a number of the scientific and higher educational institutions there are carried out the investigations on extraction and study of the micro-organisms, associated to the diseases of human being, animals and plants; that of the micro-organisms representing interest for the food industry, plant growing, medicine, bioremediation. The micro-organisms, which are iso-

lated from the natural substratum are preserved in the collections, created in various institutions and higher educational institutions (Table 2. 4).

Table 2. 4

List of the most important collections

Institution	Location	Number of cultures	Functions
Institute of microbiology and virology of the Ministry of Science – Academy of Science of the Republic of Kazakhstan	Almaty city	700	Storage, depository, consultations
Institute of pharmacological biotechnology	Stepnogorsk city	120	Storage
Scientific research Institute of food industry	Almaty city	100	Storage
Anti plague Institute	Almaty city	300	Storage, depository
Biocombinate	Almaty city	50	Storage
The Kazakh Institute of plant protection	Almaty oblast	100	Storage
Chairs of the higher education institutions	Almaty city	80	Storage, use in training process
Scientific research Institute of agriculture	Otrar city	300	Storage, depository

The Institute of pharmacological biotechnology has issued a catalogue of the collection cultures. The Institute of microbiology and virology jointly with the Centre of the agricultural studies of the Ministry of Science - Academy of Science of the Republic of Kazakhstan has prepared a consolidated catalogue of the micro-organisms in Kazakhstan.

In the collection of the non- pathogenic forms of the micro-organisms the most represented are the bacteria and actynomecetes - 78%, micelle mushrooms - 12. 9%, and yeast - 8. 5%.

Out of the bacterial micro-organisms the lactic - acid, propion - acid bacteria and oil oxidising micrococcus have been put for long term preservation. For the lactic - acid and propion - acid bacteria the optimum way in sense of long term storage (5 years) is a liophylic drying out with vacuum soldering with further storage in the refrigerator. For the *Micrococcus aurentiacus* the storage under the layer of liquid paraffin at the lower temperature (from +4 °C through -5 °C) is differing feature.

The optimum methods of conservation of the Actynomecetes - products of the biologically active substances are the liophylization method, storage in the soils at the silk threads, under the layer of the mineral oil and in the physiological solution.

The liophylization and storage under the layer of the liquid paraffin have turned out to be good methods of conservation of the viability of the mycelia mushrooms. The opportunity to pro-

long the conservation terms of the yeast organisms by cultivating them in the wort agar with 2% of NaCl.

In the collections of the micro-organisms for practical purposes it is necessary to ensure the sustainability of the pure cultures, minimise their volatility with the conservation of their properties to the supersynthesis of the substances useful for a man. However in the process of storage the micro-organism population is exposed to the changes, the morphological and biochemical properties of the cultures keep changing.

The display of the population volatility has been observed with the cultures of the Actynomectes. In the process of storage after the liophylization due to the heterogeneity of the population a splitting of the cultures is observed by the signs of antibiotics- and vitamin- like formations. The variants appear, which exceed the original strains by the synthesis of vitamins and antibiotics. The most active strains are selected to work out a technology to obtain the antibiotics.

The collections of the micro-organisms are the banks of information about their properties. The collection strains not only carry the valuable part of the genetic code of the natural microbe communities. As new information accumulates on the strain' s properties its value may increase with time, even if in the process of the re- seeding under the laboratory conditions certain of his properties have been lost. The value of the collection culture sharply increase in case if a strain is obtained in the result of laboratory selection of the desirable pheno- and genotype.

Depositing the micro-organisms in the collections is an optimal way to conserve the genetic fund of the valuable cultures of the micro-organisms.

2.2. Sustainable Use of Biological Resources

The strategy for the conservation of sustainable biodiversity under the conditions of intensification of anthropogenic activities consists of enhancing the actions on balanced utilization of biological resources – observation of the balance between exception of resources and their self-restoration. Establishment and observation of environmental standards and nature utilization restrictions serves as a basis for the following balanced utilization strategy: standards for exception of resources without violating the self-regulation function, environmental restrictions for economic activities for the purpose of preventing the risk for biodiversity, compensation measures on restoration of lost resources, and rehabilitation of the habitation places of species and populations from the risk group.

A serious problem arose in Kazakhstan because of privatization of lands and establishing farms without a sufficient legal framework on conservation and utilization of biodiversity

Sustainable Use of Eco-System Resources and their Components

Utilization of biological resources of nature and anthropogenic eco-systems is considered according to the type of economic activities as a result of utilization of forestry, pasture, hay harvests, plant raw material stock, game animals, agricultural land reclamation (including forest-park and land for berry production), and recreation in tourist and resort-sanatorium zones. Land cultivation and pasture impact prevails in large territories (Fig. 2.2), and all have a significant role.

The General National Strategy of balanced utilization of the economic resources mentioned above, combined with specific eco-systems are directed to the conservation of all types of eco-

system biodiversity; prevention of a imbalance between exception of resources and their reproduction; reduction of the risk of losing potential resources.

The Specific Strategy of balanced utilization of various economic resources is based on accounting for the factors (reasons) of the impact and response of species and eco-systems on this or that factor. The Strategy takes into account the forecast of possible consequences of environmental changes gradually accumulating in eco-systems and populations that create the risky situations of losing biodiversity and the main function of self-restoration of resources.

For agricultural biodiversity (agricultural eco-systems) the strategy of balanced utilization is based on the following human activities: creation of habitats for species (varieties, forms) and the provision for regulation of their reproduction. The Convention obliges to take into account, while creating agricultural eco-systems, the issues such as prevention of alien types damaging natural biodiversity; conservation of optimum balance of natural and ploughed lands.

Pastures

Within the pastures (182,6 million ha., including the mountain pasture – 9,4 million ha.) overgrazing has the most considerable impact on biodiversity, loss of productivity and stability resulting in an imbalance between fodder plants and their aftergrowing. With seasonal utilization, pastures may support between 2 and 8 cattle per ha. This figure was exceeded by 2-6 times in a number of districts. Degradation of pastures, their desertification was noted (Fig. 2.3, 2.3A).

The existing degradation of infrastructure and organization of other forms of economy, reduction of water supply of pastures and restrictions of possibilities for the drive out and traditional migratory animal breeding are resulting in considerable expansion of large desertification areas around remaining wells, populated areas and in places of forced year-round grazing.

The establishment of a balanced pasture utilization regime, envisages their conservation, liquidation of causes and consequences of degradation and their restoration.

The conservation sphere should accept that it is necessary to spare the utilization of pasture, especially in the areas with a risk of species loss.

In the legal regulation sphere, a Law “On Pastures” is required that takes responsibility for the monitoring of feeding lands and compensation for damage; harmonization of environmental and economic aspects with priority of environmental advantages on the high site class lands; legal provision for State expertise of the pasture status; definition of the optimum correlation of the lands subject to privatization and SPNT; monitoring and inventory, land management, irrigation etc.

In the financing sphere, while transition to the new forms of economy and creation of new infrastructure on pasture lands it is necessary to do the following: to increase investments for the conservation of biodiversity on pastures including the process of redistribution of economic benefits from pasture animal breeding. It is inadmissible to reduce financing on land management, irrigation, and phytomelioration of feeding lands because it aggravates the desertification process and losses of biological resources.

Measures on conservation and balanced utilization of biological diversity of pastures are based on environmental policy of nature utilization on the Republican, regional, and local levels. Provision for biodiversity required additional mapping inventory of species variations and a data base of quantitative and qualitative composition of the flora and fauna, eco-systems, their resources, and standards of harmless exception.

In the sphere of rational utilization and conservation of pasture varieties, the following actions are required:

- To create digital management maps on the basis of environmental districts and to annually update data on the status and productivity of pastures;
- To conduct assessment of the status, utilization, and dynamics using ground and aerocosmic methods after 2-3 years;
- To conduct passportization of district pastures identifying their feeding qualities, utilization standards, and the risk of losing floral varieties (reduction of the area of distribution, quantity, and resources);
- To select representative plots of pasture for monitoring;
- To make centralized decisions on improving the utilization regardless of the ownership form and economic benefits.

In the land management and irrigation sphere it is recommended to do the following:

- To justify a plot method of pasture utilization with rotation of pasture;
- To implement irrigation of productive weakly used drive out pastures;
- To arrange annual cadastre analysis of pastures and hay harvests by categories of land users taking into account the environmental status;
- To start creation of regional and district atlases of feeding lands utilizing periodically corrected (not less than every 5 years) assessment mapping materials: soil, geobotanical, land management, and environmental ones;

In the pasture conservation sphere and their biodiversity it is recommended to do the following:

- To identify and justify separation of special protected areas and reservations of background (zonal) pastures and hay harvests for conservation of the feeding land genic fund;
- To conduct analysis of feeding land biodiversity transformation on the species, phytocoenosis and eco-system levels;
- To develop criteria of the pasture utilization and conservation;
- To divide pastures and hay lands into regions according to their environmental status.

In the sphere of restoration of biodiversity on pastures it is necessary to do the following:

- To conduct amelioration of feeding lands on the basis of natural laws, excluding intussusception of alien species having a negative impact on biodiversity.

Forests

Regardless of the fact that forests occupy only 3.8% of the country's territory, in some one can notice an enormous concentration of biological diversity.

By physical-geographical conditions, the forests of Kazakhstan are divided into Montane and plain lands, including desert and intro-zonal (riparian woodlands and bottomland ones).

The system of forest resource conservation, restoration, and utilization provides for the safety of the major woodland ecological systems: *Pinus silvestris* of the Kazakh small hills, *Pinus silvestris* of the Irtysh region, coniferous forests of the Saur and Altay regions, dark coniferous and wild fruit forests of the the Dzhungar Alatau and the montane systems of the Northern Tien-Shan (*Picea schrenkiana, Abies sibirica, Malus sieversii, M. kirghisorum, Armeniaca vulgaris*), the remnants of juniper forests, broad-leaved and xerophytic forests of the Western Tien-Shan. With the help of artificial forest regulation more than 1.3 million ha. have been created.

However forest biological diversity is endangered by many factors such as excessive cattle grazing, unauthorized cutting, flooding, and diseases.

Forest massifs are mainly spread in the mountains of Altay, Tien-Shan, and separate massifs in the flat lands and small hills of the Northern Kazakhstan.

The total area of forests forming the woodland resource of Kazakhstan (according to the State data of the woodland calculated in January 1 1993) amounts to 24.6 million ha.(Fig. 2.4)

The area covered by forest is 10.5 million ha. In the composition of the woodlands Haloxylon (5 million ha) is dominant, then pine forests (963,000 ha.), birch groves (900,000 ha), fir forests (384,000 ha.), aspen forests (296,800 ha.), larches (175,000 ha.), spruce forests (168,200 ha.), cedars (43,3000 ha.) etc. More than a half of lands of the forest resource (13337.4 thousand ha.) were once transferred for long-term utilization.

The forests of the forest-steppe zone contain mainly birch forests (*Betula pendula, B. Pubescens)* with mixtures of aspen (*Populus tremula)* and willow (*Salix sp. sp.)*, alternating in places with steppe meadows and meadow steppes.

The forests in the steppe zone are situated in the low relief and contain birch (*Betula pubescera*) and aspen *(Populus tremula*) forests, and in the pine forests on sandy soil pines dominate (*Pinus silvestris)*. Their Southern islets are located in more severe climatic conditions. In the Kazakh small hills, pine forests are spread in a fragmentary manner by root breeds. Bottomland forests in Kazakhstan are represented by oak woods *(Quercus robur)*, maple forests *(Acer tataricum)*, elm forests (*Ulmus laevis)*, willow forests (*Salix sp. sp.)* and are degraded because of infringement of the hydrological regime.

Riparian woodlands of poplars (*Populus diversifolia, P.pruinosa*, in places *P.talassica)* Russian olive (*Elaeagnus angustifolia)*, in places willow (*Salix sp. sp.)*, tamarisk (*Tamarix sp. sp.)* and ash (*Fraxinus sogdiana)* line the rivers.

Montane forests of the Altay and Saura are characterized by a large biological diversity. On the low line of the Altay mountains deciduous woodlands occur. They are mostly spread among coniferous forests of fir *(Abies sibirica)*, pine *(Pinus sibirica),* and larch *(Larix sibirica)*. Insignificant areas are occupied by spruce forests (*Picea obovata)*. In the Saur, larch forests are dominant and in a fragmentory manner the spruce (*Picea schrenkiana)*. Considerable areas of coniferous forests are degraded (logging and fire).

The montane forests of the Northern Tien-Shan and Dzhungar Alatay are also notable for considerable biological diversity of plant communities. In the low mountains, maple forests (*Acer semenovii*) grow in a fragmentary manner, on higher land the apple grows (*Malus sieversii*) with the thornapple (*Crataegus songorica u ðp.*) and aspen forests *(Populus tremula)*. Mid-height mountains are occupied by spruce forests (*Picea schrenkiana*) and meadows, with juniper in higher altudinal forests (*Juniperus pseudosabina, J.sibirica*) and alpine meadows. Aawhile the degradation process community and forest borderline changes are observed.

The mountain forests of the Western Tien-Shan are characterized by considerable biological diversity with widespread juniper forests (*Juniperus turkestanica, J. semiglobosa, J. Seravschanica*). In the Northern part of the region, walnut (*Juglans, Amygdalus*) almond and other warmth demanding species do not occur. Forests of Walnut (*Juglans regia*), apple (*Malus sieversii*), poplar (*Populus talassica*), and birch (*Betula talassica*), willow (*Salix sp. sp.*), and also relict species (*Juglans regia, Malus kirghisorum, Aflatunia uimifolia, Ptistacia vera, Exochorda tianschanica, Abelia corymbosa*) are experiences strong degradation and exhaustion.

In line with the Forestry Code of the Republic of Kazakhstan, all the forests are protected, and depending on the environmental, genetic, and social economic functions fulfilled by them they are divided into two groups.

To the forests of Group I, 95.8 % of the forest resource territory carries the following protection categories:

- The forests of specially protected natural territories (the forests of the State natural reserves, State National natural parks, State natural parks, State forestry monuments of nature, and State reserve zones, specially valuable forest massifs having scientific significance including genetic reservations, walnut forests, forest fruit plantings and subalpine forests;
- sanitary-hygiene and recreation (city forests and park forests, forests of the green zones around cities and other populated areas, industrial enterprises including, forest park and forest economy parts, forests of the first and second stages of the sanitary water supply sources protection zones, forests of the first, second and third zones of the sanitary resort protection districts);
- water protection (protection forest lines along the river banks, lakes, water reservoirs and other water basins);
- protective (anti-erosion forests, protective forest lines along railways, highways of the Republican and regional significance, State protective forest lines, line pinewoods, steppe forests, forests in desert, semi-desert, steppe-forest, and small forest montane districts having important significance for environment protection).

Each of the categories stated above has a strictly defined utilization regime and definitive arrangements for the conservation of biological diversity. In most parts, logging is prohibited, and in some of them restricted to the utmost limit.

The forests of Group II of the restricted utilization in the mountain regions make up 4.2 % of the Republic forestry resource.

The distribution of forests by species and wood stock are given in Fig. 2.5, 2.6.

For the provision of established forest protection regimes, it is required to approve new standard regulations on SPNTs, a Regulation on forests of the specially protected natural territories, and to define the procedure for referring forests to these zones. Adoption of a number of legal acts on the issues of their financial support is extremely important.

Taking into account the fact that the forests in the Republic fulfill the role of a specific framework of the most important ecological systems one should revise a considerable number of legal acts regulating forestry activities. In particular, for the purpose of non-exhaustive rational forest utilization, it is necessary to approve a methodology for the definition of calculation forest cutting areas, an instruction on separation and enumeration of cutting areas, to introduce new sanitary rules in forests, to clarify the instruction on auxiliary forest utilization, and to revise acts on forestry revenue, and forestry financing.

To provide a plan for forest restoration of valuable wood species, a number of points need to be considered: development of Regulations on separation and conservation of the genetic fund of these breeds, forest seeds base formation and utilization; the procedure for the creation, formation, and utilization of forest seed base, and a number of documents regulating forest seed issues; forest culture production; transfer of forest cultures to the category of valuable plantings; preservation of seedling growth and young plants of the economically valuable wood breeds while developing the cutting areas and other activities. The total biomass accumulated in the forests amounts to 369.8 million cubic m.

In the last decade because of a considerable financial reduction, forest plantations have sharply reduced, and the fire areas have increased many times, and this has a negative impact on the forest status and their biological diversity.

The strategy of the forest development and utilization includes the following arrangements:

1. Optimising the areas of utilization depending on the forest protection category
2. Increasing the scope of forest formation and forest breeding in the Republic up to 100-150,000 ha. per annum

3. Improving lumbering technologies and forest regulation work on the basis of the latest scientific and technical achievements
4. Improvement of the forest protection including protection from fires on the basis of introducing distance methods and aviation protection
5. Financial provision for taking care of the forest, forest restoration, forest cultivation, and forest protection.

Resources of Wild Raw Material Plants

The flora of Kazakhstan contains about 6,000 species of vascular plants which include a considerable number of the species utilised in the economy such as technical, tannic, nutritious, ether oil, medicinal and other plants.

Technical Plants.They are numerous species (Fig. 2.7), and some of them occupy large areas in the vegetative cover and some of them have considerable reserves of raw materials. One of such plants is common reed (*Phragmites australis*) and chee grass (*Achnatherum splendens*). These plants are used as feeding, construction material, and also in the cellulose-paper industry for manufacturing paper and cardboard. Reed thickets have been reduced 7 fold and make up now 2,352,000 t. of dry raw materials. The chee grass resources have been determined to be 23,735 t. of raw materials at present.

Many fibrous plants that were formerly used for wickerwork, manufacturing baskets, various fibres and furniture have been forgotten and included types of willow (*Salix*) and dogbane (*Trachomitum lancifolium*).

Tannic plants contain valuable astringent substances in the bark and wood. This group contains more than 20 species of valuable tannic substances. Among them there are such plants as tannic jointweed (*Polygonum coriarium*), Bukhara jointwed (*P. Bucharicum*), Tien-Shan sorrel (*Rumex tianschanicus*), Paulsenovsky sorrel (*R.Paulsenianus*), Tatar rhubarb and Maksimovich rhubarb (*Rheum tataricum*, *R. Maximowiczii* etc.). The reserves of these raw materials exceed 200,000 t., including the Tatar rhubarb on the area about 20,000 ha., and Tien-Shan sorrel on the area about 700 ha. With reserves of dry raw materials more than 15,000 t.

In recent years, many tannic plants have found their application as medical plants. Thus Tatar rhubarb is used in folk medicine as anti-inflammatory medicine, and substances having anti-dermatic properties have been obtained of Tien-Shan sorrel

Nutritious plants are a large group of valuable species in the flora of Kazakhstan. The most important of them are Siverse apple tree (*Malus Sieversii*), common apricot (*Armeniaca vulgaris*), and also some species of thornapple (*Crataegus*), barberry (*Berberis* etc.). The reserves of apple trees and apricots have been determined to be 1,653 and 800 t. respectively. Forestry organizations store up to 300 t. of apple tree, thornapple, and apricot fruits. In Kazakhstan, many other valuable nutritious plants are stored as local populations. These include, raspberry (*Rubus idaeus*), blackberry (*R. Caesius*), currant (*Ribes*), gooseberry (*Grossularia*), strawberry (*Fragaria*), rowanberry (*Sorbus*), European birdcherry (*Padus*), almond (*Amygdalus*), wild cherry (*Cerasus*) and plum (sloe and cherry plum) – (*Prunus spinosa* and *P. Sogdiana*), and various species of onions (*Allium*).

Ether oil plants. About 100 species of prospective species with regard to content and composition of ether oil have been discovered. These plants are widely used in the perfumery and cosmetic industries and in the manufacture of non-alcoholic and healing drinks (balsams). The most widespread are volatile oil plants of the mint families (*Salvia*), mint (*Menta*), hyssop (*Hussopus*), yarrow (*Achillea*), catmint (*Nepeta*), thyme – (*Thymus*) and others. There are considerable areas of these plants, enough for the provision of the domestic and perfumery industry.

Very valuable and prospective volatile plants come from the thistle family of wormwood genus (*Artemesia).* Ether oils of very high quality can compete on the international market have recently been extracted from the white land wormwood (*A. terrae-albae*). Thickets of wormwood growing in a desert zone have been estimated to cover some 40 million ha.

Medicinal plants are one of the most numerous groups of useful plants in the flora of Kazakhstan containing more than 100 species. Among them one can distinguish several species not only having healing properties but also extensively growing, for example two species of licorice: *Glycyrrhiza glabra* and *Gl. uralensis.* Both of them are widely used in medicine. They are part of 40 medical gatherings and teas and serve as a basis for manufacturing more than 100 medical preparations and medicines. The resources of these plants are concentrated on 30,000 ha. with dry raw material reserves about 80,000 t.

The horsetail (*Ephedra equisetina*) is the source of a very valuable spasmolisant and a narcotic preparation, Ephedrin has resources of 200,000 t. of dry raw materials out of which one can manufacture up to 1000 t. annually. Common yarrow (*Achillea millifolium*), possessing blood-stopping, anti-inflammotory, and bactericidal properties has more than 250,000 t. of raw material reserves. Elecampane (*Inula helenium*) possessing anti-inflammatory, expectorant, and diuretic properties: reserves of raw material are 60,000 t. Intermediate Patrinia (*Patrinia intermedia*), possessing the same properties as turkestan Valerian has reserves of 950 t. of raw material. Other valuable medical plants such as Wolfsbane – (*Aconitum leucostomum*), Lobel hellebore (*Veratrum lobelianum*), delphinium species (*Delphinium*), inula (*Inula grandis*) have reserves of raw matrial within 500 t. each. Such valuable plants as common sea buckhorn (*Hyppophae rhamnoides*), St. John's wort – (*Hypericum perforatum*), *pot marjoram* (*Origanum vulgare*) have reserves of dry raw material about 100 t. The raw material reserves of many other medical plants are significant (10 to 50 t.) meeting the demands of drugstore network of Kazakhstan – dog roses (*Rosa*), barberry (*Berberis),* stinging nettle (*Urtica dioica*), greater celandine (*Cheledonium majus*), Turkestan valerian (*Valerian turkestanica*), Bunge ziziphora (*Zizihora bungeana*), Turkestan motherwort (*Leonurus turkestanicus*).

During the last decades, because of the huge anthropogenic impact and construction of numerous water economy facilities, regulation of river outflow, reclamation of virgin and lowlands, thickets of many species are disappearing (santolina – *Artemisia cina*), the whole landscapes – places of habitation of valuable raw material species have changed. It is now particularly important to conserve and multiply resources of useful plants, one of the riches of the sovereign Kazakhstan in such hard ecological situation only providing for sensible economy on a scientific basis, with observation of the volume of annual raw material stockpiling for very plant and rational methods of stockpiling.

For this it is required to do the following:

- To define the state structure of monitoring and control of raw material utilization;
- To provide for the development of systematic standard stockpiling of raw materials and observation of technologies;
- To prohibit non-organized stockpiling without licenses.
- To strengthen attention to the full inventory of plant resources, assessment of their reserves and areas on a mapping basis.

Resources of Fungi

Insignificant attention has been paid to the sustainable use of fungi. The number of recorded species and forms (4,450) illustrates the riches and diversity of the fungi. The species and genera found in Kazakhstan for the first time and turned out to be new for science (9 genera, 376

species, and 45 forms) the majority of which are endemics of Kazakhstan and Central Asia testify to their originality and peculiarities. Ancient and relict species and genera being of great interest for solving the issues related to restoration of the history of fungus flora and florogenesis have been discovered.

Fungi are a unique biological group having great economic significance and have a large impact on the human health:

- Fungi fulfil cosmic work;
- They participate in the decomposition cycle producing organic residues, and ameliorating the soil structure;
- They are producers of antibiotics, organic acids, and growth substances;
- They are used in bakery, fermentative industry, wine making, cheese making, silage (yeast fungi). In Kazakhstan more than 40 species of edible fungi are known to be collected, and some of them are cultivated.

Their negative role is known as well. Rather perceptible and sometimes irreplaceable damage are done by fungi (micromyces) to agricultural crops and wild useful plants: rust fungi, smut fungi, perisporiales, many species of non-perfect fungi (*Fusarium, Verticillium, Septoria*) and others.

But one should note that despite the great number of discovered fungal species, this list is not complete and final because the whole environmental fungus groups: water moulds, injurious, entomophilic, keratinophilic and others have not been studied at all.

At present in the whole world there is growth of mycosis, myxotoxicosis, candidiasis diseases, allergies and others caused by microscopic fungi.

Research has shown that the cause of it is the catastrophic deterioration of the environment and is having a direct impact on health (by reducing immunity of people and animals), and also through fungi (macro and micromyces) by changing their biology resulting in appearing and growing their pathogenic and toxigenic potential. This situation is especially aggravated by wide spreading of pathogenic fungi in the environment: the air, water, soil, foodstuffs, food raw materials, fodder and others.

The health of the population of Kazakhstan, especially in the environmentally unfavourable regions is of great concern. Candidacies (intestinal, dermal, vaginal forms, respiratory ones), aspergillosis, phycomycosis, bronchial asthma, rhinitis, sinuitis, bronchitis wherefungi are the main causes of a disease. Causal relationship between allergic respiratory diseases and the content of fungal spores in the air and household dust has been discovered. Most of the fungal spores in the city air are observed at the end of summer, at the same time as most of the cases of allergies. Official medicine registers them as "pollinosis ".

Research carried out by the Vita-Vint Medical Centre proves the urgent requirement for an in depth study of diseases caused by fungi. But for conducting necessary research and practical work on discovery, diagnostics and treatment of mycosis and other diseases of fungus etiology especially in the environmentally unfavorable regions (the Eastern region, Aral, Kzyl-Orda region and others) material aid is required in form of cash allocations.

Resources and Transformations of Agricultural Lands

In Kazakhstan there are more than 220 million ha. of agricultural lands, including 291 million ha. of ploughland and more than 180 million ha. of pasture.

Desertification caused by erosion of soil, loss of humus, and non-rational utilization of pastures has occurred in more than 120 million ha., which has considerably changed the status of biological resources: their areas, numbers, and productivity.

The ploughed virgin lands of the Northern Kazakhstan have lost in the last 40 years 30 percent of their humus because of their extensive utilization. Analysis carried out by agricultural economists has shown that the reform in agriculture has just changed forms of ownership for the means of production, liberalization of prices and removal of the State from intervening into the economic development. Such a policy which started in 1991 resulted in a continuous reduction of planting agricultural crops, reduction of the quantity of cattle and poultry, continuous reduction of yields and productivity of animals that in its turn had a negative impact on providing the population with foodstuffs. (Fig. 2.8, Table 2.5)

Table 2.5

Production Dynamics in the Republic of Kazakhstan

Products	Production million t.				In % per capita
	1998 Popul. 16,537 million		1997 Popul. 15,672 million		
	Total	Per capita kg.	Total	Per capita kg.	
Grain	22,56	1364	12,31	785	-74
Bread, flour	2,28	138	2,02	129	-7
Meat (slaughter weight)	1,49	90	0,63	40	-56
Milk	5,32	321	3,22	205	-57
Eggs, bl., pc.	4,2	254	1,24	79	-320
Potatoes	2,26	137	1,47	94	-46
Vegetables	1,35	82	0,88	56	-46

Strategy of Sustainable Use of Agricultural Lands includes a number of immediate land management measures:

I. Inventory (land, water economies, forestry funds and agricultural settlements):

- Agricultural lands and their cadastre assessment;
- Inventory of the open water sources for the purpose of their protection and rational utilization;
- Forest plantings, located among agricultural lands, for the purpose of their reproduction and reconstruction on a landscape basis;
- Rural populated areas for the purpose of determining the prospect of their development.

I. Agricultural landscape division of land utilization territories:

- Specialization and placement of agricultural, water and forestry sectors according to corresponding agricultural landscape and natural eco-systems;
- Separation of specially protected territories (natural and artificially created eco-systems) for the purpose of reproduction and conservation of biological diversity.

III. Improvement of infra-structure and servicing new economies formations for the production, processing, storage and sales of plant and animal breeding products:

- Educational and cultural institutions;
- Machine-technological stations;
- Primary raw materials processing lines and plants;
- Elevators and refrigerating facilities.

IV. Economic assessment of various agricultural producer models under new social economic conditions.

Agricultural landscapes (agricultural eco-systems) are divided into four groups according to the cereal crop cultivation conditions: ploughed land with more than 4.5% humus content, located mostly on flatland where the snow cover height reaches 41cm and sometimes more, with average yields of cereals between 16-20 metric centners per ha., refers to good conditions for cereals cultivation. The second group of agricultural landscapes with indices 4.0-4.5; 31-40; the relief is 0.2-0.5 degrees and the yield is 12-16 metric centners per ha.; theses are respectively intermediate conditions. The third group with indices 3-4; 21-30; 0.5-1.0 and 8-12 centners per ha. refers respectively to weak conditions. The fourth group has a humus indicex of less than 3%, and a snow cover of 20 cm. And less, with a relief bias 1.0 and more degrees and the yield less than 8 centners per ha. refers to very weak conditions of cereal crop cultivation.

On the basis of the agricultural landscape division of land territories, a real opportunity for developing an optimum structure of arable for cereal spike-shaped crops on good and intermediate (1 and 2 groups) agricultural landscapes developed.

The third group is more suitable for the creation of raw material food belts, including cereal-fodder-bean hay crop and pasture grass mixtures.

The fourth group of agricultural landscapes including windy slopes, unproductive degraded lands and a gully-ravine network must be taken from ploughed lands and used stage by stage as phyto-forest-pasture lands with moderate cattle grazing, conservation of biological diversity and environment.

Zoological resources

The natural resources, including animal resources are the national wealth of Kazakhstan, the basis of well being and prosperity of the country. Thus wild animal products such as meat, skins, horns-antlers of a young Siberian Stag, expensive poison is widely used in the Republic and is exported, being one of the sources of foreign exchange revenues.

Kazakhstan is rich in game animals both in terms of species and quantities. Out of 180 species of mammals 48 (27%) including 12 (7%) species of hoofed animals are hunted and include: saiga *(Saiga tatarica)*, moose *(Alces alces)*, roe deer *(Capreolus pygargus)*, wild hog *(Sus scrofa)*, mountain goat *(Capra sibirica)*, musk deer *(Moschus moschiferus)*, Siberian Stag *(Cervus elaphus)*. The Republic is rich in fur animals: Russian sable *(Martes zibelina)*, fox *(Vulpes vulpes)*, musk rat *(Ondatra zibethica)*, marmot badger *(Marmota)*, little marmot *(Citellus)* and others.

During the last years the hard ecological situation has drastically transformed the places of wild animal habitation. Their numbers changed, some species declined in number while others increased. At present the total number of saiga *(Saiga tatarica)* amounts to 700-750,000, roe deer

(Capreolus pygargus)-30,000, wild hog *(Sus scrofa)* -10,000, mountain goat *(Capra sibirica)* -20,000, Siberian stag *(Cervus elaphus)* -15,000 species. The available reserves of these animals allow to to except without damage for reproduction 10-15 % of their number. Many wolves *(Canis lupus)* have appeared in the reserves 100,000 and 50,000 jackals *(Canis aureus)*. The problem of the reduction in numbers of these predators in the Republic has an important significance not only for agriculture but also for conservation of rare and game species. In Western Kazakhstan the number of beavers *(Castor fiber)* is increasing- 2.5-3.0,000, and they are starting to do great damage to bottom land forests of the Ural River. It is recommended to except annually 15% of its population. The musk rat *(Ondatra zibethica)* on the contrary have become very small in number. It is unlilely that its numbers will increase in the future. Under the present circumstances, the most realistic way of increasing musk rat populations is by cage breeding and half wild breeding.

The Ornithofauna of Kazakhstan amounts to 500 bird species, out of which more than 140 are hunted. The most important group are the waterfowl (43 species), including geese *(Anser)*, ducks *(Anas)* and coot *(Fulica atra)*. The exact numbers are not known. In the water reservoirs of the country 7-8 million nest, and 8-10 million or more migrate through the territories of the Republic. The annual catch is maintained at the level of 2.0-2. million.

Migratory animals (birds, mammals) in this category are of divided natural resources, and the right of their utilization belongs to several countries where they spend various stages of their life cycle. The issues of their storage scale should be implemented on the basis of corresponding inter-state agreements together with establishing quotas for their catch.

Out of 12 species of amphibias two of them, the lake frog and green toad *(Rana ridibunda* and *Bufa viridus)* are collected for research by medical institutions of Kazakhstan and other countries. Though 250,000 are collected annually, the lakefrog suffers no overall reduction, but its distribution is gradually expanding. The green toad *(Bufa viridus)* is the most numerous and exclusively useful species. Annually 8,000 species are caught. Out of the reptiles, theCentral Asian turtle (*Agrionemys horsfieldi*) is a hunted species. In the past years up to 180,000 species per annum were collected, but since 1984 40-50,000 species are annually caught.

Restoration of species on the verge of disappearance is important and timely and include the white stork *(Ciconia ciconia)*, great bustard (*Otis tarda*), Menzbir marmot *(Marmota menzbieri*). A number of rare species may become in a short time valuable game birds and include: the Middle Asian gazelle *(Gazella subgutturosa)*, arkal *(Ovis ammon)*, mouflon *(Ovis vignei)*, onager *(Equus hemionus)*, pin-tailed sand grouse *(Pterocles)* and others as well as rare in its time saiga *(Saiga tatarica)*.

The Republic has a huge reserve of valuable invertebrates. First of all these are plant pollinators: honeybee family (bees, bumblebees) - *(Apoidea, Bombidae)*, butterflies *(Lepidoptera)*, bulb flies *(Syrphidae)* and other flies. The species composition of insects-entomophages participating in the regulation of harmful Invertebrates is rather large. These are dragon flies *(Odonafa)*, mantis *(Mantoptera)*, grasshoppers *(Teffigonoidea)*, predatary bugs *(Reduviidae, Nabidae)*, predatory thrips *(Aeolothripidae)*, carabids *(Carabidae)*, *Coccinellidae*, rove beetles (Staphilinidae) and other predatory beetles, ichneumon flies *(Ichneumonidae)*, wasps *(Vespidae)*, ants *(Formicidae)*, chrysops *(Chrysopidae)*, *Syrphidae*, wasp-flies *(Asilidae)*, *Bombyliidae*, *Tachinidae*, predatory mites *(Chyletidae),* and nematodes *(Nematoda)*. Groups of Invertebrates are very valuable, as they are a food source for fish and other economically important vertebrate animals. They include the larvae of ginger quill may flies *(Ephemeroptera)*, Plecoptera *(Plecoptera)*, *Corixidae*, caddis flies *(Trichoptera)*, *Chironomidae*, mollusks *(Mollusca)*, worms *(Plathelmintes, Nemathelminthes, Annelida),* and crustaceous *(Crustacea)*. Earthworms *(Lumbricus terrestris),* malanders

(Ceratopogonidae (Neleidae) and ants *(Formicidae)* play an important role in the soil formation processes. In Kazakhstan there are 25 species of *Margarodidae* giving a valuable dye karmin. At last in the Republic there are many insects living in natural conditions and being in great demand with collectors: dragon flies *(Odonafa)*, mantis *(Mantoptera)*, grasshoppers *(Teffiponoidea)*, red mace *(Ramulus spp.)*, beetles of many families, *Ascalaphidae*, and butterflies *(Lepidoptera)*. Out of 1,000 species of spiders *(Araneae)* and scorpions *(Scorpiones)* inhabiting Kazakhstan only 10 types of the most numerous and large ones are used at present for obtaining poison. Rare and endemic species met only in the Republic are of special value. The reserves of each specific species of valuable Invertebrate in Kazakhstan have not been established yet. This is for the zoologists of the Republic to compile a Cadastre of Invertebrata of Kazakhstan.

The invertebrata fauna in the water reservoirs of Kazakhstan amounts to several hundred specifies from various groups – from the simplest ones to the Malacostraca subclass crawfish *(Crustacea)*. They are valuable first of all as food sources for fish and waterfowl, and because of their role in bioproduction processes and autopurification of water reservoirs.

Fishing reserves of the river crawfish *(Astacus leptodactilus)* have been found in Topar and Karaganda water reservoirs; in the first of them there about 10 million pc. of , and in the second one – 22 million pc.of river crabs.

In water reservoirs without any fishing significance the main fished species are Branchiopoda subclass small crabs *(Anostraca sp.)*, *Artemia salina* and some types of water-flees *(Cladocera)*. According to reconnoitring research further water Invertebrates may become potential fished species (out of water flees – *Moina*, out of Copepoda *Diaptomus spp.*, out of Brancheoda sub-class *Branchinella spp.*, out of two wing ones *Chironomidae*.

Sensible utilization of wild animal reserves, one of the potential sources of revenues of the Republic requires an effective economic system on a strictly scientific basis. It is especially needed today when in many regions of Kazakhstan the ecological situation is hard. Strengthening degradation of eco-systems may lead to unforeseen consequences and non-recoverable losses of some populations and species of wild animals, and impoverishing the natural genetic fund.

The fish resources of water reservoirs are the property of the Republic and must be utilized in the framework of legislation. The status of the majority of useful fish is of no concern, and their resource potential is rather high.

The current ichthyofauna amounts to about 100 species of fish. They include 15 non-native species in the water reservoirs of Kazakhstan naturalized since its construction one years ago. 19 fish species have an important economic significance: beluga (*Huso huso*), Russian sturgeon (*Acipenser guldenstadti*), stellate sturgeon (*Acipenser stellatus*), small sturgeon (*Acipenser nudiventris*); herrings – sprat (*Clupeonella delicatula caspia*) and species combined conditionally into on group – pike (*Esox lucius*), roach (*Rutilus rutilus*), ide (*Leuciscus idus*), white amur-fish (*Ctenopharyngodon idella*), *Aspius aspius*, tench (*Tinca tinca*), carp-bream (*abramis brama orientalis*), goldfish (*Carassius carassius*), common carp (*Ciprinus carpio*), silver carp (*Hypophthalmichthys molittrix*), *Aristichthys nobilis*, sheat-fish (*Silurus glanis*), perch (*Perca fluviatilis*), Balkhash perch (*Perca schrenki*), sandre (*Stizostedion lucioperca*).

At present time the main fishing water reservoirs of the Republic are Balkhash Lake, the delta of the Ili River, the Alakol system of lakes, the Ural River and the Caspian Sea within the borders of Kazakhstan, the Bukhtarma, Shulbinsk, Kapshagay, and Shardary water reservoirs located in various natural-climatic regions of the country. The main purpose of reservoirs is for energy and irrigation and consequently suffer from large fluctuations of water levels leading to significant losses of fishing productivity and changes of the ichthyocoenosis structure.

According to official statistics, the total catch of fish in the Republic in 1997 was 38,680 t. including sturgeon 388 t.. An increase of fish production is being planned (Table 2.6)

Table 2.6

Production of Fish in the Major Fishing Water Reservoirs of Kazakhstan
Казахстана – the amount of catch in 1997 г.and the forecast for 1999 г.
(thousands of tons)

Water reservoir	1997	1999
The Ural-Caspian Basin Total Including sturgeon ones	 25.37 0.39	 47.5 0.4
The Balkhash-Ili Basin	3.98	11.3
The Kapshagay Water Reservoir	0.41	1.0
The Shardarya Water Reservoir	0.85	0.5
The Alakol System of lakes	1.0	1.7
The Bukhtarma Water Reservoir	7.04	11.4
Total	38.68	73,4

In some of the reservoirs a reduction of fishing is observed (Table 2.7)

Table 2.7

Volume of Fishing in Some Water Reservoirs of Kazakhstan (t.)

Water Reservoir	Years					
	1992	1993	1994	1995	1996	1997
Lake Balkhash	8098	8587	7785	6531	4803	3830
Shardarya Water Reservoir	2007	2021	1820	1598	532	850
Alakol System of lakes	1990	1136	1100	913	962	998

In general the established limits for the catch if fish are not fulfilled (Fig. 2.9)

The main reason for the observed reduction of fish catch is that under the present social economic conditions because of numerous fish resource users and imperfect control of the obtained product the official statistics data do not reflect the true scale of fish catch.

The Ural Caspian Basin because of the regulation of the river-bed of the Volga River and reduction of the spawning territories in the Volga basin of Russia it is the only spawning place for the sturgeon. For its preservation on the Kazakhstani territory in the Northern part of the Caspian Sea the Caspian reserve zone has been separated along the aquatory and the sea shore line to the

east of the Volga River where restrictions have been introduced for economic activities, construction of objects and using it as a scrap-heap of waste.

In the reservoirs of the basin, the composition of fish is extremely diverse and its density is high and include pike (*Esox lucius*), carp (*Cyprinuc carpio*), sheat-fish (*Siluris glaris*), genus (*Aspius aspius*), mirror carp (*Cuprinus carpio*), and sturgeon (*Acipenseridae*).

The fishing reserve of sturgeon is given in Table 3. Because of the sharp reduction of the sturgeon reserves in comparison with the 1970s, a sparing regime for their reserve utilization is being justified. A possible catch of sturgeon shall take 405 t. in 1999 (Fig. 2.10; 2.11).

Obtaining reliable data for making an assessment of the sturgeon reserves, would be possible to do while conducting complex international research expeditions of the Caspian countries.

Poaching in the period of sturgeon spawning is a serious menace for conservation of the biodiversity of the fish. Work on exploration and extraction of the oil and gas raw materials being implemented in spite of the status of the Caspian reserve zone is of great concern.

Table 2.8

Fishing Reserve of Sturgeon Fishes of the Ural-Caspian Region
Of the Republic of Kazakhstan in 1997 (t.)

Fish species				
Beluga	Caspian sturgeon	Sturgeon	Small sturgeon	Total
183	637	174	136	1130

By the special Resolution of the government of the Republic of Kazakhstan in April 1998, the function of the management of the issues of protection, reproduction, and rational utilization of the fish resources has been given to the Committee of Forestry, Fishing and hunting Economy and its local branches: regional and inter-regional Departments of Fish Reserve Protection and Fishing Regulation.

The catch of fish is regulated by the Rules of Fishing and Catch of Water Animals and annual limits for the catch of fish and seal are approved by the Government.

The conservation and reporduction of biodiversity in fish reserves in the Republic is being provided mainly by 13 existing state water companies. In 1998 two sturgeon fish factories were established in the Caspian region. These annually introduce fish to the natural reservoirs of more than 120 million pc. fish. The lack of financial resources does not allow these companies to keep fish larvae up to the most viable age of one and two years, and this reduces effectiveness of fish introductions.

The environmental catastrophe of the Aral Sea has led to the loss of fishing significance of this unique water reservoir at the end of the 1970s. In the same years, work was started on acclimatization of the river plaice (gloss) (*Platichthys flesus luscus*) from the Azov Sea. The successfully naturalized plaice gave during 1991-1993 a 235 tonne yield of the fish product, in 1996 – 165 tonnes, and in 1997 – 350 tonnes.

In 1999 year it is expected to obtain 940 tonnes of the plaice-gloss from the Aral Sea.

Water reservoirs of the Ili-Balkhash basin are the significant ones from the point of view of biodiversity and reproduction of the valuable species of fish and in terms of fishing. Their ichthyofauna contains carp (*Cyprinus carpio*), white amur-fish (*Ctenopharyngodon idella*), small sturgeon (*Acipenser nudiventris*), barbel (the Aral population) (*Barbus brachycephalus*), trout (*Salmonidae*), marinka (the Ili population) (*Schizothorax argentatus*) and others. The Balkhash perch (*Perca schrenki*) has been entred into the International Red Data Book.

Because of the construction of the Kapshagai water power station dam and regulation of the Ili riverbed, the spawning routes of some fish breeds passing through it have been infringed, and it has become one of the main reasons for their reduction in numbers in the reservoirs of this basin.

The pond economies of the Republic of Kazakhstan are in the crisis situation and require big investments for their development.

The scope of amateur and sport fishing is not known.

The strategy of conservation and utilization of the water resources requires the following measures:

1. Increasing capacities of small rivers (cleaning the river-beds, creation of protective lines along the rivers);
2. Prevention from water reservoir pollution (preventing discharge of unpurified sewage, observing the water protection lines regime);
3. Preventing reservoir pollution while conducting oil and gas exploration and extraction works;
4. Expansion of the water economy network providing and increase in reservoir productivity.
5. Improving protection of fish reserves from poaching.

2.3. Developing Legal Framework for Conservation and Sustainable Use of Biological Diversity

The rates and standards for exception of biological resources is the main instrument providing for conservation and balanced utilization of biological diversity. They should reflect peculiarities of local conditions and forms of bioresource utilization and their protection. This requires development of territorial- environmental standards for each type of resources within a natural climatic zone, sub-zone, and montane belts.

The principle of utilization calculation rates requires the following actions to be conducted:

- Establishing criteria for calculation of the rates of resource exception taking into account their status in different environmental geographical regions;
- Mandatory annual (and sometimes seasonal) correction of the exception rates on the basis of accounting for annual dynamics of the quantities and productivity of specific utilization objects;
- Prohibition or reduction of the resource exception rates in the environmentally crisis regions.

At present the Ministry of Ecology and Natural Resources, the Ministry of Agriculture, the Ministry of Science – the Academy of Sciences of the Republic of Kazakhstan are developing on the national level methodologies for calculation of the natural resource exception rates, including forest, plant-raw material, and feeding resources.

The action strategy is being considered by the ecological system major types utilization.

Forests

Including all the components of the forest ecological system biological diversity: wood, medical, food, feeding, technical, and zoological resources should become the basis for the development and improvement of the forest resource exception rates and standards.

Utilization of the forest resource potential is regulated by the Forestry Code of the Republic of Kazkahstan and a number of other standard legal acts. With this regard, forest utilization in the forests having the most important environmental significance is prohibited or considerably restricted.

In particular, in the forests of State natural reserves, State national parks and State parks, State forest nature monuments, and State reserve zones, in especially valuable forest massifs, in the forests having scientific significance, walnut forest zones, forest fruit plantations, sub-alpine forests, city forests and forest parks, forest park parts of green zones, in the forests of the first and second zones of the resort sanitary protection zones, State protective forest lines, anti-erosion, protective forest lines along the river banks, lake shores, water reservoirs and other water objects forest cutting for the main purpose, stocking-up of gallipot, auxiliary forest materials and wood juice must not be done. In the same forests with a few exceptions hay-mowing and professional storing-up of non-wood forest products is prohibited.

In the other forests of Group I and forests of Group II storing-up of wood is restricted by the scope ensuring continuous non-exhausting forest utilization. In these forests on the basis of natural studies (forest management) calculation cutting-areas determining the size of wood utilization by each wood type and for each forest should be established. It is being envisaged that these cutting-areas shall come into force only after their detailed consideration by experts and after their approval. Violation of the established utilization scope is punished according to the procedure established by the legislation.

The amount of wood storing-up while carrying out cutting for the purpose of taking care of forests and sanitary cuttings should be determined by the forest regulation on the bias of available plantings needing such type of forest care. The procedure for conducting such cutting is regulated by special standard acts not allowing unjustified cutting of wood plantations.

Cattle grazing and hay mowing in the forests are regulated by special Rules providing for restrictions of such types of forest utilization depending on the status of forest lands and for the purpose of biodiversity conservation. Other types of forest resource utilization are also regulated by various standard acts.

At the same time separate standard forest utilization regulations including forest cutting rules require clarification because of enhancing environmental requirements. During the last years because of the crisis of the economy, the volumes of forest resource storing-up have become considerably reduced (Table 2.9)

Table 2.9.

Use of Forest Resources

Types of Forest Use	**Unit of measurem.**	**Volumes of use in 1997**
Stocking up wood for the main use		
The size of a calculation felling-area	thou	2,170.6
Actually stocked up	s.m3	552,2
Stocking up wood from care and sanitary cuttings	-"-	
The calculation size of the liquidity mass		370.0
	thou	280.0
Actually stocked up	s.m3	46.5
Stocking up wild fruit and berries	-"-	7.6

Stocking up medical raw materials Grass cutting	t. t. t.	29,000

Hunting Economy

Hunting is a profitable branch of the Republics economy. Hunting lands make up about 240 million ha. The habitats of about 75% of the hunted animal are linked with forests, thus hunting economy management is overseenby the State body of forestry management.

About 82 million ha of hunting lands have been delineated for huntsmen who carry out the protection and all the necessary biotechnical arrangements for hunting species and conservation. The rest of the hunting land territory are the reserve hunting grounds that are occassionally protected. Poaching caused mostly by social reasons is a serious problem.

In the Republic, professional, amateur and sport hunting is carried out; the periods and procedures of it are regulated by special rules approved by the Government of Kazakhstan. For the main hunted species, a catch is set every year through Government Resolution (Table 2.10)

Table 2.10

Catch of the Animal Hunting Types on the Territory of Kazakhstan /species/

Animal species	Catch limit for 1998.	% exception from nature
Elk	131	5.5
Red deer	367	5.9
Roe deer	2021	7.5
Saiga	40000	6.7
Wild hog	1162	10.8
Siberian mountain goat	900	6.2
Musk deer	15	5.0
Bear	65	5.0
Marmot badger	89800	5.9
Musk rat	54170	25.8
Russian sable	500	20.0
Cock-of-the-wood	300	8.8
Pheasant	16500	14.4

Pastures

Pastures serve as the basis of cattle breeding development in the Republic. Their total area is 182.6 million ha, out of which 124.0 million ha. are irrigated, and 5.9 are improved. About 112 million ha. of pasture lands are situated in the desert zone where animal husbandry is the leading branch of agriculture. Pasture lands include more than 900 eco-system types.

The status of pasture feeding resources is not satisfactory. Excessive grazing, deterioration of irrigation systems, destruction of the old well networks, and centralization of management have resulted in non-controlled pasture utilization and their degradation.

Degradation of pastures is reflected in the violation of the optimum structure, composition, and sustainability of plant communities, deterioration of food value of fodder, massive appearance of weedy and poisonous species, decrease of the role of perennial plants, and reduction of their productivity.

There are no legal acts regulating rational pasture utilization on the regional and local levels. For calculation of the need in the pasture fodder under specific conditions it is necessary to take into account the following: daily rate of pasture feed for cattle, seasonal crops, possible load for utilization of each type of pastures, and other indices. The daily rate of pasture fed depends on the animal need in nutritious substances and actual nutritiousness of the fodder, and on the type of grazing animals, their age and the nature of the pasture vegetation.

The rate of feeding plants exception on pastures should not exceed 65-70% of their increment.

While calculating the load rate one should determine environmental restrictions for the pasture utilization in three directions:

- Territorial restriction of pasture plots within environmental regions;
- Determining admissible cattle grazing load by grazing seasons on specific pasture plots;
- Determining admissible rates of cattle placement by drinking places.

Territorial restriction of pasture plots should be carried out on the basis of analysis of natural climatic, demographical, economic, and other conditions of the environmental geographical region which allows to establish an optimum option of the territorial disposition of pastures.

Determining the upper limit of cattle load should be done on the basis of analysis of pasture types, their annual and seasonal crop dynamics.

Determining disposition of drinking places should be done on the basis of the specific rates of fixing these places for cattle stock.

In the process of environmental division by regions, development of an environmental passport is required for each division reflecting an actual level of anthropogenic load on ecosystems, borderlines of pasture plots, an optimum level of cattle stock load, and actual disposition of drinking places.

It is necessary to set pasture utilization limits for all economic entities. Under the market conditions when economic mechanisms are coming to the foreground, the only possible way for a user of nature is observation of the pasture utilization rules and the established limit. Supervision of the regional pasture utilization should be carried out by State bodies.

The system of payments for pasture resource utilization should become the basis of the economic mechanism in the following forms:

- Payment for protection, reproduction, and utilization of the pasture resources;
- Fines for utilization of resources above the established limit.

Money from payments for protection, reproduction, and utilization of pasture lands should be used for arrangements on protection and restoration of the degraded pasture territories.

Hay Harvests

Meadow vegetation, including highly productive flooded and lowland meadows (3.5 million ha.) form the basis of hay harvest lands in Kazakhstan (4 million ha.). General degradation of meadows has taken place because of regulation of the river outflow, non-rated hay mowing and

the general desertification process. Montane meadows – Dzhailau are exposed to considerable pasture load.

Exhaustion of biodiversity of meadows in the steppe zone is 70%. The number of meadow eco-systems has reduced from 293 to 40, and in the desert sub-zone by 60% from 193 to 35 co-systems.

To provide for the rational utilization of meadow lands, it is necessary to develop special standard acts on the flooding and hay mowing regime for various categories of meadows (flooded, estuary ones) in different zones on the mapping basis.

In the hay harvest land utilization regimes opportunities for storing-up medical and technical plants, organization of hunting and recreation should be taken into account.

While developing standards for using meadow lands one should take into consideration rare and disappearing species of plants and animals, and unique communities requiring protection.

This requires reducing the rates of hay mowing and introduction of strict standard hay mowing rotation for the creation of conditions for self-restoration of rare populations. Unfortunately in reserves and reserved forests an insignificant meadow species diversity on about 40,ooo ha. is protected.

The first strategic direction of the work on developing standards of resource exception for meadow vegetation of the hay mowing significance should be a full inventory and preparation of a cadasre of hay mowing lands on the basis of large-scale mapping, assessment of their status and dynamics trend while planning anthropogenic affects.

Vegetation Raw Material Resources

Development of the legal framework of the conservation and balanced utilization of vegetation raw materials for pharmaceutical, food and other industries is dependent on the rates of biological resource exception while utilization of other types: cattle grazing, hay mowing. That is why the rates of stocking up vegetation raw materials should be much lower than the possible exception rates. While showing up advantages of raw material utilization, for example before hay mowing, the standard acts must regulate isolation of raw materials stocking up areas excluding other types of utilization of eco-systems having other raw material types.

The rates of raw material exception at present have been developed for a number of valuable species of plants but without clarification of standards by administrative regions and environmental geographical regions.

The Ministry of Ecology and Natural Resources has developed a methodology for calculation of the exception rates for 67 species of raw material (mostly medical) plants for natural climatic sub-zones. Work on determining rates on the level of regions and districts is going ahead.

Peculiarities and Conditions of Development (Action Strategy):

- Full inventory of the diversity and exposure of the areas of raw material species on the basis of environmental division by regions;
- Assessment of useful raw material stock and their accessibility;
- Establishing time limits and periods for stocking up taking into account self-restoration of resources;
- Determining restrictions: vulnerability and danger of loss of rare and disappearing species, the degree of infringement of populations and Eco-systems, where there are available (factors of the exception rate decrease);
- Legislative arrangements for sovereign rights of the country for resource utilization prohibiting poaching and stocking up raw materials by the population from the neighbouring repub-

lics;

- While general assessment of the raw material stock, protection and pollution areas including areas along roads, drainage lakes and channels, industrial objects, electric transmission lines and other ones should be excluded.

The problems of conservation and balanced utilization of vegetation and woody raw materials that are holding back development of rates and control of the exception and reproduction of resources are related to insufficient centralized management, information data base and lack of earmarked monitoring.

Development of territorial environmental standards while environmental division by regions has been acknowledged as a priority action. Among the species diversity rates and standards of resources exception should be established first of all for valuable medical types having an industrial significance: *Glycyrhiza glabra, G. uralensis, Hypericum perforatum, Ephedra equisetina Equisetum arvense, Leonurus turkestanicus, Artemisia cina, Aconitum soongaricum, Valeriana turkestanica, Lulla grandis* and others.

The rate of optimum resource exception determining their non-exhaustive utilization in these regions serves as a basis of developing the standards (Fig 2.12).

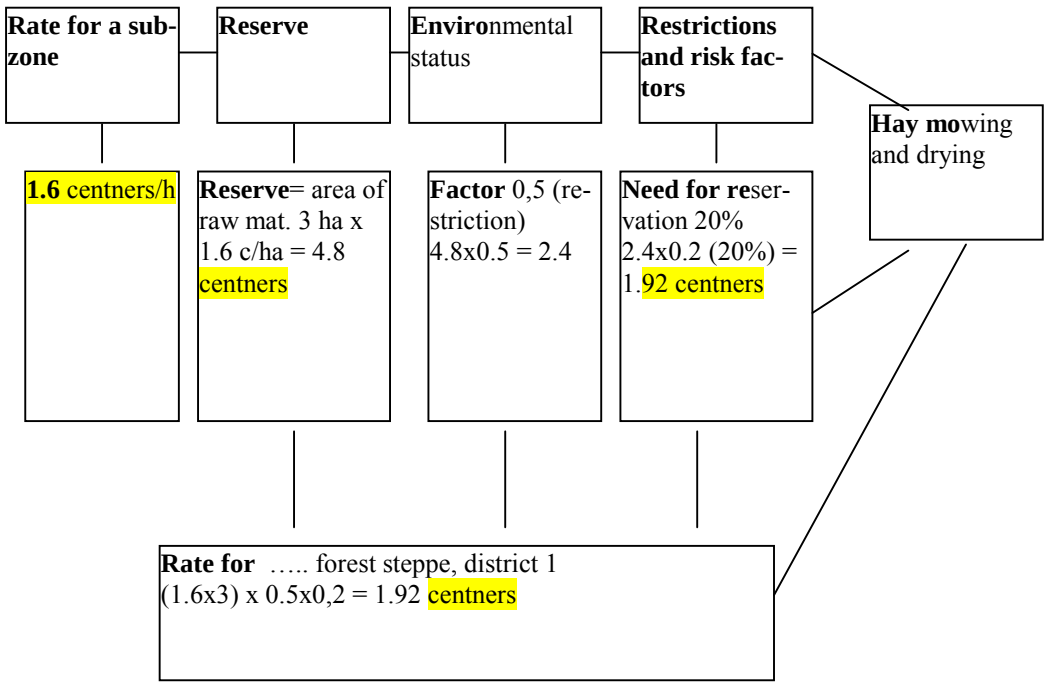

Fig. 2.12 Calculation of the Standard for Common Horsetail

Developing the standards on a mapping basis has been acknowledged as a priority action. Among the species diversity rates and standards should be established first of all for valuable medical technical types of an industrial significance.

Water and Coastal Eco-Systems

The existing fishery rules are oriented to the regulation of this business and are not developed with regard to other bioresources of water and coastal eco-systems. Reserves of mineral resources (extraction of salt, sapropel), water and coastal plants as possible fertilizers, construction materials, raw materials for pharmaceutical industry, water invertebrates, giving various food products (various Crustacea, mollusks) and lastly vertabrate animals – birds and animals.

It is not admissible to apply a one-sided approach to a reservoir from the point of view of Fishery (or Fishery rules). A Fishery reservoir does not have a single understanding and requires a primary legal interpretation. In this dispute interests of many organizations – energy, agricultural and other ones interested in the water reservoir resources clash.

The standards of using restored resources (the scope of exception, parameters of production, time limits and places for stocking up, authorized methods and facilities of catch etc.) refer to specific measures and must change depending on the yield of the year by the utilized species.

Economic interest of local government and the population in restoration of the bioresources is an important condition for their conservation.

Water and coastal eco-systems are notable for their sufficient distinctness of borders in some cases and transpborderline stretching in other cases (migration cycles of fish, birds and mammals), that excludes one local master. It is necessary to solve the legal issue of renting such lands.

In all cases of the exploitation of water eco-systems, there should be separate State fund – plots not subject to any stocking up activities for a certain period. This should be like a forest reserve, not identified by a separate species but by the whole eco-system that gives an opportunity of restoration of natural links throughout the whole water reservoir aquatory.

The whole approach to the protection of separate species while exploitation of the coastal and water bioresources should be revised. Protection of one species is always accompanied with damage to other species of biocoenosis and as a result of it can give an undesirable effect (protection of beaver in the basin of the Ural River).

Thus the goals of rational utilization of bioresources of water and coastal eco-system may be characterized in the following way:

- Preparation of a cadastre of water reservoirs of the Republic determining the significance of its biological resources;
- Provision for complex utilization of biological resources of water eco-systems (on the basis of the cadastre assessment);
- Conducting systematic research on the identification of bioresource reserves and exploitation standards;
- Isolation of reservation plots of the water-coastal eco-systems;
- Conservation of native, especially endemic species within an eco-system.

Rules: Exploitation of sturgeon and seals of the Caspian Sea must be regulated in the process of preparation of the Framework Convention on Conservation of the Caspian Environment.

Development of Environmental Tourism.

Environmental tourism has many functions. Firstly, visits are made to natural objects on the basis of a scientifically justified rate of recreation load, which prevents the degradation of eco-systems. Secondly, recreational activities which raise the spirits and strengthen health. Thirdly, environmental education of population and fourthly, the additional source of funds for enhancing on a material basis specially protected areas. In the fifth place, there is an opportunity for small

businesses to service tourists and finally the provision of additional working places and stable salaries and wages for part of local population.

Currently, in most cases nature tourism is massive and not organized. These include trips to the country, picnics, fishing, spending the night in the lap of nature etc. That results in excessive recreation load in the place of recreation, cluttering up, degradation of eco-systems, and fires. Naturally, such initiatives do not generate any revenue for local budgets or the Republican Budget, and no funds are received for nature protection arrangements.

In many countries environmental tourism is a massive enterprise generating large profits. For example, up to 100 million people visit Switzerland annually, the USA with its developed network of national parks receive up to 300 million tourists every year, 90% of the National Revenue of Costa Rica comes from the profits of environmental tourism.

In Kazakhstan nature tourism is the least well developed. There are about twenty private tourist firms who organize helicopter tours, mountain and alpine climbing, water trips, ornithological expeditions, visits of the most attractive and picturesque places. Private entrepreneurs do the same acting as guides. Starting from the 90-s, State reserves and National parks started conducting environmental excursions and rendering paid services that gives them a small revenue. To organize and carry out environmental tourism, reserves and National Parks need a legal basis and additional funds.

The development of environmental tourism is detailed by the Long-Term Strategy of the Republic of Kazakhstan up to the Year 2030 "Environment and Natural Resources". The Program of the Ministry of Ecology and Natural Resources of the Republic of Kazakhstan envisages that for the years 1998-2000, the formation of the environmental tourism system, improvement of the recreation properties of the landscapes, and organization of the environmental tourism zones in the National Parks "Charyn Canyon ", "Dostyk", "Altyn-Emel", in the tourist-recreation zone "Katon - Karagaisky". In addition 80 sites for hunting and fishing are envisaged to be created. In Kazakhstan there are many regions with a unique nature, suitable for organizing environmental tourism. But lack of infrastructure and the decline of social economic development does not allow the involvment of these potential regions to the programs of environmental tourism development in the Republic. The Zhibek Zholy Tourist Firm is developing a State Project of creating a tourist route along the Great Silk Road, linking the Eastern Kazakhstan, Almaty, Zhambyl and Southern Kazakhstan regions. The work "Information Provision for Development of Environmental Tourism, has been fulfilled; it is making an assessment of the opportunities of environmental tourism in reserves and National Parks. The Program "Development of the Specially Protected Nature Territories Network and Creation of the National Cadastre of Unique Nature Objects for their Inclusion to the Cadastre of the World Cultural and Nature Heritage " is being implemented" (1998-2000). The "Map of Tourist-Recreation Resources of Semirechye " has been prepared. The Global Environmental Fund is developing the Project "Conservation of Biodiversity of the Western Tien-Shan " including the reservation "Aksu-Dzhabagaly ". The Project is envisaging the development of environmental tourism in the reserves and adjoining territories. Organization of the biosphere reserve of international significance on the basis of Kuldzhinsk reserve also envisages coordination of actions in line with the programs on conservation of biodiversity and development of environmental tourism.

Tourist activities are regulated by the Law of the Republic of Kazakhstan of 29 July 1992 "On Tourism ". Section 5 *(*Articles 17 and 18) of this Law are envisaging "protection of nature and cultural property of the Republic in developing tourist activities ". The Government of Kazakhstan has approved "the Procedure of Forestry Fund Utilization for Recreation purposes ". In the Recommendations and in the Action Plan, developed by the IY World Symposium on Na-

tional parks and Other Protected Territories (Venezuela, 1992) recommendations on development of tourism in protected territories have been given.

Weak development of environmental tourism explains the lack of specialists in this type of tourism. At present tourism specialist are trained by the Kazakh State National University named after Al-Farabi, the Almaty State University named after Abay, and the Turan University. Graduates of these Universities are successfully working in the tourist business.

Development of environmental tourism depends first of all on financial investments in the construction and improvement of hotels, development of an infrastructure, communications, technical facilities, advertising etc. Lack of government support and a State program for the development of environmental tourism. The shortage of money is a limiting factor in developing environmental tourism in Kazakhstan. Financial assistance is required for reservates and National Parks of Kazakhstan as scientific-methodological State nature protecting centres of the Republic.

2.4. Ecological districting in Kazakhstan as a base for biological diversity conservation

In the ecology and environmental land-use section of Kazakhstan's National Strategy, the balanced use of natural resources is given the highest priority. To implement this effectively, the districting of ecological areas has been proposed. It is viewed as one of the optimal measures for natural land management especially in terms of developing ecological and geographical regions at local, regional and national levels.

The first priority is to modify existing map schemes of biological diversity components on a general scale. This will involve mapping the floristic, zoological, geobotanical, forest and vegetal systems. This will facilitate the creation of a multi –level data set which will be incorporated in a geographical information system (GIS). This tool will be used for the management of biological resources and will have the potential to incorporate a wide range of data sets, utilising for example, government data on biological diversity.

Given the appropriate utilisation of the database, ecological districting will create a basis for linking project areas specified under the biological diversity convention. This may be used as a mechanism for understanding and managing issues such as desertification and global climate change, ensuring the rationality of solutions and enhancing protection of biological resources beneath the umbrella of sustainable development.

The most accepted ecological districting scheme in Kazakhstan is the strategy based on natural and climatic zones within areas such as mountain zones, or smaller sub-zones classified by localised factors. Using this as the map base for biological diversity, indicators such as status, state assessment, exhaustion reason, endanger to the resource conservation, etc. will be inserted on the second level. Cartographic assessments of biological diversity in addition to the administrative framework need to be implemented in stages as the scope expands and the data base increased in accordance with the Strategy of Kazakhstan - 2030.

In this respect, a methodological guidebook has been written (1996) with a map of ecological districts at a scale of 1: 2,000,000 (1996). However, this map contains only the generalised biological diversity data of zone biomes, which are the dominant ecological systems. A more complete inventory accounting for flora and fauna within the ecological system is required. There is a need to identify the status of the biological diversity by sub zones and zones, as well as understanding the stages through the ecological and geographical districts. Local monitoring of biological diversity should be run at a mandatory level by the administrative oblasts and districts, accounting for the forthcoming privatisation of land.

The introduction of GIS for ecological mapping and decision making has facilitated the design of the balanced management plans for conservation and economic development:

- the improvement of regional and local conservation schemes;
- modification of plans for industry, transport networks and other industrial and economic developments with a view to conserving biological diversity;
- identification of indicators for biological diversity;
- the provision of information for state decisions on the use of the biological resources;
- insurance of biological safety and risk assessment for territorial hearths;
- development and improvement of the legislative base for biological resources use;
- improvement and development of Specially protected natural territories (SPNT) ;
- economic evaluation of biological resources in specific ecological districts;
- the designation of penalties against persons and institutions who fail to preserve resources whilst utilising the land. This will require accounting for ecological damage potential whilst privatising land.

2.5. Organisation of the biological monitoring system

Monitoring usually implies a system of observation, analysis, assessment and projection of the natural state. The system of ecological monitoring must be sure to demonstrate the direction and rate of change to the environment. Decisions should be made with a view to preventing degradation of ecological systems and genetic erosion. The important features of a country's ecological monitoring system are the sub-units of biological monitoring. The system is designed for the observation, analysis, evaluation and forecasting of the dynamic state of the ecological system and in particular the resource parameters of their floristic and faunistic composition. To monitor the state of endangered plant, animal ecological system, a unique methodological approach is required.

The species and communities of ecological systems - their genes and genomes, have significant social, scientific and economic importance and are subsequently the object biological monitoring in Kazakhstan.

There are no special monitoring programs for monitoring the biological diversity of Kazakhstan. However, the areals of some plant and animal species and their quantitative indicators have been monitored over long periods. The monitoring of the saiga has taken place for over 40 years. As for other game hunting species such records have been carried out for a number of years in some territories. The number of records was investigated for a number of rare and vanishing animal species and inserted into the Red Data Book of Kazakhstan: *Gazella subguffurosa, Equus hemionus onager, Chlamydotis undulata, Pelecanus crispus, P. Onocrotalus, Anthropoides virgo, Ibidorhyncha struthersii*. In every decade, the principal forestry systems has been recorded. Every five years a state survey of the forest fund is carried out, annual forestry and forest pathology supervision of the current state of forests is also implemented. Regular monitoring is costly - mostly in terms of transportation.

It is important to note that monitoring studies have to be carried out over many years. These must use the same methodology over time to achieve accurate and standard results.

The regions with the highest degree of biological diversity and those under threat, become the biological monitoring priorities.

To establish a monitoring system in Kazakhstan it would be sensible to utilise the existing network of the environmental observations for Specially protected natural territories in addition to specially identified plots in degraded landscapes.

The criteria for assessing biological diversity suggest the need for an objective evaluation, which is indicative, factorial and integrated.

The observation system includes the field, regime, surface, aerial photography and satellite observations. At fixed monitoring stations it is intended for a direct regime of scheduled observations to be recorded seasonally, with recurring maps compiled once every 3 -5 years. After this, the processed data will be extrapolated for similar territories (given that the chosen monitoring stations are representative). The traditional methods of the respective disciplines will be applied.

Assessment of the dynamic state of rare animal and plant species

The inventory survey and location of rare plants is the first observation of their state. The grades of the International Union on the nature protection (IUNP) are to be used.

Flora species, which are characterised by a small species number within the population are classified in the rare species category. They are usually distinguished by the following rarity: a - common area, when the species are in small abundance within the limits of a whole area; b - regional, that is within the geographical limits they are restricted by natural and climatic regions; c - local, i.e. localised.

To identify the dynamic state of the population, the quantitative ratio of the age profile has an important significance. The monitoring of their number provides an opportunity to identify the state of the population.

The population may only be sustained under specific community numbers. When the numbers drop below this critical limit (sustainability threshold), the historically conditioned connection to other species components breaks down and the competitiveness and viability weaken.

The assessment of the dynamic state of animal species is carried out by the defining the following main parameters: frequency, numbers and density of population, gender and age structure of the population, level of fertility and death rate. To achieve this, the historical state is defined with the aid of literature sources, collection materials and other documents. Evidence of major trends of change for this species and its population should be taken over a sufficiently long period and measured at least in decades (it is desirable to have periods of not less than 50 years duration). Then a monitoring programme is carried out by conducting regular surveys of numbers in separate selected populations of the species (sub species) and also through the stationary observations of remaining parameters. This may include the gender and age structure of the population, its fertility and death rate. One of the best ways to get the data on these issues is to issue questionnaires among the hunters, nature protection services, students of the higher and secondary school and others. The cartography of separate model plots, held jointly with the botanists and soil experts, will give a key to understanding the spatial and biotopic localisation of rare species at the present time. The repeated cartography of model plots in 5 -10 years shall detail the dynamics of all elements of the community, including the plants and animals, over time.

The Specially protected natural territories play a special role in the evaluation of a dynamic state of rare animal species as standard plots in this landscape zone.

The peculiarities of assessing the dynamic state of animals differ to that of plants – as the mobility of objects studied must be considered with animals. This is especially true for birds, which move from time to time over hundreds and thousands of kilometres. To evaluate the dynamic state of such flying species one has to have information on the conditions of their habitat far beyond Kazakhstan' s territory - in the north (nesting area) and in the south - (wintering location).

This can be attained through international co-operation, aimed at the study and protection of rare species of flying birds.

Assessment of the dynamic state of ecological systems

Periodical cartography is the principal methodological approach to assess the dynamic state of ecological systems and their territorial sets. Ecological districting is impossible without cartography. The cartographic models are the most rational method for assessing the state and matrix of consequent ecological control and decision making for use at the level of ecological systems.

In studying ecological systems, their typification and sustainability, the study of the vegetation is a priority. The vegetation cover is one of the most important components of ecological systems and determines their borders, structure and functioning. The vegetation has to be viewed as the most significant indicator of processes taking place in the ecological systems.

The main principles for evaluating the dynamics of ecological systems comprise the identification of the type and degree of damage under various impacts, and their reversibility. The extent of damage to ecological systems are differentiated by their nature: biota degradation; soil degradation; change of the state of surface and sub surface waters - the hydro chemical regime of the locality; relief changes; general changes and change of the ecological system.

Typification of the dynamic state of ecological systems is carried out on the basis of present damage: i.e: a lack of damage; weak damage; moderate damage; strong damage (e.g. return from desertification); very strong damage.

The reversibility of ecological system degradation is evaluated by criteria monitoring the loss of self-recovery functions. The degree of damage is characterised by structural change such as the adaptability of the species to detrimental forces.

The series of dynamics (or the series of transformations), characterised by degradation stages are identified against thriving ecological systems.

2.6. Improvement of the government's biological diversity management

A system for government bodies and institutions to ensure the management, protection and rational use of natural resources is clearly differentiated by local variables (Fig. 2.13).

The Parliament of the republic establishes the legal base for conservation and balanced use of biological diversity. The central and local governments as a result of their status establish the order of protection and use, approving the rates of payment, and regulating the activities of land users in accordance with environmental legislation. They are also responsible for designating specially protected territories.

The Ministry of Ecology and Natural Resources and its local affiliations are the central executive institutions of Kazakhstan in terms of environmental protection. The tasks of coordination, state control over smaller agencies and offering ecological expertise to projects are the responsibility of this ministry. In accordance with the Decree of Kazakhstan's Government No 918, August 19, 1984: "On approval by the Republic of Kazakhstan the Convention on Biological Diversity has arranged to fulfil the incurred commitments". This central institution is in charge of co-ordinating and supervising the republics' approach to the commitments stipulated by the biological diversity convention.

The responsibilities for the protection, reproduction and use of biological resources are those of the Ministry of Agriculture in Kazakhstan. The following subordinated agencies are directly addressing these issues: The Forestry, Fishing and Hunting Committee and local subsidiaries, (responsible for conservation, multiplication, and insurance of rational and non-exhaustive use of flora and fauna); the veterinary committee and other subdivisions (concerned with the sanitary and epidemiological issues, domestic animal breeds and conservation of biological diversity in cultural food and fodder plants); the committee for land resource management (concerned with landscape diversity); and the committee for water resources (responsible hydrological wetland

systems).

There are a number of other ministries and agencies involved in the conservation and utilisation of biological diversity as a national resource. The principal organisation involved with this is the Academy of Science in Kazakhstan, which researches via a network of affiliated scientific institutions, all aspects of biological diversity development.

The state controls legislation concerning the protection, reproduction and use of flora and fauna and the management of specially protected areas. All these issues are run throughout the management hierarchy of the national and local institutions.

The management of natural resources and the protection of environmental assets have not been sufficiently finalised and are still undergoing restructuring. Crossover between the function of different institutions has not yet been overcome. There is no adjusted system for ecological monitoring and no centre for the analysis and processing of data on the current state of biological resources. Such a research centre could provide up to date information for the decision-making institutions on management issues. The current available funds for environmental protection are insufficient and are being use inefficiently. The non-government organisations and private sector have little effect on the conservation and use of biological diversity. To solve these issues the republic needs to alter the legal framework surrounding this matter.

The improvement of Kazakhstan's existing management frameworks for the protection, reproduction and use of flora, fauna and specially protected areas is greatly needed. In view of Kazakhstan's law for "environmental protection", there is a need to strengthen the link between the Ministry of Ecology and Ministry of Natural Resources in terms of managing state ecological control. A highly efficient system of state, institutional, production and public supervision needs to be established under its guidance. The responsibility for the co-ordination of environmental protection and land-use management is carried out jointly by the ministry and central government bodies.

2.7. Improvement of the legislative framework for the implementation of state policy for biological diversity

Improvement of the nature conservation legislation determines the effectiveness of the biodiversity management system. During the years of independence of the Republic of Kazakhstan the following legislative acts regulating environmental issues relating to a certain extent to the problem of conservation and rational utilization of biological diversity:

- The Forestry Code of the Republic of Kazakhstan (23 January 1993);
- The Water Economy Code of the Republic of Kazakhstan (31 March 1993);
- The Law of the Republic of Kazakhstan "On Conservation, Reproduction and Utilization of the Animal World" (21 October 1993);
- The Decree of the Republic of Kazakhstan, having the force of Law, "On Oil" (28 June 1995);
- The Decree of the President of the Republic of Kazakhstan, having the force of Law, "On Land" (22 December 1995);
- The Decree of the President of the Republic of Kazakhstan, having the force of Law, "On Mineral Wealth and Mineral Wealth Utilization" (27 January 1996);
- The Law of the Republic of Kazakhstan "On Ecological Expertise" (18 March 1997);
- The Law of the Republic of Kazakhstan "On Protection of Environment" (15 July 1997);
- The Law of the Republic of Kazakhstan "On Specially Protected Natural Territories" (15 July 1997).

The Law "On Protection of Environment", determines the legal, economical and social basis of environment conservation in the interests of the present and future generations and is directed to the prevention of harmful impacts of economic activities on biological diversity.

The Laws "On Conservation, Reproduction, and Utilization of the Animal World ", "On Specially protected natural territories ", and "The Forestry Code of the Republic of Kazakhstan " are directly related to the objectives of conservation and balanced utilization of biological diversity.

One should note that all the Laws of the Republic of Kazakhstan regulating legal relations in the sphere of economic or any other activity linked with utilization of natural resources correspond to the Law "On Protection of Environment ".

During the period of State Independence a considerable number of legal acts directed to conservation and balanced utilization of biological diversity of the country were adopted.

The Republic of Kazakhstan also fulfils its obligations on international agreements which include the following:

- Convention on Biological Diversity approved by the Government of the Republic of Kazakhstan in 1994;
- Convention on Conservation of Cultural and Nature Heritage signed in 1994;
- Agreement on Conservation and Utilization of Migrating Types of Birds and Mammals and Places of their Habitation concluded in 1994 between the Government of the Azerbaidzhan Republic, the Republic of Armenia, The Republic of Belarus, The Republic of Georgia, The Republic of Kazakhstan, The Republic of Kyrgystan, The Republic of Moldova, The Russian Federation, The Republic of Tadzhikistan, and the Republic of Uzbekistan;
- The Framework Convention on Climate Change ratified in 1995;
- Convention Combat to Desertification and Drought ratified in 1997;
- The Vienna Convention on Conservation of the Ozone Layer ratified in 1997;
- The Montreal Protocol on Substances Destroying the Ozone Layer ratified in 1997.

The current Nature Conservation Legislation matches in general the Regulations of the Convention on Biological Diversity, but it does not envisage some standards required for fulfilling international obligations by the Republic of Kazakhstan ensuing from this Convention. The measures on prevention of introduction of alien types and responsibility for the unauthorized introduction or creation of conditions for accidental introduction of harmful live organisms are not sufficiently developed in the Legislation. Legal standard acts in the sphere of safe transfer and utilization of live changed organisms obtained through using biotechnologies are not available, rights and obligations of local populations on conservation and balanced utilization of biological diversity have not been envisaged.

After the adoption of the Constitution of the Republic of Kazakhstan the former legal framework created by the former Soviet Union bodies lost its force, and urgent measures are required for the adoption of corresponding laws and legal acts:

- On the Conservation of the Atmospheric Air, ozone layer, and Climate (in place of the current Law of the Kazakh SSR "On Conservation of the Atmospheric Air" of 12 June 1981);
- On Conservation, Reproduction, and Utilization of Natural Plant Resources;
- On Production and Consumption of Waste;
- On Environmental Education;
- On Safe Handling of Chemical Substances and Biological Preparations in Agriculture and Forestry.
- On the Regulation of Transborderline Transfer of Live Organisms;
- On the Supervision of Work in the Sphere of Biotechnologies and their Transfer;

- On the Rights of Local Population Traditionally Using Biological Resources.

Some revision is required of some current legal acts not matching the Legislation of the Republic of Kazakhstan and not creating the legal framework required in the new political and social economic conditions.

The departmental and inter-departmental legal acts are also not up to the mark. Many departmental acts have not been passed through the State Registration according to the established procedure, and their non-fulfillment does not result therefore in legal consequences, and they cannot serve as a basis for regulating corresponding legal relations. Some part of standard acts do not match new social economic and political conditions. With regard to this the central executive bodies of the Republic of Kazakhstan should develop, approve, and register corresponding standard acts in the sphere of environment conservation according to the established procedure.

Revision is required for the following: standards of the atmospheric air, water, and soil quality; the system of payments for environment pollution.

Achievement of these strategic goals should be implemented in line with the action plan on improving the legislative framework of conservation and balanced utilization of biological diversity.

2.8. Improvement of the Economic System of Stimulating Conservation and Sustainable Use of Biological Diversity

The existing system of State management in the sphere of environment conservation is determined by the Law "On Protection of Environment" and a number of legislative and standard acts that use a purely administrative approach. Limiting nature utilization, fines and sanctions are not always effective and do not stimulate fulfillment of the strategy goals of biological diversity conservation. That is why it is necessary to use economic mechanisms of stimulation, additional fund raising for the purpose of conservation of biological diversity and sustainable use of biological resources.

The main condition of stimulation is including priorities of biological diversity conservation as an element of sustainable development into the strategy of economic policy until the year 2030. The essence of economic stimuli is influencing production activities, creation of conditions ensuring rational nature utilization and conservation of biological diversity as one of its elements. The basis for creation of this mechanism is laid in the draft Law of the Republic of Kazakhstan "On Payments for Special utilization of Natural Biological Resources", where Articles 28, 30, and 31 of the Law of the Republic of Kazakhstan "On Protection of Environment" are clarified. Payment for utilization of biological resources, their protection and reproduction, depending on their significance (Republican or local one) is being envisaged to be introduced.

An article on the system of privileges on payments for special utilization of natural biological resources on the basis of balancing negative and positive stimuli giving an incentive of rational utilization of biological resources to nature users has been included into the draft Law. Such payments refer to the category earmarked for a specific purpose ones received by the budgets of different levels. Central executive bodies in the sector of environment protection and tax inspectorates shall be responsible for organizing their collection and control over it.

Adoption of the Law "On Payments for Special Utilization of Natural Biological Resources" shall require the development of a number of standard documents and legal acts:

- An Instruction on the Procedure of Settlements and Payment Receipts;
- Methodological Recommendations on identifying the amount of payment for:

a) animal world resources,

b) vegetable world resources,
c) forestry resources,
d) recreation resources.

Economic mechanisms of nature utilization contain a number elements.

Accounting for the social and economic assessment of biological diversity and resource potential in the form of cadastres include the following key components: State registration of nature users, quantitative accounting for biological resources; volumes of internal consumption and export potential; biological resource valuation. The cadastres should have territorial indices. The existing system of branch resource cadastres does not ensure effective nature utilization management. That is why it is required to create a complex territorial cadastre of natural resources (CTCNR), maintenance of which shall include collection, accounting for, processing, analysis, and output of information for providing the government bodies with reliable information on natural resource potential of the regions.

According to the Law of the Republic of Kazakhstan "On Protection of Environment " the conservation of biological diversity and other nature protective arrangements are financed from the following sources:

- The Republic Budget and local budgets,
- Environment protection Funds resources,
- Environmental insurance resources,
- Nature users own resources,
- Voluntary contributions and donations of legal entities and individuals,
- Other sources of financing not prohibited by the Legislation of the Republic of Kazakhstan.

Licensing of nature utilization is carried out by the issue of authorization documents (extraction, catch, exception, utilization without exception) for biological resources, for emissions, drainage, discharge of polluting substances and waste according to scientifically justified standards.

Licensing is one of the most important ways of controlling economic activities preventing the danger for biological variety, and a way of payment for nature utilization.

In the license for nature utilization the following data is included: on nature user; detailed purpose of work; borderlines of the territory and periods of utilization; a list of utilized natural resources and rates of their utilization and exception; a list and limits for emissions and placed waste; payment rates; environmental requirements and consequences in case on non-observance of these requirements.

Limits and standards of nature utilization are an environmental measure of resource exception, and at present for the majority of biological diversity objects in the Republic have not been established, especially at the local level. As mechanisms of economic stimulation these measures shall be effective only in the system of payments for standard (balanced) utilization of restored resources and fines for utilization above limit or damage done to endangered species.

Payment for natural resources must be taken for the following: for the right of utilization of land, mineral wealth, biological (forestry, animal, and vegetable), and recreation resources; for reproduction and protection of natural resources (compensation of expenses on carrying out reproduction and protection of separate types of natural resources); payment for the damage done to environment as a result of non-observance of rates and rules of nature utilization.

State and extra-budgetary environmental funds are formed first of all at the expense of payments for utilization of natural resources and serve for the mobilization of financial resources for nature protection arrangements. These funds are used for financing and giving loans for pro-

grams and scientific technical projects directed to the improvement of environmental quality, ensuring environmental safety, economic stimuli for rational nature utilization, introduction of environmentally pure technologies and environmental education.

An environmental Fund is autonomous, not dependent on the State Budget and serves for the accumulation of resources for financing nature protection activities.

While transition to market relations under the conditions of an economic crisis, unbalanced financial-credit system, when new relationships between enterprises and regional governments are just starting, compensation for the damage done by emergency (sudden, involuntary) pollution of environment is becoming practically not possible because both enterprises and local government bodies lack money.

Lack of directives for the compensation of damage for extreme circumstances pollution of environment and damage done to the health of population, creates an illusion of lack of punishment and intentions to invest money only in support and development of production without taking into account its possible impact on environment. Under such conditions environmental insurance is becoming the only way of compensation for the damage as one of the types of entrepreneurial activities in the environmental sphere.

Environmental insurance is insurance of civil-legal responsibility of an enterprise as a source of environmental danger for the damage done to the health and property of individuals and legal entities (third parties), and also for doing damage to environment as a result of extreme circumstances (emergency) pollution of it.

The need for introduction of environmental insurance in the Republic of Kazakhstan is stipulated by Article 32 of the Law "On Protection of Environment", whish states that it can be implemented in the form of mandatory or voluntary insurance.

Voluntary environmental insurance is based on the free will of individuals and legal entities, and is carried out under the conditions and within the rights given by the legislation of the Republic of Kazakhstan.

The enterprises whose economic activities are environmentally dangerous should be subject to mandatory environmental insurance. Application of the mandatory form with regard to manufacturers operating in the market relations system violates in some degree their rights for free economic activities. However the society must be sure that the damage done to people and to the environment (which by Law must be compensated for) shall be compensated by the guilty party.

Mandatory environmental insurance should help in solving a number of problems.

Firstly, it shall reduce expenses of insured enterprises in meeting the claims of third parties because of the damage done by this enterprise as a result of polluting the environment because of extreme circumstances. Payment of compensations by an enterprise itself may result in serious material difficulties.

Secondly, mandatory environmental insurance may give guarantees to the damaged party that they will get the amount due to be paid to them by Law regardless of the financial status of the guilty party.

Thirdly, insurance organizations that have insured an enterprise shall fulfil the functions of additional control of taking measures by an enterprise on ensuring environmental safety, and this shall decrease the risk of any kind of accidents and catastrophes.

In the fourth place, insurance transactions shall serve as one of the sources of financing arrangements on ensuring accident-free operation of the insured enterprises. Such financing may be implemented through deductions by insurance organizations of part of insurance bonus for preventive arrangements and at the expense of profits from transactions on environmental insurance, and also through using created reserve funds for giving loans for arrangements on reducing vol-

umes of accident pollution and its consequences.

On the basis of the considerations stated above the following mechanism of the mandatory environmental insurance is proposed:

Akimats of regions and the city of Almaty, after receiving the list of enterprises subject to mandatory environmental insurance from local executive bodies shall approve it;

Enterprises identified in the List shall conclude insurance agreements with insurance organizations having a corresponding license (local executive bodies from the sector of environment protections shall take an active part in this work;

Insured enterprises shall make insurance payments in the time stipulated by the agreement;

In case of the case envisaged by the insurance agreement (an accident resulting in environment pollution and/or damage to the health of population) the insurance organization according to the established procedure shall pay compensation for the damage done; in this case the insurance organization that has paid an insurance compensation acquires the right to claim the paid amount from the party responsible for the damage done to a person.

For the purpose of practical implementation of the proposed mechanism of the mandatory environmental insurance system, the creation of a standard legal framework is required for carrying out this work in the Republic of Kazakhstan. Adoption of the Government Regulation approving "Regulation on the Procedure of Establishing and Conditions of Implementing Mandatory Environmental Insurance in the Republic of Kazakhstan " must become an immediate document.

Conservation and sustainable use of biological diversity requires the implementat a system of complex arrangements and adopting a number of legal acts. These include all the following:

- Provision for an autonomous and independent budget of the environmental fund and exemption from taxes;
- Establishing tax privileges for subjects while introducing technologies and production with little waste or without waste, and utilization of secondary resources;
- Introduction of special taxation for environmentally harmful products and environmentally dangerous technologies, and privileged loans to subjects carrying out environment protection;
- Full or partial exclusion from taxation the amount of revenues from profits reinvested to nature protection needs;
- Exemption from taxation of the enterprise revenues received from utilization of industrial and household waste;
- Privileged taxation of enterprises manufacturing nature protection equipment, materials, reagents, facilities for controlling environment, and those ones implementing construction and reconstruction of mature protection objects;
- Exclusion from taxation of revenues contributed voluntarily by legal entities and individuals to environmental funds.

2. 9. Scientific, information provision and personnel training

The Republic of Kazakhstan has a large scientific potential. In a system of the Ministry of Science - Academy of Science of the Republic of Kazakhstan there are functioning the scientific subdivisions of the general ecological (biosphere) profile (Institute of geography, the Institute of cosmic research), that of biological trend (the Institutes of botany and phytointroduction; zoology and genetic fund of animals; microbiology and virology; soils; plant physiology, genetics and bioengineering; molecular biology, centre of the biotechnology and reproduction of animals); the

Institutes of agricultural trend - (farming; cereal farming; fruit and grape farming; potato and vegetable farming; agriculture and ecology). There is a network of the Institutes of applied nature of the forest farming and agriculture melioration; plant protection; fodder production and meadow pasture).

All these institutions and the higher education institutions as well (the Kazakh State National University, Karaganda University, Almaty State University, the Kazakh State Architecture and Construction Academy and other) are well staffed with scientific personnel and ensure the carrying out of the investigations on the problems of biological, agronomic diversity in accordance with the plans of the Ministry of Science - Academy of Science, the Ministry of Ecology and Natural Resources and international projects.

There are established the scientific societies: the Kazakh subdivision of the international Academy of the ecological reconstruction, the Kazakh botanical, the Kazakh geographical, Central Asian zoological societies. The implemented or regular conferences serve a good means of the timely informing of the scientific community on the ecological problems.

The Ministry of Ecology and Natural Resources of the Republic of Kazakhstan, the National Environmental Centre of sustainable development with the financial support of the international organisations have held the seminars and conferences on the actual problems of the conservation of the biological diversity, in which the specialists, the top managers of the enterprises and leaders of the public organisations have taken part.

The important for Kazakhstan was signing of the Convention on access to information, public participation in environmental decision-making and access to justice in environmental matters at the Aarhus conference of the environmental ministers on June 25, 1998.

The ecological problems are widely lightened in the mass - media - newspapers “Atameken”, “Ecology courier”, quarterly publication “Information Ecology Bulletin”. The most important regional events are reflected in the ecology sections of the oblast and rayon newspapers. The fundamental investigations of the scientists are published in the scientific publications of the Ministry of Science - Academy of Science, Kazakh State national University and other. Radio and TV are also involved.

The provision of the reliable and objective information for the public and all population access has to be carried out basing the Information ecology system (IES), which enables to:

- provide the various ecological data to all concerned members of society, willing to take part in the solution of the tasks on protection and improvement of the environment;
- provide in efficient and fast manner the scientific information and ecological data to the institutions, which play an important role in the process of ensurance of a sustainable development;
- to ensure a possibility of access to the large number of data, thematic researches and other sources of theoretical knowledge to make an objective evaluation of the ecological state in the various regions of the Republic of Kazakhstan;
- work out the cycles of the education broadcasting on the issues of the environment, conservation of the biological diversity and rational use of the natural resources;

- hold the competitions on the best publication in the mass- media in the area of ecology issues.

Compile the themes of TV - and radio broadcasting on the issues of the conservation of the biological diversity.

Under conditions of the transition of Kazakhstan to the model of sustainable growth the ecology education and training acquire a priority importance. They have started to include the elements of environmental knowledge in the programs of the pre school education institutions. The primary ecological education is provided in the schools, gymnasium, lyceums and colleges. The leading role in the training of specialists able to participate in implementation of the scientific, technical and educational programs on the ecology problems, and also in carrying out the managerial activities belongs to the higher education institutions. The ecological training is conducted in all education institutions, new faculties, chairs, courses and magistrates on ecology are being opened.

At the Kazakh State National University named after Al- Farabi, the Kazakh State Architecture and Construction Academy the training of young specialists - bachelors and Masters, specialising in bioecology, chemical ecology, nature protection, engineering protection of the environment and its monitoring is held for already several years.

The issues of training, retraining and qualification improvement for the specialists in the area of environmental protection are dealt with by the Institute of qualification improvement of the teachers under the Ministry of Education, Culture and Health of the Republic of Kazakhstan, state higher education institutions, and the public universities and academic institutions as well: the Institute of ecology and sustainable development (Almaty city), Independent University of ecology under National company “Ecology” (Kyzyl- Orda), International University named after Yassavi, Non- government public organisation “Ecologist” (Kentau city).

A certain role in the ecological and aesthetic education of population is performed by the three existing in the republic state zoological parks (Almaty, Karaganda, Shymkent) and botanical gardens (the chief one in Almaty, Altaiskyi, Karagandinskyi, Zhezkazganskyi, Iliiskyi, Mangyshlakskyi).

The non - government public organisations exert a large support in formation of the ecology consciousness and ensurance of the ecological information for the large groups of population. They hold the seminars and lectures, widely disseminate the knowledge in the area of the conservation of the biological diversity.

Within the framework of the Inter - state Ecology council (IEC) in recent years they regularly review the issue “On development and improvement of the ecological education in the IEC member - states”. The Ministry of Ecology and Natural Resources does not have so far an agency responsible for the co-ordination of the activities in the field of ecological education of all structures in Kazakhstan.

To train highly qualified specialists, possessing the profound knowledge on the environment protection issues, including the conservation and the balanced use of the biological diversity, the appropriate resource provision is needed.

- Creation of the efficient infrastructure of the ecological education, enlightenment and bringing up of all groups of population irrespectively the age or professional orientation in the field of conservation and the balanced use of the biological diversity.
- Establishment of the facility and co-ordination of the activities of all participants of the ecology education and training system (institutions of culture and education, agencies of the nature protection and education management, the bodies of the executive and legislative authorities, public organisations) in the area of ecological education and bringing up in a whole and including that in the area of the conservation and the balanced use of the biological diversity.
- Elaboration of the state educational standards for the multi- level training and retraining of the specialists in ecology.
- Information and methodological provision - creation of a single information and education common space, working out of the training and methodological manuals, modern programs and technical means of training, introduction of the distance education, improvement of system for retraining and qualification improvement for the specialists and pedagogists.
- Creation of a special program of the material and technical supply of the scientific and technical training and personnel training in the area of conservation and the balanced use of the biological diversity, financed from the Fund of nature protection.

2. 10 Role of the non-governmental organisations

For positive solving of any problem the efforts of the state agencies only are not enough, the efforts of public are needed. About 100 ecological non-government organisations are operating in Kazakhstan, which are focusing on problems of health and environment. Last time the republic's ecological situation has become worse and the effect of the unfavourable factors on human health forced the non-governmental organisations to participate actively in the problem decision. The main objective of these organisations are the following: nature and environment protection, ecological education and propaganda of the ecological knowledge, environmental legislation, the cultural heritage and animals' protection, ecological safety and health, conservation of the biological diversity, the scientific researches and monitoring, propaganda and information, the nuclear safety and radioactive pollution, etc. The public ecological associations expand at high pace under the democratic conditions, the number of ecologists-specialists of different profile is increasing. However, the majority of the non-government organisations, directly dealing with the ecological problems, weakly interacts with each other and are almost unknown to the wide public and population.

After Kazakhstan has signed the Convention on Biological Diversity in 1994, many non-governmental organisations have raised their interest in the problem and have started actively to develop these or other projects. Along with the government institutions some non-government organisations, such as "Naurzum" from the Naurzum reserve, "Nature of Kazakhstan", "Green salvation", "Centre of the ecological education support", "Fauna foundation" from Almaty, have participated in the preparation and development of plan of the Middle Asian Transboundary Project on the biological diversity conservation of the Western Tien - Shan.

The representatives of the ecological organisations, operating in the legislation field, such as "LEEP", "Green salvation", deal with studying and propaganda of the laws of the Republic of Kazakhstan on nature protection and international Conventions on environment in the mass media.

The majority of the non-governmental organisations are specialising in the ecological education, that is very important in the informing of the public about values of the biological diversity and participation in the biological diversity conservation. The non-government organisations also play an important role in the promotion and support of the local communities initiatives to advance further the activities on conservation of the biological diversity. The non-government organisations, which operate in different regions of the Republic, also play the significant role, such as "Young generation for the ecological safety and sustainable development" in Kostanai, "Kokzhiek" in Aralsk, "Horizont" in Kokshetau, "Kaspi tabigatya" in Atyrau, "Landscape" in the West Kazakhstan oblast, "Belovodie-1" in Leninogorsk.

"Centre of the ecological education support", "Green Salvation", "Kazakhstan–Central Asian Zoological Society", "Tabigat", "Envirs", "Tetis", "The National Ecological Society", "Ecologists of the XX century" actively work among the ecological non-government organisations, which have been registered in Almaty. The first three of the specified non-government organisations are the members of the World Conservation Union (IUCN), and "Eco Centre" from Karaganda is a collective member of the Commission on the species survival.

The Ecological Centre "Vita", Association of workers of the reserves and national parks "Koryak" in Almaty, "Argaly" in Karaganda and "Wild nature" in South Kazakhstan oblast are operating in support of the government and non-government organisations on the implementation of the Convention on Biological Diversity.

Some non-government organisations of Kazakhstan have been incorporated in a "Biostan", which is the NGO information network of the Central Asian countries, named the International Institute of biological diversity of the Central Asia.

Since June 1997 the Small Grants Programme of the Global Environment Facility (GEF) has been started, the priority of which is the support of activities of the ecological NGO, oriented for the biological diversity conservation. The main principles of this program are the involvement of local population into the biological diversity activities, strengthening of the partner relations between the local authorities and public organisations.

Five projects, which have been submitted by the non-governmental organisations, operating in the field of the biological diversity, have been financed during the period from September 1997 to November 1998.

The non-government organisations deliver a big aid to the Government in the formation of the ecological consciousness and information provision of different groups of population: they hold the training seminars and actions, participate in the collection and distribution of the ecological information, popularise the knowledge in the field of the biological diversity conservation.
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Despite the increase of the number of highly qualified ecologists of different profile and public ecological associations, their potential possibilities still don't find the proper use inside the country and are almost unknown to the international ecological movement, too.

The participation of the non-government organisations is very important for the implementation of the program on the conservation and the balanced use of the biological diversity.

It is necessary to attract the non-governmental organisations on the following:

- development of the legal and normative-methodological base of the conservation and balanced use of the biological diversity;
- development and execution of the program on protection and reproduction of the fauna and flora species, which are endangered by vanishing, and expansion of the Specially protected natural territories (SPNT);
- preparation of researches and introduction of the ecological safe economic methods in practice;
- implementation of the ecological propaganda and population education.

2. 11. Use of indigenous knowledge of the local population in conservation and sustainable use of the biological diversity.

Living in close interaction with nature, the Kazaks shared big attention to the nature laws and the wild nature spirits, personified them by magic signs, which forecasted the fate or explained the nature phenomena.

In autumn- winter period some part of population hunted. Wolf, fox, corsac fox, rabbit, polecat, saiga, goitred gazelle, out of the birds – heath-cocks, kekliks, pheasants, Caspian snow - partridge, geese, ducks, etc. have been the main hunting objects. Hunting birds, cheetahs, borzoi dogs - tazya, watchdogs - tobet, and also different devices , traps, guns have been used for hunting.

In summer period some times they hunted for Saiga, goitred gazelle. Light and durable suede trousers and sleeveless jackets - “kokrekshe”had been made from fell. The Kazakhs hunted for elk, mountain goat -teka, roe deer, wild ram, kulan, maral because of their meat, fell and antlers. The fat of rabbit, badger, marmot, bear had been used as the medicines. The public medicine of Kazakhs had been very developed with the use of the animal and plant products. More than 200 species of plants have been used for treating of different human and animals diseases.

All life of the Kazakhs were closely bound with the nature and animal world. Shamans-baksya have sewed amulets on their clothes, which have been made from talons of the golden eagle, eagle-owl and owl, claw of the bear, polecat and wolf. The young people (Dzhigits) wore the osseous of the racing anchylosis of wolf (asyk) on the neck to be protected from the evil eye and spirits. Bow down before the nature force, the Kazakhs have respected the host of the water element, named him “su-esi Suleiman”. The lake or river with many water fowls, have been considered as a good will on behalf of Suleiman, who gave a great energy for life on the Earth.

The Kazakhs tried not to shatter the birds peace, collection of eggs was very rare in cases of starving and in order to prepare the medicine powder from the eggshell of these birds. In the Kazakh bylina and fairy tales the swan, goose, duck, rudy sheldrake, owl, falcon and gold eagle have been a symbol of kindness and wisdom, and bald coot, cormorant, pelican have been the symbol of evil, voracity and greediness.

The spring flight of cranes flock over the aul caused a crush of people happiness, as the symbol of the winter end and beginning of the warm period of year. The old people thanked God

for that they have survived through the difficult times and saw the spring, the women took a scoop on their hands and knocked the yurta from left to right, saying: “sut mol, komir as” - “a lot of milk, a bite of coal”. After that they hanged the scoop at the right side of the house entrance.

The spirit of wild nature had a great meaning in the life of the Kazakhs, even they have preached the Islam of the sunnite sense, the Mohammedan rites have been mixed with the shaman superstition. These superstitions have formed the ecological way of thinking and the respect of the nature laws in the process of close contacts with the nature.

We are becoming aware about the public religion from the oral heritage of myth, fairy tales, proverbs on this or that case, or from the attitude to the animals, which are originate from the animistic attitude to the world. These religions and rites came out from the reasonability to support the equilibrium in nature.

Based on the Kazakhs religion, a snake is considered to be keeper of wisdom and mystery of the world, therefore if it crawled into the house, the Kazakhs have poured a milk on its head and took it away. There is a proverb for this case: “Zhlanga da ak Kyap sgygaradya”, that means “the snake has to be taken away with clean thoughts”. It was prohibited to shatter the resting animals peace, to go for the water at night, and if it was necessary to get the water, people threw a stone to the water three times and then having got a permission from the water host Suleiman, they took water in their bucket, the young girls and women were prohibited to go for water at night.

The Kazakhs had a special attitude to the wild animals and birds. It was prohibited to kill owls, eagle-owls, woodpeckers, blue crowns, cuckoo, martins, etc. Their nests were never destroyed. The training and experienced hunters have dealt with the hunting on the wild animals. For example, in the end of the XIX century the three- four experienced hunters have dealt with the hunting on Saiga and - in the Lower Chu (river), which were permitted to - these animals.

The places of nesting of the predatory - birds were strictly protected, in the open places they made the seat -places for them. The raptorial birds have been presented to the respected guests, sometimes they (birds) have been exchanged for captured relatives, but often they were sold at the fairs. In the places of their nesting the signs were made - tamga of the tribe, which owned these lands. The thieves of the -hunting birds were strictly punished, sometimes they were wrist of their right hand.

The Kazakhs never hunted for ataika (rudy sheldrake) - “sarya ala kaz “. According to a legend this duck once in 1000 years hatches out of its egg a pat of a borzoi dog - tazy. It was also prohibited to hunt for the animals habituating near the saint springs and in the holy places. The Kazakhs consider that the spirits of dead people live in these animals. The breakers of these rules had to be punished by sticks. When the Kazakhs slotted or killed the animal, they asked for forgiveness from them , saying: “senin zhazygyn zhok, menin asygym zhok, besmellya “ (there is no your guilt, but I have no meal (food), bismilla). The appealing to the animal for forgiveness was considered to bring its spirit into good mood. It was forbidden to kill for the entertainment purpose.

The Kazakhs tried to choose a dry and sunny place for the construction of the staying aul or settlement, in hygienic purpose they tried not to contaminate the nearest water sources. The eco-

nomic constructions and dwellings were built far from the water, that gave the wild animals an opportunity to go quietly to the drink water. While arranging the staying location every 30-35 days the yurta was moved to the new place, and the premise was smoked by archi and garmalya (adyraspan) burnt with sera. The modern science has proved that the incubation period of microbes from dust lasts 40-45 days, and now we know that overshaking of the casual stuff and clothes and its smoking was done with hygienic aims.

Housing was considered to be the holy place of the human habitant and therefore the guest entering the house had always welcomed the spirits of this house, hearth - pershte. The guest should be given good meal - that was supposed not only a display of hospitality, but also a way to fix lack, wealth at home. A soap, made from the ash of different herbs and haloxylon (ala byata saharya, sekseul saharya) and also the herbs powder (opa) have been used in hygienic purpose as the antibacterial means, paints (enlik), made from the lichens, growing on the stone surface, have been used in cosmetic aims.

Three types of economy traditionally existed in Kazakhstan: nomadic, half-nomadic and settled economy, that is hay mowing and farming of bread.

The nomadic cattle-breeding needed the definite knowledge and skills. The herd of sheep did not exceed 400-500 heads to ensure rationale use of the pastures and conservation of soil from erosion.

In the settled auls the spring preparing works of farmers, the plugging and seeding of the cereals have been carried out, the wheat, millet, barley and oats were mainly sowed. Part of the cattle have been taken away from the pastures, and the milk cattle was put to the open hedged place, the winter sheep fold have been cleaned from the manure, which was cut by the blades and exposed to air for drying, in winter time this was used for heating the dwellings.

For the successful economical activities the important significance had been paid to the studies of the nature phenomena, the migratory birds arrival and departure, their nesting, the observation of the stars in the sky. The necessary calculations have been made by the star location, these data have been checked with the phenologic(al) observations, which the special categories of people (esepshi) made, and basing the received data they have forecasted what kind of year would be for the economy

In the middle of May the Heads of the auls, families (clans) and tribes gathered on the annual spring kurultai, where they have distributed the pastures on the jailyau, based on the results of the received offspring, the issues of the movement rate, the order of roaming, choice of the places to be passed through and other important issues of tribe generation were solved.

Today we already realise that the old has been lost, the nature habitant area is damaged, but we have to save the traditions of careful attitude to the nature followed by our ancestors.

2. 12. Strengthening of the regional interaction and international co-operation on the problems of the biological diversity

Since Kazakhstan became independent, the Republic has repeatedly approved **its adherence to the ideas of the ecological safety and sustainable development**, having signed the con-

clusive documents of the UN Conference on environment and development (Rio-92), and has become the active participant of the process "The Environment for Europe ", has joint to the important international Conventions on the Climate Change, Combat to Desertification and on Biological Diversity. Kazakhstan has become a member of the UN Commission on the sustainable development and has signed the Issyk-Kul and Nukuss Declarations (1995), orientated toward the development of the regional plans of actions on the sustainable development of the Central Asian region. In the Nukuss Declaration the special accent was made on the problem of the biological diversity conservation. In February of 1997 the Almaty Declaration has been signed by the Heads of the five countries of the Central Asia, which announced the 1998 year as the Environment Year in the region of the Central Asia. The joint statement, which envisages the preparation of the Regional Central Asian Plan of Actions on Environment, has been adopted at the Regional Central Asian Conference of the Ministers on Environment, which has taken place in 22nd of April 1998.

The international co-operation of Kazakhstan has been developed, which is oriented on the biological diversity conservation under the Interstate Ecological Council of the CIS countries. The Agreement on protection and use of the migratory species of birds and Mammal and their inhabitants, Agreement on the Book of rare and endangered by vanishing species of animals and plants - the Interstate Red Data Book have been signed by our country in 1994. Kazakhstan makes the definite steps on co-operation with secretariats of some international conventions and agreements in the field of the ecological diversity conservation. Thus, two memorandums under the Bonn Convention have been signed - that on protection of the Siberian crane and thin -beak curlew. Under the Ramsar Convention the grounds on inclusion the water -marsh lands of the international significance of the lake Alakol to the "Ramsar List ", in the coastal part and three islands of which the Alakol reserve was created. The preparation of the project on the development of the special protected natural territories network, conservation in -situ of the mountainous agricultural biological diversity of Kazakhstan has been started.

The work on organising of the co-ordinating centre on the execution of the Convention provisions of the UN European Economical Commission in the Central Asia countries is implemented in Kazakhstan.

Kazakhstan participates in implementation of the "Pan-European strategy of the biological and landscape diversities", develops: the program on the expansion of the specially protected nature territories network (theme 1 "Establishment of the Pan-European Ecological network"); the Law on payments for the biological resources use (theme 2 "Consideration of the issues related to the biological and landscape diversities in different sectors"). Kazakhstan has: approved the development of the ecological education system as a priority (theme 3 "The increase of information level of the directive agencies and publicity and expansion of the support from their part"); adopted the Law on the specially protected nature territories (Theme 4 "The landscape conservation"); developed the legal base of the ecological safe operations on the exploration, mining (extraction) and transportation of the carbonhydrogen raw materials on the Kaspi shelf and has actively participated in efforts on keeping the water level of the Aral sea in the modern position (theme 5 "The coastal and sea ecological systems"); prepared the project of purification of the bottom sediments of the river Nurya from mercury compounds (theme 6 "The river and wetland systems related to them" and theme 7 "The internal wetland systems"); prepared the National plan of actions on struggle with the deserting (theme 8 "The pasture ecological systems"); established the increase of the wooded lands of the republic territories to 5.1% of its area as a priority

and has legally approved the nature protected status of the Kazakhstan forests (theme 9 "The forest ecological systems"); prepared the project "The conservation of the biological diversity of the Tien - Shan" in co-operation with the Kyrgyzstan and Uzbekistan, having created the Ili-Alatau National Park and started the creation of the Karatau reserve and the Shymkent National Park (theme 10 "The mountain ecological systems"); published the new edition of first volume of the Red Data Book, (Vertebrate animals) and prepared the second volume for publishing (Invertebrate animals); submitted the lists of animals and plants, put into the Red Data Book of the Republic of Kazakhstan to the Bern Convention Secretariat; having refused from the Caspian seal hunting; made the collection of the bulbar plants, which is the biggest in the Central Asia; implemented the successful reproduction ex-situ of the rare and vanishing species of animals of the Kazakhstan fauna (theme 11 "The measures on protection of the species, which are endangered by vanishing").

The package of the bilateral agreements in the environment field has been prepared, including the biological diversity, with the Governments of the USA (1995), Israel (1995), Russian Federation (1995), Turkish Republic (1996), Kyrgyz Republic (1997), Republic of Uzbekistan (1997), Azerbaijan Republic (1997), Mongolia (1998). The Memorandum on co-operation in the environment field with the Government of Georgia (1996) and three-party agreement on co-operation in the environment field and the rational nature use between the Governments of the Republic of Kazakhstan, Kyrgyzstan and Uzbekistan, dated 17th of March 1998 have been signed

Due to the attraction of the international investment and grants the ecological projects in the field of the biological diversity conservation have successfully been implemented. That is, first of all, the Frame Ecological Program for the sustainable development of the Republic of Kazakhstan (the Ministry of Ecology and Natural Resources - 414 thousand of US dollars, UNDP - 102. 5 thousand US dollars, Akimat of the Atyrau oblasts - 50 thousand US dollars, IEDSD- 7.5 thousand US dollars), the World Bank Program on the increase of the institutional capacities for the establishment of the management and planning in the environment field (399 thousand US dollars, the executors of the Ministry of Ecology and Natural Resources and National Environmental Centre for the Sustainable Development), the support of the development of the National Environment Action Plans in the Central Asian region (Harvard Institute for the International Development - 12 thousand US dollars), the support of the development of the National Action Plans on environment in the newly independent countries and Mongolia (TACIS - 40 thousand US dollars). The Aid Program for the Government of the Republic of Kazakhstan on implementation of the Convention on Biological Diversity is performed by the Ministry of Ecology and Natural Resources (investment - 47. 5 thousand US dollars) under the GEF grant use (132.7 thousand US dollars) and UNDP (14 thousand US dollars) and is orientated for the value of the biological diversity situation, preparation of the National Strategy and Action Plan on Conservation and Sustainable Use of Biological Diversity, on establishment of the intersectional co-ordinating agency, preparation and distribution of the National Report on Biological Diversity situation.

The Central Asian Transboundary project on the biological diversity conservation of the Tien - Shan, is considered to be substantial by its scale, which preparatory phase is to be completed by the Government of the Republic of Kazakhstan, Kyrgyzstan and Uzbekistan, given the use of the GEF's funds (345 thousand US dollars of USA) and The Know-How Fund of the British Government (240 thousand US dollars). The application of the three Central Asian countries for grant provision in the amount of 10-15 million US dollars for the financing of the five- year project has been approved by the Council of the GEF, which aim is to strengthen the countries

possibilities in conservation of the region biological diversity in the limits of existing and planned protected territories, involving the local population into this process. The development of the Regional Program of Small (scale) Grants in the amount of 500 thousand US dollars for the support of the non-governmental organisations and local units communities in the field of the biological diversity conservation is specified by the project.

The GEF Small Grants Programme (241.65 thousand US dollars) is implemented under the co-operation of the Ministry of Ecology and Natural Resources, National Environmental Centre of the sustainable development, Non-Governmental Organisations (NGO) and oriented on the strengthening of the local unit possibilities in the solution of problems on the conservation of the balanced use of the biological diversity.

1 million 475 thousand US dollars was invested by the World Bank within the framework of the technical assistance to the Republic of Kazakhstan for the strengthening of the legislative and institutional base of the natural protection sector. The project on the development of the National Action Plan to Combat Desertification (under the financial support of the UNEP - 40 thousand US dollars of USA) is closely related to the goals of the biological diversity conservation.

In 1994 the Project on the conservation of the biological diversity of the Caspian sea and its coast zone has been prepared and submitted to the GEF by the Ministry of Ecology and Natural Resources of the Republic of Kazakhstan in co-operation with the concerned organisations and scientific publicity of the Caspian countries. The project review is restrained by the solution of the political issues between the Caspian countries.

The reports on the modern state of the biological diversity in countries and the package of the investment proposals, which are orientated to its protection and balanced use, have been prepared by the Russian office of the World Fund of Wild Nature with the participation of three experts form the Central Asian countries.

The project, which is orientated for the strengthening of the Central Asian countries capacities in planning of the process of the biological diversity conservation and activization of their participation in implementation of the European Strategy of the biological and landscape diversity, has been started by the World Conservation Union (IUCN) and Regional European Office of the IUNP. Under the support of IUNP European Program the formation of the subregional program of this organisation for the countries of the Central Asian region is under way.

The financing of the activities on the text preparation of the regional Convention on co-operation in the nature protection in the Caspian sea region has been implemented by the Regional European Office of the UNEP;

On the development of the National Action Plans to combat desertification in the Republic of Kazakhstan.

Since 1997 the implementation of the project of the TACIS program on raising the level of public awareness about the environment position in Kazakhstan has been started.

The international funds (Soros-Kazakhstan, HIVOS and Friedrich Ebert Stiftung) and non-government organisations, such as ISAR, Counterpart Consortium and Milieukontact OOST-Europa, make a big contribution in the development of the public initiatives in the environment

field and biological diversity conservation. The Union of the Nature Protecting (NABU), which is the German Non-Governmental Organisation, has started to implement the projects on creation of the biosphere reserves (reservates) in Kazakhstan.

The relations of the Republic of Kazakhstan with different international and regional government and non-government organisations and also financial institutes in the environment field are developed on a bilateral base, such as:

The World Bank and its regional representation office in Kazakhstan

The European Bank of Reconstruction and Development

The Asian Bank of Development

The Global Environmental Facility

The UN Environment Programme and its European and Asian offices

Commission on Sustainable Development under the UN

UNESCO

FAO

The European Ecological Commission under the UNO

The Economical and Social Commission for countries of the Asian-Pacific region under the UNO

Organisation of the economical co-operation and development

Commission of the European Community

The European Council

The European Agency on Environment

NATO

The World Conservation Union

The World Fund of Wild Nature

The World Centre of Monitoring and Nature Protection

The European Centre of Nature Protection

Fauna and Flora International

The regional meeting of the representatives of the Central Asia countries, which was initiated by IUCN and held in Kazakhstan in September 1994, has made a big contribution in the formation of the methods, used in the world practices, for the review of the problems on the bio-

logical diversity conservation. Recommendations, developed during this meeting, have been taken as the base of the planning process of the biological diversity conservation in both our and other countries of a region.

With the international financial organisations support the development of the programs and projects, orientated to the biological diversity conservation, is continued. Two donor conferences have been held, the Consulting Ecological Council (CEC) has been established. The organisations, willing to participate directly in the development of recommendations on planning, financing and implementation the measures on the improvement of the environment position, may be their members.

Under the project of the Republic of Kazakhstan "The Program of Introduction of the Strategic Plan for 1998-2000 years" - "Ecology and Natural Resources" and the National Action Plan on Environment the whole blocks of projects, closely related to the biological diversity conservation, are envisaged and executed: the establishment of the network of the special protected wetlands on the territory of he Republic of Kazakhstan; the project, which is oriented to the development of the possibilities of the Kazakhstan's non-government organisations on the global ecological issues; the regional international program on the Caspian Sea.

The joining of our country to the Conventions is specified in the National Action Plan on the biological diversity conservation:

On International Trade in Endangered Species of Wild Fauna and Flora, CITES

On Wetlands, which have the international significance, mainly, as the habitat of the water fowls, Ramsar Convention

Convention on the Conservation of Migratory Species of Wild Animals, Bonn Convention

On Protection and Use of the Transboundary Water Flows and International Lakes.

Beside this, the possibilities of the Kazakhstan membership in the International Agreement on protection of the migratory African – European – Asian water fowls is reviewed, the mechanisms of the co-operation on the Convention on the wild animals protection and their inhabitancy in Europe have been developed.

3. EXISTING PREREQUSITES FOR CONSERVATION AND BALANCED USE OF BIOLOGICAL DIVERSITY

For the purpose of implementation of the National Strategy and Action Plan of conservation and balanced use of biological diversity in Kazakhstan a good political, legal, and institutional framework has lately been established.

After independence Kazakhstan has many times confirmed its **adherence to the ideas of environmental security and sustainable development, having signed the summary documents of the UN Conference on environment and development** (Rio-92), become an active participant of the process "Environment for Europe", and joined very important international conventions, including the one on biodiversity conservation. The Convention on Biological Div

ersity has been approved through the Government Regulation (No.918 of 18 August 1994). The Ministry of Ecology and Natural Resources has been made responsible for coordination and control of the fulfillment by Kazakhstan of the commitments stipulated by the Convention.

Kazakhstan has become a member of the UN Commission for sustainable development and signed the Issik-Kul and Nukus Declarations (1995) oriented to development of regional actions plans for the Central Asian region sustainable development. In February 1997 the heads of five Central Asian countries signed the Almaty Declaration that has declared the year 1998 to be the Year of environmental protection in the Central Asian region under the auspices of UN. At the Central Asian regional Conference of Environmental Ministers in Almaty on 22 April 1998 a Joint Declaration has been adopted envisaging preparation of the Regional Central Asian environmental action plan one of the components of which is joint actions of the countries on biodiversity conservation.

As it has been mentioned, the state legal mechanism status in the sphere of conservation and balanced use of biodiversity complies with the Convention requirements and establishes necessary conditions for implementation of the projects on the territory of Kazakhstan represented in the plan. The main regulations of the country's environmental policy have found their expression in the existing legal system of environmental protection. Taking into account that the nature regulation issues are an important element of implementation of the environmental projects of Kazakhstan, and the fact that the nature use relations are a basis of the country's economy, a range of laws and codes regulating these activities has been adopted in the Republic.

Implementation of the environmental policy has been made the responsibility of the existing government bodies system that is subdivided into the representative (the Parliament and Maslikhats), the executive (the Government of the Republic of Kazakhstan, Ministries and Akimats), and the judicial power.

Non-governmental public ecological organizations, the number of which in the Republic is presently about 300, out of which 100 are actively operating, take an active part in the environmental management. Their activities are being regulated by the Law "On Public Associations" 1996, and by the Law ""On Protection of Environment" 1997, where a special Section has been separated giving wide authority to public ecological organizations.

Active work has been carried out on **improving financial mechanisms of nature protection activities**. The Government of the Republic has expanded the activity sphere of the nature protection funds that have been given a status of an independent body with the right of supervision of the ecological payments collection and spending. Establishing the nature protection Funds on an updated legal basis shall give opportunities for further improvement of the current nature

use economic mechanism and allow for considerable increase of investments directed to biodiversity conservation.

The Ministry of Ecology and Natural Resources being the main executive body in the environmental protection sphere **is implementing coordination of interactions of the participants of the Republic of Kazakhstan commitments fulfillment under the Convention on Biological Diversity.** Results have lately been achieved in the consolidation of efforts of ministries and departments aimed at development of the biodiversity conservation integrated policy the results of which are the National Strategy and Action Plan on Conservation and Sustainable Use of Biological Diversity.

For the purpose of coordination of activities of ministries, departments, local government bodies, and public organizations the NEAP was established under the MENR that has later been transformed into the National Ecological Centre for Sustainable Development. Agreements have been signed with the World Bank, UNDP, and TACIS on support of the process under the National Environmental Action Plan.

In the process of work staff has been trained that is capable to manage, maintain, and direct analytical, political, and consultative processes in accordance with the international requirements.

Kazakhstan possesses huge scientific capacities and has large research developments on conservation and use of biological diversity. The higher education system carrying out training of specialists-ecologists in various directions is also well developed. The Republic is provided with highly qualified specialists in this sphere capable to solve many environmental problems.

Thus, the political, legal, and institutional framework available in Kazakhstan allows for starting the implementation of the National Strategy and Action Plan on Conservation and Sustainable Use of Biological Diversity. But for the effective implementation of the actions being planned, practical steps for their further development and integration into the overall development strategy are required. First of all, these are: improvement of the environmental management system, streamlining inter-departmental interaction, development of the tax system complying with the market economy conditions and so on. For fulfillment of the projects stipulated in the plan the Republic urgently needs foreign investments and assistance from international organizations.

CONCLUSION

The Republic of Kazakhstan, as one of the parties of the Convention on Biological Diversity takes energetic measures for implementing its main regulations. The Republican Academy of Science has developed a research Programme into theoretical and application targeted biodiversity. In 1997 a working group and Secretariat for the development of the National Strategy and Action Plan on conservation and sustainable use of biological diversity were established under the auspices of the Ministry of Ecology and Natural Resources of the Republic of Kazakhstan.

During the last two years intensive work on the preparation of this document has been carried out, which has involved a large group of specialists from different sectors of natural and social sciences (biologists, soil scientists, geographers, lawyers and others), the Government (the Ministry of Ecology and Natural Resources, the Ministry of Science – Academy of Sciences, the Ministry of Agriculture, the Forestry, Fishing and Hunting Committee of the RK and others), research institutions (the Institutes of Botany and Phyto-introduction, Zoology and Animal Genetic Fund of the MS-AS, the National Academic Center for Agricultural Research and its Institutes, the Kazakh State National University named after Al-Farabi and other higher educational institutions), non-governmental public organizations of the Republic (the Kazakh Branch of the International Academy of Ecological Reconstruction, the Kazakh-Central Asian Zoological Society, the Institute of Ecology and Sustainable Development, and the Koryk Association of Reservation and National Park Officers and others) took place. The team have produced two documents: The National Report on Conservation and Sustainable Use of Biological Diversity of the Republic of Kazakhstan issued in June 1998, and this Strategy and Action Plan.

The Strategy includes a conceptual approach to the development of the National Strategy and Action Plan on conservation and sustainable use of biological diversity and three main Sections. In the first one, analysis of biological diversity of the Republic has been given with a view of the natural and socio-economic conditions, general trends of changes and existing dangers for biological diversity have been shown, and priorities of its conservation have been established.

Analysis of the biological diversity has been given in relation to the flora and fauna, by the zonation of natural ecosystems, and in terms of resources (pastures, hay harvests, forests, zoological resources, agricultural resources and others). Special attention has been paid to rare and endangered species (sub-species) of plants and animals, and to the strict protection of agro-, phyto- and zoo-coenosis. Considerable attention has been paid to woody species, being the source of formation and conservation of biological diversity in forest ecosystems. Infringement of many economically valuable ecosystems in the past and the current decline of biological diversity have been identified. This decline is linked with the weakening of environmental controls because of the considerable reduction of finance available for research and monitoring. Complete inventories are lacking, mapping and accounting of diversity and productivity of forests, pastures, flora and fauna resources, and agro-ecosystems has been reduced, and the bioresources management system is not operating.

The second Section includes the main goals and objectives of the Strategy and identifies the activity directions for conservation and balanced use of biological diversity of the Republic of Kazakhstan. They are based on the most important requirements of the Convention on Biological Diversity in a natural habitat (in-situ), including rational use of bioresources and enhancing the role of Protected Areas. The issues of *improving the state management structure, developing a legal framework in the sphere of biological diversity, and establishing a biological monitoring system* given the division into ecological regions of Kazakhstan are highlighted in the Section as some of the instruments for observance of the requirements of the Convention on Biological Di-

versity. The following steps have been acknowledged to be the most important: development of a legal framework for the conservation and balanced use of biological resources, improvement of economic measures by providing incentives to nature users regarding this issue, and increasing public awareness. A special role belongs to non-governmental public organizations and to local populations that have preserved traditional mechanisms of the sustainable use of nature.

A considerable role in the Strategy is given to the protected areas. Firstly to reserves and national parks that should conserve the most typical and unique natural landscapes and the biological diversity represented in them. Because of insufficient reserves and national parks in Kazakhstan, which amount to only 0.5% of the land area, the Action Plan envisages the establishment of new protected areas in the regions representing the endangered species and their habitats in the near future.

In addition to in-situ conservation, the Strategy identifies the most important works on the conservation of specific plant and animal species through their reproduction under artificial conditions carried out by specialized institutions, botanical gardens, zoological parks and nurseries.

The conservation of the agro-biodiversity, selection achievements, old time local plant varieties and animal breeds, and wild relatives of cultivated crops are acknowledged to be of importance. These sources may provide valuable material for selection of new varieties and breeds in the future for the formation of the agricultural crops, thus the establishment of germplasm banks have been acknowledged as important.

The third final Section of this document is the National Action Plan on Conservation and Sustainable Use of Biological Diversity. Given the complexities of the current stage of Kazakhstan's development, the plan covers the period only until the year 2005. The measures for conservation and balanced use of biological diversity have been developed on the basis of the criteria established in the process of work on this document.

The section "biodiversity conservation" has been acknowledged to be the most important one, and includes the following priority projects: development of a scheme of a network of scientifically based protected areas; conservation of forest ecosystems and balanced use of their components; establishment of a network of protected wetlands of international significance in line with the Ramsar Convention; publishing the remaining Volumes and Parts of the Red Data Book of Kazakhstan (Invertebrata, Plants, Ecosystems); compilation of the Book of the genetic fund of the flora and fauna of Kazakhstan (an annotated list of species); formation of the germplasm bank of endemic and disappearing plant species of Kazakhstan and the bank of the agricultural crops germplasm. The blocks "completion of the biodiversity inventory" and "control of the biodiversity conservation and use" without which implementation of the arrangements under the Action Plan is not possible are directly linked with the previous one.

The most important section of the Action Plan "sustainable use of biodiversity" together with improvement of the pastures rational use and establishment of sown pastures also includes renewal of biological diversity on degraded lands.

For the successful fulfillment of the actions stipulated in these major sections, implementation of the arrangements stipulated in the two auxiliary sections "an institutional framework" and "enhancing international links" is required. The first one includes the issues of a legal framework, economic assessment of bioresources, incentives for biodiversity conservation, and increasing public awareness regarding biodiversity conservation; the second one includes the issues of regional interaction and international cooperation in these spheres. For the successful implementation of the National Action Plan for conservation and sustainable use of biological diversity, its close interaction with the other National Programmes and International Conventions and Agreements is being envisaged.

Glossary

AGRICULTURAL ECOSYSTEM – the non-sustainable ecosystem with an artificially created mono-dominant community or community with depleted species, giving agricultural products.
AGROBIODIVERSITY – includes varieties, hybrids, lines, and crosses of birds and agricultural animals.
ALIEN SPECIES – the species that for some reason have penetrated within a certain territory or ecosystems for which they are not characteristic naturally and historically.
AMELIORATION – a complex of technical and agro-technical facilities for formation and treatment of surfaces of low productivity or infringed lands aimed at amelioration of their unfavorable physical-chemical properties.
AREA – the surface (biochore) of land or sea within which (sphere of distribution) this or that species or gender of plants and animals is widely distributed.
BIOLOGICAL DIVERSITY – the variability of living organisms from all sources, including inter alia terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part; this includes diversity within one species, between species and ecosystems.
BIOLOGICAL RECULTIVATION – the final stage of land recultivation carried out after technical (and mining) recultivation using phyto-amelioration arrangements.
BIOLOGICAL RESOURCES – the genetic resources, organisms or their parts, populations or any other biotic components of ecosystems, being actually or potentially useful or valuable for a human being.
BIOME – the totality of ecosystems (biocoenosis), consisting of plant and animal communities and their habitat within natural climatic zones (sub-zones) and belts.
BIOTA ORGANIZATION LEVELS – according to study approaches the living substance is conditionally subdivided into several organization levels: the molecular, sub-cell, cell, organ-tissue, organism (species), population-species, biocoenotic (coenotic + ecosystem), and biosphere ones.
BIOTECHNOLOGY – any type of technology related to the use of biological systems, living organisms or their derivatives for manufacturing of change of products or processes for the purpose of their specific use.
BIOTOPE – the homogeneous plot corresponding to separate parts of biocoenosis or ecosystem, being a place of habitat of this or that species of animals and plants.
DEGRADATION OF ECOSYSTEMS – the gradual deterioration of the soil properties, drop in the animal and plant component numbers, simplification of the structure, and as a result of it abatement of functional displays and a self-regulating capability.
DESERTIFICATION – the degradation of lands including the soil, vegetation, and fauna, in arid and dry sub-humus regions as a result of action of various factors, including changes of climate and human activities.
DOMESTIC OR CULTIVATED SPECIES – the species which evolution process is affected by a human being for the purpose of satisfying human needs.
ECOLOGICAL HAZARD – the probability of unfavorable environmental consequences resulting from any impacts on biological diversity.
ECOLOGICAL TOURISM – a specially organized trip having earmarked complex nature educational and recreation significance.
ECOSYSTEM – a dynamic complex of plant, animal, and microorganism communities, and their physical environment, inter-acting as one functional wholeness.
ENDEMIC SPECIES – plant and animal species confined in their distribution to most frequently one relatively small geographic region.

ENVIRONMENTAL CHARACTERISTICS – the complex information on ecosystem environmental conditions (also populations and species) reflecting the effects of natural and anthropogenic factors on biological diversity.
ENVIRONMENTAL DAMAGE – damage done to ecosystems, populations, and species as a result of non-fulfillment of nature protection standards or under the influence of destructive natural forces.
ENVIRONMENTAL DIVISION INTO REGIONS – a system of territorial division and mapping by means of distinguishing environmental geographic regions, districts, sub-zones, zones, mountain belts, and provinces – area formations with relatively similar natural and social economic characteristics, taking into account the environmental status of the distinguished districts (the degree of ecosystem infringement).
ENVIRONMENTAL MONITORING – the measurement, assessment of status and forecasting ecosystem changes as a result of natural and anthropogenic impacts.
ENVIRONMENTAL MONITORING – tracking the environmental status and warning of critical situations, harmful or dangerous for human and other organisms health.
ENVIRONMENTAL SAFETY – a status of international relations ensuring conservation, rational use, renewal and increase of environmental quality in the interests of sustainable and safe development.
ENVIRONMENTAL STANDARDAZATION – a limit of stress anthropogenic load, not reducing the natural density, structure and productivity of this ecosystem.
ENVIRONMENTAL STATUS – a complex of ecosystem elements, their composition and interrelationship, causing certain functional displays, including degradations.
EX-SITU CONSERVATION – conservation of biological diversity components away from their original habitat.
FOREST PROTECTION CATEGORY – the part of forests separated because of their special protection, water protection, sanitary-hygienic, recreation, scientific or any other specific significance. For each category a special regime of forest utilization is established.
FOREST TYPE – a forest plot or an aggregate of forest plots that are characterized by common forest vegetation conditions, a similar composition of wood breeds and lower storey plants, a like fauna, and require one and the same forestry arrangements.
GENETIC FOREST RESERVATION – the forest plots with valuable in genetic selection terms part of species or sub-species population.
GENETIC MATERIAL – any material of vegetable, animal, microbial or any other origin, containing functional heredity units.
GENETIC RESOURCES – genetic material having actual or potential value.
HABITAT-ECOTOPE – a type of country or place of natural dwelling of this or that organism or population, abiotic conditions of an ecosystem.
HERMO-PLASMA – the collection of living organisms, stored up seeds, vegetation organs, transplants, capable for reproduction of progeny.
IN-SITU CONDITIONS – conditions under which genetic resources exist within ecosystems and habitats, and with regard to domestic or cultivated species – in the environment where they have acquired their distinctive signs.
IN-SITU CONSERVATION – conservation of ecosystems and habitats, and maintaining and renewal of viable species populations in their natural environment, and with regard to domestic or cultivated species – in the environment where they have acquired their distinctive signs.

LEGISLATION – the system of Laws and Presidential Decrees having the force of Law, or Presidential legal standard acts, departmental legal acts, and international liabilities of the Republic of Kazakhstan.
MINING RECULTIVATION – a stage of recultivation of lands infringed while extraction and processing of mineral deposits for their further earmarked utilization.
PESTICIDE – the chemical substances used for pest, plant disease, and weed control.
PHYTO-AMELIORATION – a complex of measures on amelioration and creation of cultivated lands fertility with the help of cultivating herbaceous, shrub, and wood ameliorating crops.
POPULATION – the totality of organisms belonging to the same species, inhabiting a territory with geographically homogeneous conditions during a great number of generations (a geographic population), or within homogeneous environmental conditions (an ecological population) or a group of species in communities (a coenotic population).
PROTECTED REGION – a geographically designated territory that is separated, regulated and used with the view of achieving specific nature protection purposes.
PROTECTION REGIME – the established aggregate of rules, arrangements, and standards ensuring rational utilization, conservation and renewal of natural resources.
RAW MATERIAL RESOURCES – the stock of raw materials subject to processing for manufacturing a ready-made product or a product.
RECREATION – refreshment of body and mind after work is done.
RECULTIVATION – a complex of works aimed at renewal of productivity and economic value of infringed lands, and amelioration of environmental conditions.
REGIONAL ORGANIZATION FOR ECONOMIC INTEGRATION – the organization established by sovereign countries of this region, to which its member countries have given the authority regarding the issues regulated by this Convention, and which is duly authorized to sign, ratify, adopt, and approve the Convention or join it in line with its internal procedures.
RELICT SPECIES – the plant and animal species remaining from the disappeared flora and fauna species with wide distribution in the past.
RESOURCE EXCEPTION STANDARD – a calculation value applied for determining resource exception standards.
RESOURCES – the stock, sources, and components of environment used in the production process for satisfying material needs of a society.
SPNT – a specially protected natural territories.
STATE FOREST ACCOUNTING – the system of government arrangements on accounting for forests availability, quality and changes.
SUSTAINABLE USE – use of biological diversity components, preserving its capability to satisfy the needs of the present and future generations and comply with their aspirations.
TECHNOGENIC (TECHNOGENESIS) – the process of natural complex changes as result of a human production activity impact.
TRANS-BOUNDARY AREA – an area of distribution of this or that plant and animal species and gender, moving from one administrative or bio-geographic region to another one.
WOODED NATURE – a degree of some territory cover with forests, defined as a ration of lands covered with forests to the total area in percentage.
ZONE-BELT ECOSYSTEMS – the totality of ecosystems within zones, sub-zones, altitude belts corresponding to the natural climatic division by region and uniting functionally integral elementary ecosystems of various ecotopes.

ABBREVIATIONS

BD	Biological Diversity
BDCF	Biological Diversity Conservation Fund
BDCU	Biological Diversity Conservation and Use
CAR	Central Asian Region
CEC	Consultative Environmental Council
CIS	Commonwealth of Independent States
CITES	Convention on International Trade of Endangered Species
CTCNR	Complex Territorial Cadastre of Natural Resources
EOPP	European Organization for Plant Protection
FAO	Food and Agriculture Organization of the United Nations
FFHC	Forestry, Fishing and Hunting Committee
FS	Feasibility Study
GEF	Global Environmental Facility
GIS	Geographical Information System
HEI	Higher Educational Institution
HPS	Hydro Power Stations
HTF	Hydro-thermal Factor
IBPI	Institute of Botany and Phyto-Introduction
IEC	International Environmental Council
IESD	Institute of Ecology and Sustainable Development
IUCN	The World Conservation Union
IZAGF	Institute of Zoology and Animal Genetic Fund
KCAZS	Kazakhstan-Central Asian Zoological Society
KOT	Key Ornithological Territories
KRIFAA	Kazakh Research Institute of Forestry of Agricultural Amelioration
KRIFP	Kazakh Research Institute of Fodder and Pastures
KSNU	Kazakh State National University
MA	Ministry of Agriculture
MECH	Ministry of Education, Culture, and Health
MENR	Ministry of Ecology and Natural Resources[1]
MEIT	Ministry of Energy, Industry and Trade
MINC	Ministry of Information and National Consensus
MF	Ministry of Finance
MFA	Ministry of Foreign Affairs
MJ	Ministry of Justice
MM	Mass Media
MS-AS	Ministry of Science – Academy of Sciences
NATO	Northern Atlantic Treaty Organization
NEAP/SD	National Action Plan for Sustainable Development
NEC	National Ecological Center

[1] According to the Decree of the President of the Republic of Kazakhstan N.A.Nazarbayev "On Structure of the Government of the Republic of Kazakhstan" of January 22, 1999, the Ministry of Ecology and Natural Resources was renamed as the Ministry of Natural Resources and Protection of Environment

NGO	Non-Governmental Organization
PAK	People's Academy Kazakhstan
RC BDCU	Regional Center for Biologic Diversity Conservation and Utilization
RI	Research Institute
RK	Republic of Kazakhstan
SGP	Small Grant Programme
SNM	State Nature Monument
SNNP	State National Natural Park
SPNT	Specially Protected Natural Territories
TACIS	Technical Assistance for the CIS
TCG	Temporary Creative Group
UNDP	United Nations Development Programme
UNESCO	United Nations Education, Science, and Culture Organization
UNO	United Nations Organization
WB	World Bank