Forest Rehabilitation in Kazakhstan

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1. General Information on the Country

1.1 Location, Population and Natural Resources

Kazakhstan is a country with a rich historical and cultural past. Situated in the centre of Eurasia, Kazakhstan found itself at the cross road of the earliest civilizations of the world with social and economic, cultural and ideological connections between East and West, South and North, between Europe and Asia. The geographical centre of the European and Asian subcontinents is located exactly in Kazakhstan, in the epicentre of Semipalatinsk, the former Soviet nuclear test site.

Kazakhstan is roughly the same size as all of Western Europe. Its territory extends over 2.73 million km^2 (or 1.48 million square miles). By its area Kazakhstan is in the ninth place in the world, i.e. it is among the world's top ten countries with large territories. The seven largest countries of Europe such as France, Spain, Sweden, Germany, Finland, Italy and Great Britain or Asian countries such as Pakistan, Turkey, Iraq, Japan and Vietnam rolled into one could be located on the lands of Kazakhstan.

Kazakhstan borders Russia in the east, north and northwest (the length of the border is 6,477 km), Central Asian countries – Uzbekistan (2,300 km), Kyrgyzstan (980 km) and Turkmenistan (380 km) in the south and China (1,460 km) in the southeast. The total length

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of the borders of Kazakhstan is almost 12,200 km including 600 km along the Caspian Sea (in the west).

Kazakhstan extends from north to south over approximately 2,000 km and runs west to east for 3,000 km. Almost unbroken plain lands occupy the largest part of the territory. Lowlands are located mainly in western, northern and south-western regions, while highlands are located in the central regions and mountains in the southeast. In the west, the Caspian Sea is enclosed by the Caspian Plain, in the north there is the Turanian Plain and in the north and northeast there is the West-Siberian Plain. These plains enshrine – like the shape of a horseshoe - the central part of Kazakhstan which is dominated by hills and low-hill terrains, jointly called Kazakh Upland or Kazakh Folded Country. The high-mountain ranges of Altai, Dzungarian Ala Tau and Tien Shan are standing out in the east and southeast. Zaisan, Balkhash-Alakol, Ili and Chu-Talas valleys lie between or adjacent to them. Sandy deserts Saryishikotau and Muyunkum spread in Balkhash-Alakol and Chu-Talas basins.

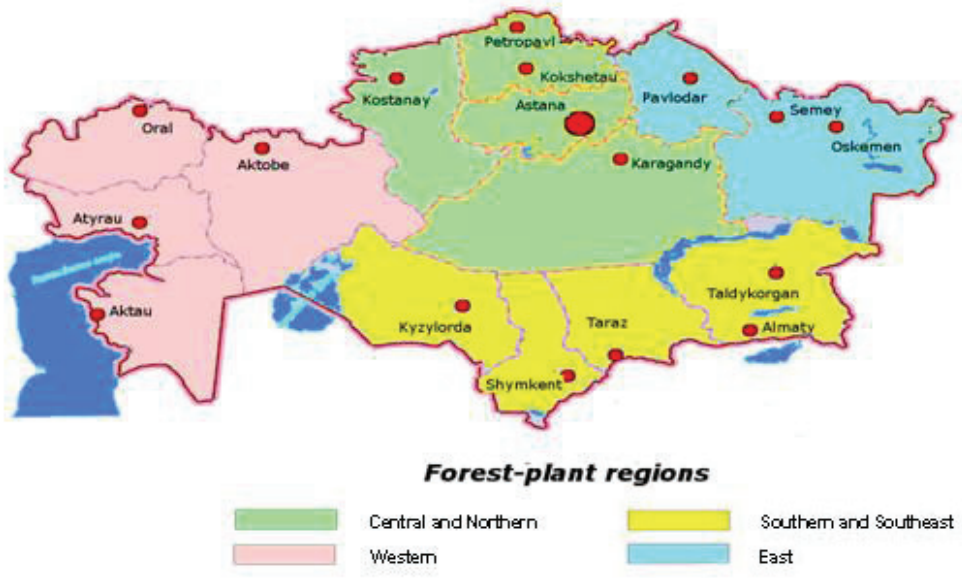


Figure 1: ***Administrative division and forest vegetation zones of Kazakhstan***

Kazakhstan consists of 14 provinces with Astana established as the capital city of the Republic. The largest province is Karaganda Province occupying an area of 428,000 km^2 with a population of 1.3 million or 3.1 people per km^2. The provinces in the south of Kazakhstan are the most populated areas with 2.3 million people and a density of 19.8 people per km^2.

1.1.1 Climate

The diversity of geological and geomorphologic climatic and vegetative-ground conditions of Kazakhstan's territory provides a variety of landscapes. Natural vegetation zones (i.e. forest steppes, prairies, semi-deserts and deserts) occur with an increase in solar radiation from north to south proportionate to the decrease in rainfall. The territory of Kazakhstan in the south is part of the "Variable Zone". The climate is highly continental with considerably colder winters and hotter summers than is the case at the same latitudes of Eastern Europe. The

coldest month is January and the warmest one is July. There is little precipitation, especially in the southern regions. There is 100 mm of annual precipitation in the south and 300-500 mm in the north. In Kazakhstan (except for its mountain part) the annual rainfall is several times less than what could be evaporated, resulting in a considerable moisture deficit. Such a dry climate provides the conditions for the predominance of desert and semi-desert landscapes and requires artificial irrigation for cultivating agricultural crops.

The average temperature in January, the coldest month, varies between -5°C in the extreme south and -20°C in the north. In the plains of Kazakhstan the average July temperature varies between +18°C in the north and +29°C in the south.

1.1.2 Hydrography

The Republic of Kazakhstan has a deficit of water resources due to its geographical position in the steppe of Central Asia. Specific water consumption per head of population is 37,000 m³/km² or 6,000 m³ per year. Large areas are classified as landlocked inland drainage basins of inner lakes.

There are 48,262 lakes in the Republic of Kazakhstan, 45,248 of them have areas less than 1 km². There are 21 large lakes each having a size of more than 100 km^2. Kazakhstan is endowed with large lakes such as the Caspian Sea and the Aral Sea. Besides, one of the largest lakes of the world, Balkhash, is also situated in Kazakhstan. The lakes are spread all around the territory of Kazakhstan. In the northern part there are 45% of all lakes, in the central and southern parts 36% while only 19% are located in the rest of the country. The total surface area of Kazakhstan lakes measures up to 45,002 km^2. Overall water volume is 190 km^3.

Apart from mountain regions, atmospheric precipitation is insignificant. Kazakhstan has six rivers with a river flow rate of 100 m^3/sec to 1,000 m^3/sec, seven rivers with a flow rate of 50 m^3/sec to 100 m^3/sec and 40 rivers with a flow rate of 5 m^3/sec to 50 m^3/sec. There are more than 7,000 rivers in Kazakhstan with a length of over 10 km. All in all, there are 39,000 perennial and temporary streams in the Republic of Kazakhstan. Most rivers belong to the continental basins of the Caspian and the Aral Seas, and the lakes of Balkhash and Tenghiz and only the rivers Irtysh, Ishim and Tobol carry their waters to the Kara Sea of the Arctic Ocean.

The total water resources of rivers amount to 101 km³, 57 km³ of which are formed in Kazakhstan. The remaining capacity comes from the neighboring states: Russia – 8 km³, China – 19 km³, Uzbekistan – 15 km³, Kyrgyzstan - 3 km³.

1.2 Demography

Linguistically, the native population (Kazakhs) belongs to the Kipchak group of Turkic languages. At the end of the last century, Russian and other nationalities moved in considerable quantity to Kazakhstan from Central Russia, the Volga region and other regions of the former Soviet Union for the purpose of industrial development as well as for the cultivation of virgin and fallow lands. As of May 1, 2009 the Republic's population is about 15.8 million people including 8.4 million (53.4%) urban population and 7.4 million (46.6%) living in rural areas. Kazakhstan is a multi-ethnic country. The largest ethnic groups include Kazakhs – 46%, Russians – 34.7%, Ukrainians – 4.9%, Germans - 3.1%, Uzbeks – 2.3%, and Tatars – 1.9%. The national language is Kazakh with Russian being the international language. Kazakhstan has various religions such as Islam (47%) and Orthodox Christianity (44%).

1.3 Natural Resources

Environmental conditions such as solar radiation, climate, topography and natural resources, minerals, water, plant and land resources, as well as animals have a significant effect on the development of the economy. Depending on predominance of natural resources, people have at all times developed different production sectors such as industry, agriculture, animal husbandry, fishery and forestry. Considering the natural environment of Kazakhstan (the combination of natural conditions and natural resources) in the context of economic development, it can be said that it is exceptionally rich and diverse.

There are significant reserves of many types of valuable mineral resources, large areas of productive arable lands, and vast grasslands. These natural resources often occur together and create a natural basis for the development of a diversified and large scale national economy. However, it should be noted that the severe extremely continental natural conditions of Kazakhstan such as dry climate and shortage of fresh water in large territories of the country complicate the exploration of natural resources. It should be taken into consideration that the land and its subsoil assets, waters, flora and fauna and other natural resources are the exclusive property of the Republic of Kazakhstan, thus forming the basis of its independent statehood.

1.3.1 Agro-industrial complex resources

Kazakhstan is an agricultural country with considerable agricultural potential. Until recently, 38% of the national income was produced by the agricultural sector using only 16% of the country's labor force. This demonstrates the presence of extensive mechanization and relative effectiveness of the agricultural production. Out of its total land area, 222.5 million ha (82%) are agricultural lands.

It is known that the leading agricultural activity is grain production. Among other cereal crops, Kazakhstan is a top producer of wheat (71.3% of cereal production). Summer wheat is under cultivation in the north, and in the south winter wheat is grown. Kazakhstan has tremendous land resources for grain production and thus can meet not only its own needs but can export wheat also to neighboring countries. The increase of overall yield of high quality cereal crops is a powerful resource needed for the economic stabilization of Kazakhstan including food security for future population growth and prosperity. The Republic ranks sixth in the area of cropland in the world (over 36 million ha). Production of cereal and pulse crops per head of population is 1,702 kg.

Kazakhstan has been and remains the only country of the former Soviet Union exporting grain. Top-grade wheat (hard and strong wheat) is produced here. However, the average yield capacity of grain and other agricultural crops in Kazakhstan is one of the lowest in the world. With a crop yielding capacity of 1,220 kg per ha, Kazakhstan occupies the 142nd place in the world which is comparable with crop yields in Mongolia, Mali and Greece. Alongside with serious deficiencies in the agricultural industry, there are considerable and almost annual variations in the volume of its production depending on weather conditions.

Grain production in Kazakhstan is rather unstable because the main areas under crops are located in zones of higher risks for farming. This is exemplified by the fact that in 1990 the production of cereal crops was 28.5 million tons, while in the much drier year of 1998 it was only 6.4 million tons. The bioclimatic capacity of the agricultural zone of Kazakhstan is 2.5 times lower than that in Western Europe. The potential yield of cereal crops is one of the lowest in the world. On average, in the period between 1990 and 1994 it was 0.97 t/ha, from 1995 to 1999 only 0.52, and from 2000 to 2004 it fell to 1.05 t/ha. In comparison, during the last five years, the average yield production in Russia and Ukraine was between 1.5 and 2.0

t/ha, while in some countries of Western Europe it was 7.0 t/ha. In the 1990s, there was a sharp drop in animal husbandry and production of cereal crops due to the conversion of cultivated areas to other land-uses. During the last years grain production has come to a standstill as far as the growth of cultivated areas and application of new soil and moisture saving farming technologies is concerned. According to preliminary data, Kazakhstan will produce 15 million tons of wheat in 2009.

1.3.2 Animal husbandry

Animal production is the leading branch of farming in Kazakhstan. Collective farms and state farms grow strong spanker horses, Persian and Lincoln sheep, angora goats and camels on steppe grasslands, the area of which exceeded 170 million ha. Animal production has been a key economical activity of Kazakhstan throughout many centuries and remains a major source of employment, food and income of the rural population. The vast grasslands of Kazakhstan provide an important production base, whereas the improved local and global economic environment creates possibilities for further developing the animal production sector especially for small and medium enterprises. Before the transition period, animal production contributed about 60% of the gross domestic agriculture product. Today, this sector has declined to 42%. The income from cattle-breeding accounts for 76% of agricultural income of the local population, which is 15% of the total family income, according to a survey on private household income conducted in 2006.

Sheep breeding is the main branch of farm animal production of Kazakhstan. Sheep and goats are forage unpretentious animals. They can pasture out at grass all year round, including high-mountain alpine and sub-alpine meadows (jailau). In the beginning of the 1990s, there were over 35 million heads of sheep and goats in the country. Sheep and goats are raised mostly in the south, west and east where grasslands of different seasons successfully go together on plains, foothills and uplands. Fine wool breeds are prevailing in the south and east and coarse-wool and semi-coarse-wool fat-tailed breeds are widespread in the west.

North Kazakhstan, the main stock-rearing region is agriculturally the most cultivated part of the Republic. About 50% of the total cattle stock is concentrated in this region. Another important stock-rearing region is located in the foothills of South and East Kazakhstan with up to 30% of the total cattle stock. Among cattle breeds raised in Kazakhstan, breeds such as Red Steppe breed, Alatau, Talas dairy-beef and Kazakh white-headed beef-and-dairy can be distinguished.

Among other developed sectors of cattle breeding in Kazakhstan, there are horse-breeding, camel husbandry, pig breeding and poultry. Horses are raised in all regions of the Republic and camels prevail in most desert areas of Atyrau, Manghistau, Kzyl-Orda and South Kazakhstan provinces. Poultry state-farms and pig-breeding farms can be found around many large cities.

Following the disintegration of the Soviet Union at the beginning of the 1990s, the livestock sector of Kazakhstan had undergone fundamental changes. Auxiliary structures of the cattle-breeding branch disintegrated, the infrastructure was destroyed and the lands were reallocated. The reduction of governmental control over the grazing lands lead to infrastructure collapse: roads to alpine summer pastures were no longer maintained for regular use; cattle yards and winter huts were destroyed; agricultural equipment was not repaired; enclosures were broken or removed; mechanical wells for watering cattle on grazing lands became unserviceable. As a result of these changes the total cattle stock in Kazakhstan dropped considerably. However, as a result of governmental reforms intended to support agricultural development (land reform, credit-finance system and other), the livestock

cut-down on a national basis was stopped and tendency to its increase surfaced as cattle-breeders and farmers started adjusting to new economical conditions.

At present, the agricultural sector, the main component of the agro-industry, is represented by more than 5,000 agricultural entities based on private property and asset ownership. They include 5,296 peasant (farm) holdings, 172 enterprises with different forms of management: production cooperatives, joint stock companies, and business partnerships. 1.8 million ha of farmland and 570,000 ha of croplands are managed by agricultural enterprises. Peasant holdings occupy 7.6 million ha of farmland and 709,000 ha of cropland. As per the beginning of the current year over 102,000 landowners have used 7.6 million ha of farmland out of which 4.6 million ha are cropland.

1.3.3 Fossil minerals

Kazakhstan is endowed with large reserves of mineral resources. According to estimates of the world's leading scientists, Kazakhstan is the world's sixth country measured by the reserves of natural resources though still it can not use this advantage with maximum effect for itself. According to calculations, the explored mineral resources of Kazakhstan are estimated at approximately 10 trillion US dollars.

Kazakhstan obtains rich mineral resources as evidenced by the fact that out of 110 elements of the Mendeleyev Table 99 are found in Kazakhstan, 70 of which are already explored (known or studied) but meanwhile 60 of those elements are being extracted and used. Kazakhstan is one of the richest countries in the world by its resources of oil, gas, titanium, magnesium, stannum, uranium, gold and other non-ferrous metals.

The leading branches of the industry are non-ferrous and ferrous metallurgy, chemicals, consumer and food industries. During the last period, oil engineering and production of building materials are in significant progress. Considerable parts of the world's reserves of copper and complex ores, nickel, wolfram, molybdenum and many other rare and rare-earth metals can be found in Kazakhstan. The country's known deposits of iron, manganese and chromite ores are of global significance.

Large deposits of copper, lead, zinc, rare metals, coal, iron and manganese ores are concentrated in the central part of the Republic. The known deposits of copper are located in Kounrad, Sayak, and Bozshakul. Besides Karaganda, the coalfield at Ekibastuz, supplying fuel for power generation is operated as open-pit mines and therefore is very cheap. The Pavlodar-Ekibastuz fuel and energy facility has been established on the basis of these deposits.

The main regions of non-ferrous metallurgy are Central Kazakhstan and Rudny Altai. Copper melting is concentrated in Balkhash, Karsakpai and Irtysh plants as well as in Dzhezgazgan. Kazakh Altai is well-known for its copper-lead-zinc ores, deposits of gold, stannum and rare metals. Major complex deposits are Leninogorsk, Zyryanovsk and Belousovsk.

The iron industry is represented by the Temirtau plant, Aktobe ferro-alloy plant, Karaganda steel works, Sokolovsk-Sarbai mining and the concentration complex in the Kustanai region. Iron ores are extracted in the south of Atasu in the Karazhal mine. Manganese ores are extracted in the village of Marganets.

The Transural regions of Kazakhstan are characterized by chromite, copper and asbestic mineralization. The Cis-Ural Region near Aktyubinsk is famous for its phosphorites and high-quality nickel ores. The south of Kazakhstan has considerable deposits of phosphorites.

Lead-and-zinc ores are also extracted here, especially in the Mirgalimsai, Baizhansai and Achisai minefields.

Kazakhstan is also rich in reserves of chemical raw materials: there are lucrative deposits of potassium and other salts, borates, compounds of bromine, sulfates, phosphorites which are the most diverse raw materials for the paint and varnish industry. Titanic deposits of sulphur ores as part of the complex ores are also found here.

The consumer goods industry is represented mainly by the processing sector of agricultural raw materials (leathers, wool and cotton). The largest centers of the leather industry are Semipalatinsk, Almaty, Pertopavlovsk, Uralsk, Zhambyl and Kzyl-Orda.

The Caspian Plain is associated with tremendous deposits of sodium and potassium salts. They are confined to salt-dome structures breaking out of loose sedimentary cover (for instance near the lake of Inder). Solar salt lakes are also known in other regions such as the Irtysh River region, Sub-Aral and Balkhash areas.

Crude oil production in Kazakhstan is mainly concentrated in the Atyrau region (on the valleys of rivers Emba and Sagyz) and partially in the Aktyubinsk region. Annual crude production is 1.6 million tons. Thus, taking into consideration the actual reserves and indicated resources ashore, the expert oil reserves in the country amount to more than 6.1 billion tons, gas supplies are 6 trillion of m^3, out of which the biggest annual extraction is only 26.6 million tons of crude and 8.2 billion m^3 of gas (in 1991). The other resources of Kazakhstan comprise mineral, medical and thermal waters, which have not had a widespread application yet.

1.3.4 Plant resources

Forests and grasslands of Kazakhstan play an important role and are considered as national resources, providing important environmental services such as climate regulation, soil and water protection, and sanitary and hygienic functions. They are also the leading force in the economy of the country, supplying its population with forage, food, fuel (combustible), drug plants and are also used by people for recreation.

The state forestry fund includes not only forests but also grazing land, open forest stands, hayfields and other lands. The total area of the state forest fund is 27.8 million ha (according to an inventory of the forest land as of 01.01.08), including a forested area of 12.3 million ha, representing 4.5% of the total land area (272.5 million ha) of the Republic. In terms of area size it takes the third place among the countries of Europe and Central Asia.

Traditionally, with total reserves of standing timber stocks equal to 380.7 million m^3 Kazakhstan lags behind the countries of Europe and Central Asia which are rich in forests (only one third as compared with Romania) but its level corresponds to that of South Africa, Vietnam or the Philippines. The production potential of such forests is rather low (average forest stocking density per 1 ha is 42 m^3), which is partly due to low temperatures, extremely continental climate and small amounts of rainfall.

Native steppe grasslands constitute over 60% of the total territory of Kazakhstan. The country is the sixth in the world by the size of grazing area. Grasslands are the main forage resources for cattle breeding under the conditions of dry and hot climate of Kazakhstan with limited water resources. As of 2004, the grassland area in Kazakhstan has constituted about 189 million ha or 85% of all agricultural lands. However, during the last years only some 30% of grasslands have been used for cattle grazing due to lack of water, remoteness from population centers, reduction in livestock as well as owing to incompleteness of land reforms.

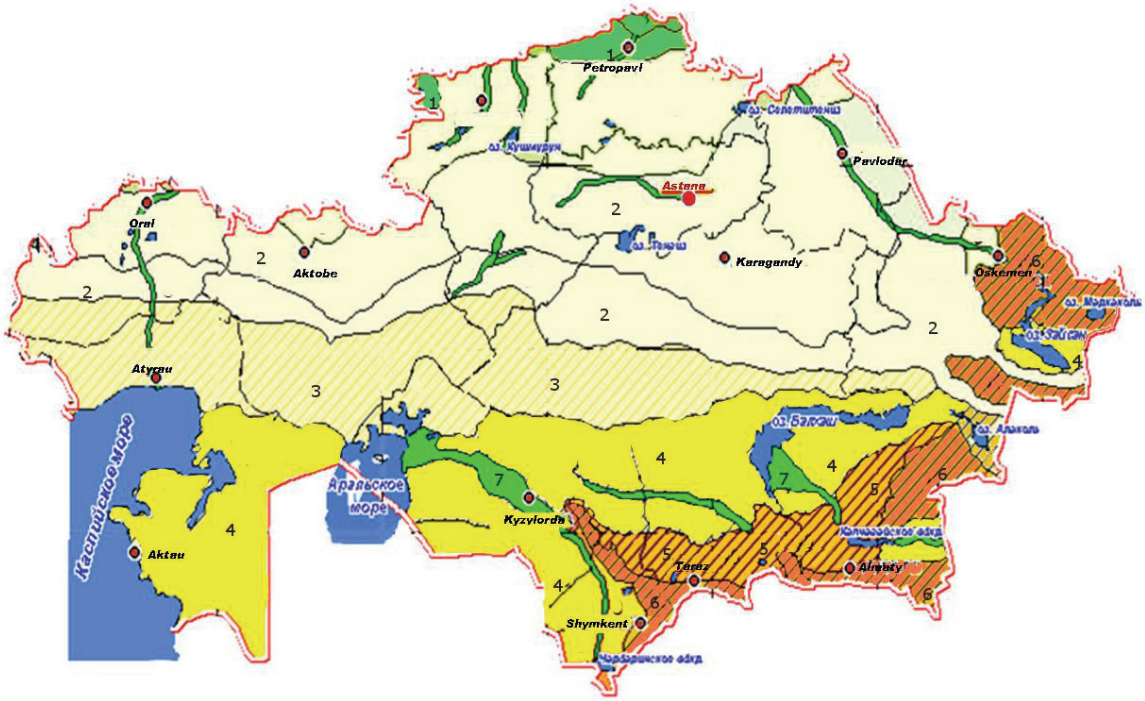
The productivity of sand plain grassland used during the cold period of the year varies between 0.10 and 0.25 t/ha, i.e. 2-2.5 times. The typical yield of the piedmont plain grasslands ranges from 0.5 to 0.26 t/ha in the spring season and from 0.9 to 0.45 t/ha in autumn, while that on sand plains from 0.07 to 0.14 t/ha. In many cases unrestricted grazing mainly confined to watering places results in pastoral digression which is accompanied by a reduction of the soil projective vegetation cover, lowering of biological and grazing capacity as well as reduction in biological diversity.

Economic return of wooded lands and grasslands is an important motivation for stable control of ecological systems as well as it can result in considerable economical and social losses in case of desertification and other forms of sudden degradation of lands. About 300,000 people depend directly on the forest sector including those residing in forest areas or using forests for the purpose of harvesting of fuel wood, cattle forage and other forest products. According to estimations, 4-5 million people (40% of the population) directly or indirectly depend on these resources for their livelihood, thereat many of them live in poor conditions. Most of the grassland areas are dry lands with average level of rainfall of 100-300 mm per year and temperatures of above 30℃ in summer and below -25℃ in winter. Some of these lands, in particular saxaul forests in Betpakdala and Moyunkum represent unique resources in terms of landscape and ecological systems. Moreover, the rangelands of Kazakhstan are important for the global carbonic balance as they retain considerable reserves of carbon.

2. Status of Forests

2.1 Phytogeographic Information

The forests in Kazakhstan belong to different phytogeographical zones. The more humid north refers to forest steppe zone, and with an increase of dryness towards the south follow steppe, semi-desert and finally the desert zone as shown in the zoning map in Figure 2.



Legend: 1 Forest Steppe, 2 Steppe, 3 Semi-Desert, 4 Desert
5 Zone of Foothill Plains, 6 Mountain Zone, 7 Lowland Forest

Figure 2: ***Natural vegetation zones***

Depending on soil type and topography there are intrazonal (riparian woodlands, saxaul woods in deserts, etc.) and azonal (meadows and bogs) vegetation types interspersed within the typical phytogeographcial zone. The extensiveness of Kazakhstan's territory and unique character of its geographical position lead to a great diversity of natural conditions and flora and fauna composition. The present-day flora of Kazakhstan includes 68 species of woody plants, 266 species of shrubs, 433 species of bushes, dwarf sub shrubs and semi-grasses, 2,598 species of perennial and 849 of annual grasses.

The main forest-forming species are conifers – Scots pine (*Pinus silvestris*), Schrenk's spruce (*Picea Schrenkiana*), Siberian spruce (*Picea obovata*), Siberian fir (*Abies sibirica*), Siberian larch (*Larix sibirica*), Siberian pine (*Pinus sibirica*); softwood broad-leaved – white birch (*Betula pubescens*), European birch (*Betula verrucosa*), aspen (*Populus tremula*); hardwood broad-leaved – English oak (*Quercus robur*), European white elm (*Ulmus laevis*), Pinnate-branch elm (*Ulmus pinnato-ramosa*), oleaster (*Elaeagnus angustifolia*); black saxaul (*Haloxylon aphyllum*), white saxaul (*Haloxylon persicum*).

The country's forests can be subdivided into birch separated forest stands of the northern provinces, island pine forests of the northwest, pinewoods of Kazakhstan's hummocky topography, ribbon-like relict pine forests of the Irtysh River banks, mountain forests of Altai and Saur, Dzhungarskiy Alatau, and Tien-Shan, saxaul forests, riparian woodlands and flood-plain intra-zonal forests.

In the northern part of Kazakhstan, on a huge territory being the continuation of the West Siberian Lowland (Kostanai, North-Kazakhstan, Aktyubinsk and Pavlodar provinces) there are birch forests (*Betula*). These forests are scattered in small areas (from 0.5 ha up to

several dozens of ha) generally among croplands. Sometimes, birch is mixed with aspen (*Populus tremula*) in small amounts, and with pine (*Pinus*) in drier upland places. Being natural moisture accumulators birch forest stands play a big forest-ameliorative role, thus protecting agricultural crops from dry hot winds and dust storms.

Pine woods of the Kazakhstan hummocky topography are situated in Akmolinskaya and Karagandinskaya provinces. Typically, these forests grow on shallow soils above granite, rocky slopes, in cracks between bare rocks and stones. Thanks to previous intensive weathering processes the relief of the region exhibits bizarre forms. Therefore, the forests of the area are sometimes called Aeolus pine woods. The production potential of these forests is not high (II-III growth classes in degradations and Va- Vb- on peaks of mountain ridge tops and on slopes) and are mostly used for recreational purposes (e.g. resorts, rest houses, sanatoriums, etc.).

The ribbon-like pine forests grow along the right bank of the river Irtysh. Here, pine woods (*Pinus*) in the form of long and narrow ribbons grow on sandy soils. Generally, they are pure pine woodlands of III-V growth classes, with average stand density around 0.4 (i.e. open stands). Due to the dry climate, site conditions are unfavorable. The main types of forests are therefore classified as dry pine woods.

Apart from pines there are birch and aspen trees. In the recent past, ribbon-like pine forests were actively cut down and after disastrous fires of 1997-1998 they suffered from unprecedented illegal cutting of which the total damage could not be ascertained so far.

Kazakhstan Altai covers the eastern part of the Altai including the right sub-basins of the Irtysh river. This mountain area is covered by forests consisting of spruce (*Picea*), Silver fir (*Abies*), larch (*Larix*), Siberian pine (*Pinus sibirica*), pine (*Pinus*), birch (*Betula*) and aspen (*Populus tremula*).

Siberian pine (*Pinus sibirica*) occupies the top part of mountain slopes; larch (*Larix*), fir (*Abies*) and spruce (*Picea*) grow at lower altitudes. Pines (*Pinus*) grow alongside the Kalbin range and on its spurs; it can be met in the valley of the river Ulba and in the valley of the river Ulba by separate woodlots. As a rule, coniferous trees grow on northern slopes while southern slopes are mostly covered by shrub vegetation.

During many decades in the past the Altai forests have suffered from intensive clear felling with the cleared areas quickly developing into grass or bush land. Within the last years, final felling operations have been performed in violation of forest legislation with regard to felling distribution, their intensity (number of trees harvested), cutting cycles, slash removal, protection of young re-growth leading to fast-moving decline in forest cover.

Forest cover of North Tien-Shan is mainly represented by spruce (*Picea*), apricot (*Prunus Armeniaca*) and apple tree (*Malus*) forests. Sometimes, Siberian fir (*Abies sibirica*), which rarely forms high productivity forest stands, can be met on the northern and western slopes of the Dzungarian Ala Tau. Mountain forest types are distributed according to altitudinal zones and grow mainly on northern slopes.

The lower slopes of the mountains are covered by different bush formations followed uphill by plantations of apple and apricot trees, with woodlots of broad-leaved forests (aspen) in between. At the height of 1,300 m asl the broad-leaved species are mixed with Schrenk's spruce which, from 1,500 up to 2,800 m, form pure fir stands. Above this zone, fir is substituted by juniper (*Juniperus*) progressively changing to alpine meadows at higher altitudes. Schrenk's spruce regeneration is generally poor and planting is successful only on rare occasions.

The Schrenk's spruce (*Picea Schrenkiana*) has not been seen in the forests of West Tien-Shan. In canyons and valleys fruit tree forests prevail consisting of apple, apricot, pistachio, alycha, sea-buckthorn, currant, raspberry, barberry, honeysuckle, dog rose and almond. Juniper (Juniperus) brushwoods can be seen throughout the zone between 2,000 and 3,000 m asl.

Saxaul (*Haloxylon* sp.) forests grow in deserts around the Aral Sea, in Kyzylkum along the Syrdaiya River, in Muyunkum along the Chu River, along the banks of Balkhash Lake in Saryishukitau Desert, in Alakol Valley along the river Ili, and in Zaisan Valley along the river Black Irtysh. This zone occupies almost 50% of the Republic's territory (Almaty, Zhambyl, Kzyl-Orda and South Kazakhstan provinces) and has an area of 140 million ha. Apart from black (*Haloxylon aphyllum*) and white (*Haloxylon persicum*) saxaul, zaisan saxaul (*Haloxylon ammodendron*) also grow in the Zaisan valley. Among shrubs growing in deserts there are also tamarisk (*Tamarix*), salt tree (*Halimodendron*), calligonum (*Calligonum*), acacia (*Acacia*). Saxaul forests are traditionally used as pastures and saxaul wood is serving as fuel.

Riparian woodlands grow along the southern rivers: Syr-Daiya, Chu, Ili, Karatal, Lepsy and others – and consist mainly of oleaster (*Elaeagnus*), willow (*Salix*), poplar (*Populus*), tamarisk (*Tamarix*), salt tree (*Halimodendron*), calligonum (*Calligonum*), as well as barberry and goat's-wheet (*Berberis*). They seem to butt into and cut the desert zone into several parts. A special type of poplar, the Asiatic poplar (*Populus diversifolia*) as well as the relict moisture-loving ash-tree or sogdiana ash-tree (*Fraxinus sogdiana*) can also be found here.

Lowland forests grow along the northern rivers: Irtysh, Ishim, Tobol and Ural. In general, broad-leaved tree species such as willow, aspen, poplar, European white elm, birch, bird cherry and alder are represented. Lowland forests have to fulfill important water protection and water regulation functions.

2.2 Forest Area and Condition

The total area of state and private forestry funds as of 01.01.2009 is 27.8 million ha or 10.2% of the Republic's territory. The land covered with forests occupies 12.3 million ha or 44.2% of the total forest estate lands. The percentage of forest lands amounts to 4.5%.

The area of the forestry fund is divided among various governmental departments as follows. About 4.7 million ha or 17.1% of the total forestry fund land comes under the jurisdiction of the Committee of Forest and Hunting Industry. They include:

- 10 State Wilderness Areas (hereinafter - SWA) with a size of 1.2 million ha;
- 9 State National Nature Parks (hereinafter - SNNP) – 1,73 million ha; and
- 3 State Nature Reserves (hereinafter - SNR) – 1.7 million ha.

Apart from the above-mentioned specially protected natural reserves (hereinafter - SPNR), the Committee has the responsibility for two forest plant breeding centers – 1,600 ha and one training and production forest management enterprise – 25,900 ha as well as around Astana City the forest nursery of the Republican State Enterprise (RSE) "Zhasyl Aymak" with a total area of 45,800 ha.

The other committees are in charge of:

- One hundred twenty three (123) government forestry management enterprises coming under the jurisdiction of Akimats (executive committees) of the regions, managing 22.9 million ha or 82.3% of total forestry fund area;
- SNNP “Burabai” - 83,500 ha of the Presidential Property Management Department;
- Scientific and Production Center (SPC) of Forestry Management (FM) JSC “KazAgroInnovatsiya” of the Ministry of Agriculture – 14 ha (forest nursery);
- State Nature Park “Medeu” of Akimat (executive committee) of Almaty city – 53 ha; and
- Public Utility Company (PUC) “Astana Ormany” of Akimat of Astana city – 15.7 ha and plantings on railway and highway “right off ways” land of the Ministry of Transport and Communications – 82,400 ha including JSC “National Company Kazakhstan Temir Zholy” - 62,100 ha; Committee of Automobile Roads – 20,300 ha.

According to Article 44 of the Forestry Code of RK, there are additional specially protected forest areas which include the categories of the state forestry fund being part of state forestry fund institutions of regional Akimats. These are the state forest natural monuments, forest areas with scientific importance including forest genetic reserves, outstanding woodlands and forests and fruit tree plantings. The total area of these categories of the state forestry fund (SFF) is 49,400 ha.

The area of the most valuable forest plantings in the forestry fund comprises 9.2 million ha (out of which 8.2 million ha or 89.1% is under the jurisdiction of the Akimats in the regions).

Forming part of forest estate lands forest cover 67.9% or 18.9 million ha (Figure 3).

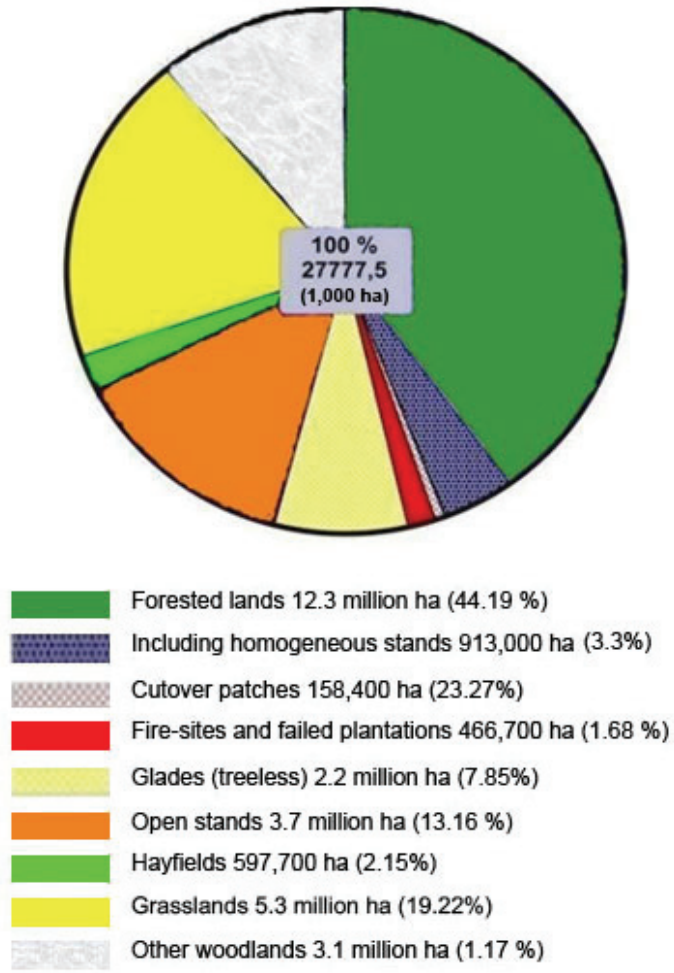


Figure 3: ***Forestry fund lands according to current stocking conditions***

The total area is 27.8 million ha (100%) including:

Homogeneous stands are 3.3% or 913,000 ha, of which 113,500 ha or 0.4% is artificial plantings below the age of woodlands. Forest nurseries in the forestry fund area cover 4,300 ha.

Being part of non-forested land comprising 23.3% or 6.5 million ha of the total forestry lands, fire-sites and failed plantations occupy 466,700 ha (1.7%), failed areas are 2.2 million ha (7,9%), open stands are 3.7 million ha (13.2%). Felling areas where forests have not been restored yet are 158,400 ha. Non-forest areas represented by pastures (5.3 million ha or 19.2%), hayfields (352,700 ha or 1.3 %), arable lands (0.45%), bogs (0.41%), sands (1.4%), waters, glaciers and other areas constitute 32.1% or 8.9 million ha.

When analyzing the changes in the extent of forestry fund lands of the last 10 years, it should be noted that there was a considerable increase (1998 – 25.6 million ha and 2008 - 27.8 million ha) (Table 1). The increase by 2.2 million ha is the result of the inclusion of agricultural lands covered by shrub vegetation, which once were registered as forested lands (1.2 million ha) and about 1 million ha of degraded desert grasslands allocated for forest rehabilitation.

Table 1: ***Changes in forestry fund lands in the period of 1966 to 2008***

Forest land	Changes for the period, in thousand ha					
	1966	**1988**	**1993**	**1998**	**2000**	**2008**
Forested	**7,993.3**	**9,309.9**	**10,273.7**	**11,067.8**	**11,080.6**	**12,274.2**
Including:						
Artificial stands	160.1	917.2	1,029.3	1,052.5	1,122.0	913.0
Unclosed stands	208.9	282.2	253.9	165.5	121.6	113.5
Unforested	**7,595.6**	**5,787.0**	**6,169.2**	**6,743.8**	**6,802.6**	**6,464.3**
Including:						
Failed areas	4,579.5	3,805.9	3,858.8	3,934.1	3,928.8	3,654.7
Fire-sites, failed plantations	45.4	129.1	86.1	180.6	226.6	466.7
Fellings	210.2	261.8	333.7	434.7	473.3	158.4
Glades, wastelands	2,766.2	1,590.2	1,890.6	2,194.4	2,173.9	2,184.5
Total forest lands	**15,798.2**	**15,384.2**	**16,701.0**	**17,982.0**	**18,009.9**	**18,859.2**
Total forestry fund lands	20,849.3	20,760.5	23,974.0	25,565.0	25,654.4	27,777.5

The total area damaged by forest fire, vermin pestholes and other forest diseases increased by 286,100 ha, while there was a decrease of 276,300 ha in forest areas affected by the moratorium for main timber felling in haloxylon deserts and in fir forests. At the same time, the area of open stands increased by 279,400 ha. This was caused by intense timber cutting intended to harvest mature trees followed by natural regeneration.

The areas of glades and wastelands remained practically unchanged, which indicates the lack of natural forest rehabilitation processes as well as the lack of special measures on artificial regeneration of these former forest areas.

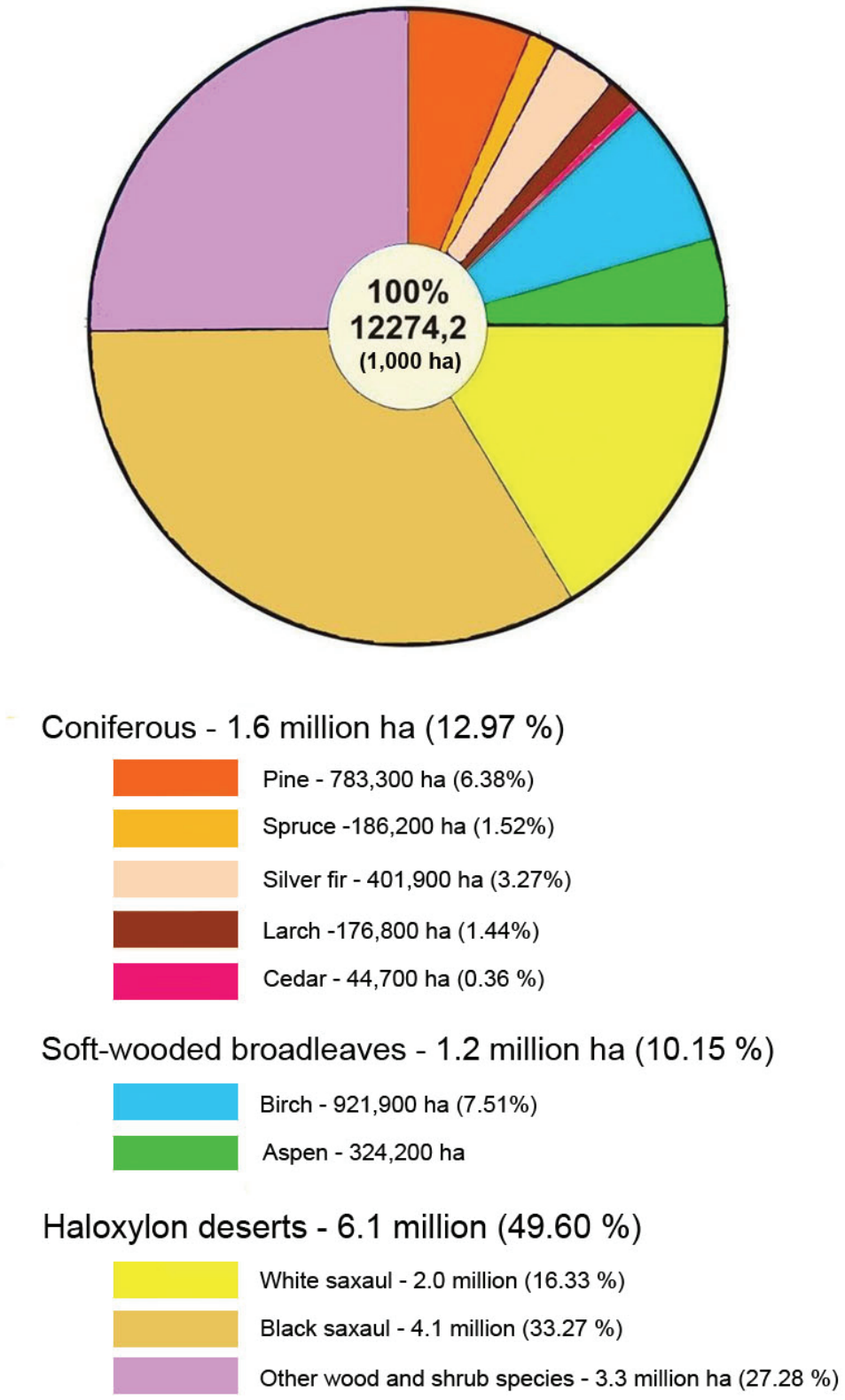


Figure 4: ***Distribution of dominant species on state forestry fund lands of the Republic of Kazakhstan***

As part of the forested land, haloxylon deserts cover the largest area. White and black saxaul plantings grow on 6.1 million ha thus constituting nearly half the area of all forests of the Republic (49.6%), followed by the area of shrubs – 24.1% (3.3 million ha). Considerably smaller areas are occupied by woody species plantations such as coniferous – 13.1% (1.6 million ha) and soft-wood broad-leaved species – 10.15% (1.2 million ha).

According to area, saxaul plantings cover by far the largest portion of the land. However, based on stocking density the haloxylon deserts constitute only 3.9% (14.93 million m^3) of the total growing stocking of planted forests. Because of the harsh environmental conditions saxaul forests show a very low forest density per ha.

Coniferous forest stands make up 61.8% of the total growing stock (235.35 million m^3) including pines, which have a share of 27.5% (104.71 million m^3). Soft-wood broad-leaved forests represent a total growing stock of 112.64 million m3 or 29.6%, dominated by birch grooves constituting 21.9% (83.26 million m^3) of the total growing stock of all forest plantations (Figure 5).

The plant community in the forests of the forestry fund lands is represented by a wide array of species, in particular with regard to shrubs (up to 40 species), and other kinds of woody plants (up to 15 species). Their ecological distribution ranges from the snow line (fir tree, larch, Siberian pine) to the arid conditions of the Kyzylkum hot deserts (saxaul).

Total volume - 380.7 million m^3

(100%) including:

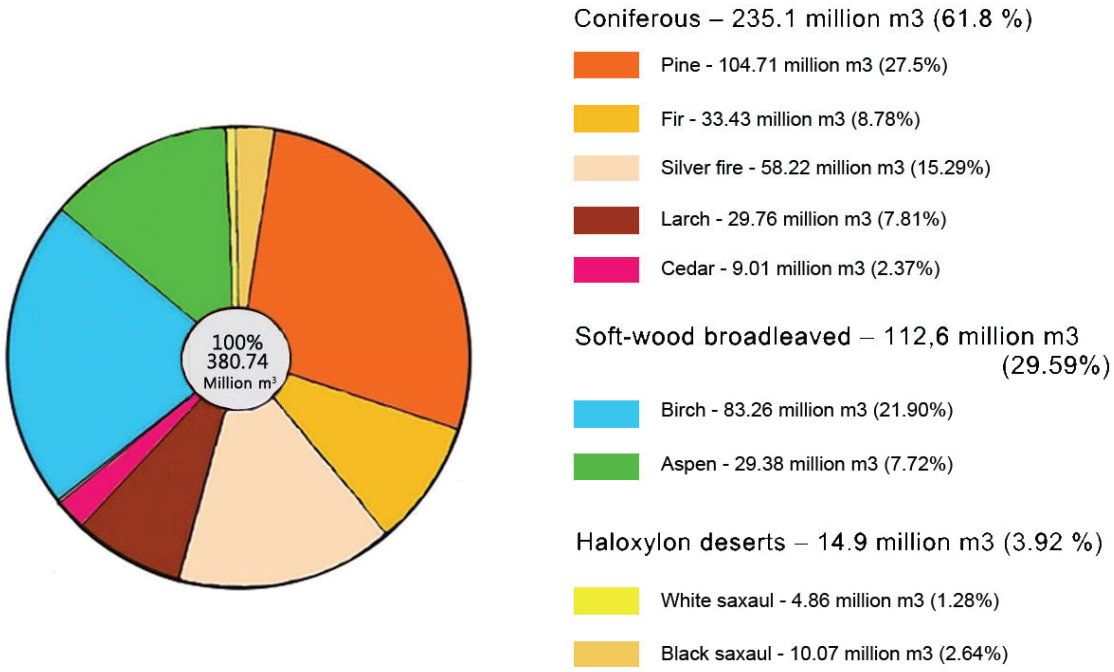


Figure 5: ***Distribution of total growing stock according to main tree species***

The age-class distribution of Kazakhstan's forests (Table 2) shows that most of the forests represent middle-aged plantations representing 3.0 million ha (33,1%), while mature and

over-mature forests cover an area of 2.8 million ha (31,3%). However, the current extent of regeneration forests of 2.0 million ha (22.2%) and young forests of 1.2 million ha (13.4%) is obviously insufficient for sustainable development of the forests in the country. Thus, sustainable, qualitative development of forest ecosystems requires an even distribution of all age classes. Otherwise, irreversible degradation of forests will occur with dramatic increase in mature and over-mature forest stands that are less resilient to anthropogenic and natural factors.

Table 2: ***Age-class distribution of Kazakhstan forests***
(Numerator: data of 1998; denominator: data of 2008)

No.	Dominating composition of plantations	Forest areas (1000 ha)	Including by age groups (%)			
			Young forests	Middle-aged	Mature	Mature/ over-mature
1.	**Saxaul, including**	5,305.5	10.7	29.7	29.6	30.0
		6,088.0	11.0	32.7	24.3	32.0
	Black haloxylon deserts	3,679.8	14.8	38.9	27.7	18.6
		4,083.8	12.8	44.6	20.8	21.8
	White haloxylon	1,625.7	1.8	8.8	33.7	55.7
	deserts	2,004.2	7.4	8.5	31.1	53.0
2.	**Soft-wood**	1,371.5	20.6	39.9	18.1	21.4
	broadleaved	1,378.1	19.3	27.3	21.5	31.9
3.	**Hard-wood broad-**	98.0	47.0	49.0	1.9	2.1
	leaved	99.0	29.2	61.8	5.2	3.8
4.	**Other broad-leaved**	82,5				
		-	-	-	-	-
5.	**Coniferous**	1,687.3	23.8	28.2	17.4	30.6
		1,605.8	16.6	37.6	16.0	29.8
	Total	8,544.8	15.0	31.3	25.1	28.6
		9,170.9	13.4	33.1	22.2	31.3

2.3 History

Until the middle of the 20th century there was no systematic forest management in the territory of what today is Kazakhstan and the forests were used by the local population mainly as pasture land, area to over-winter domestic livestock and for forage production. During those days, in most cases, the Kazakh population did not build stationary houses and in rare cases they used wood as firewood. For heating and cooking they more often used brushwood (dead branches of trees and shrubs), salt grape (stalks of dried grass), reed (cane stalks) and dung (dried excrements of domestic animals). Needless to say that the lack of forest management was not just because of the people's attitude towards the forests but also the local population did not have appropriate tools, instruments, and experience in storing, processing and transportation of woody materials (Andriyevskiy, 1914, 1915). All lands and other natural resources were in possession of Kazakh clans joined into Kazakh zhuzes governed by khan powers. "Zhuz" (horde) is defined as a certain alliance of tribes belonging to the Kazakh nation and populating a part of all-Kazakh land set by tradition. After inclusion of all Kazakh lands into Russia (1867), all steppe areas and natural resources of these territories were declared governmental property. From that moment onwards,

measures were taken to control, safeguard and use these forests. Certainly, the main influence on forestry in Kazakhstan was from Russia, a powerful empire having borders with it in the north and west for many thousands of kilometers.

First wildlife reserves were established and separated from local forests. Later on, the most valuable forests were declared as “treasury possessions” while those of lesser value were managed jointly by the “treasury and nomad population”. Further on, independent “forest ranger stations” were created on the basis of those wildlife reserves and their management was handed over to professional foresters from Russia.

A total of 24 forest ranger stations were functioning by 1920, each of them had its own forest nursery to raise new planting stocks. By 1912 there were 54 forest ranger stations and by 1917 this number had increased to 75 units. In total, 405 forest workers and 1,255 forest guards were employed in these ranger stations. By that time, the total forest fund area comprised 23.84 million ha, out of which 9.53 million ha were covered by forests.

Initially, the activity of forest workers was oriented towards the protection of forests, regulation of timber removal and cattle pasture. Then, more attention was given to the study of ecology and growth of natural forests, experimental work on raising planting stocks, and planting of new forest stands. Tree plantings mainly aimed at creating forests for recreation, afforestation in treeless areas and beautification of cities and other human settlements. As a matter of fact, amenity plantings stimulated the development of other forms of green cultivations because people at all times wished to decorate streets and their gardens with flowers, bushes and trees.

There is reliable information that in the territory of present-day Kazakhstan, by order of Dzhangir Khan (1823), dense woodlots of pine and other trees species had been created in the sandy plains of the Naryn River around Khan’s settlement. These forests have survived until today by means of natural regeneration.

In the south, in the Semirechensk Province, two wildlife reserves were established in 1853 on an area of 2,200 ha, consisting of English elm trees planted by Chinese people (tarangs and dungans). The city of Almaty (formerly called Verny) founded in 1854 and former capital city of Kazakhstan became one of the centers of afforestation and landscape beautification in Kazakhstan. All efforts on planting stock supply and forest cultivation in Semirechye were led by the famous professional forester E.O. Baum. The “Vernenskaya Grove”, a small forest plot planted under the direction of E.O. Baum on an area of 315 ha, still extending over 130 ha today, is named after him.

In the western regions of the Republic silvicultural planting (1884) was carried out under the direction of M.K. Savich. He organized the Ural steppe forestry activities aimed at reducing unfavorable effects of dry eastern winds on the European part of Russia. On the lands of Aktyubinsk Province wildlife reserves (1889) were established by Ch. Shtromberg and F. Derting. In 1908 N.V. Androsov planted 5,000 seedlings of pine on sandy soils of Bolshiye Barsuki in the same area. Trial plantations and forest plantings were also carried out in the northern regions of Kazakhstan.

Before 1914-1917, forest planting in the territory of present-day Kazakhstan had mainly experimental character and therefore the total area of established homogeneous forests (apart from landscaping around centers of population, small woodlots and roadsides) did not exceed 5,000 ha. After all, their planning was based only on enthusiasm and personal initiative of forest lovers and specialists and very often it was carried out without strict plans and lacking financial resources from the government.

After the Russian October Revolution (1917) forest management capacities were almost entirely lost until 1931. By then, alongside with revisions of timber felling at the rate of annual growth and development of protective forest plantations, the provision was made for the implementation of personnel training “institutes” by opening new institutions for higher education in agriculture and forestry. In addition, considerable extension of the number of secondary technical schools was made by the Regulation of the Soviet Government “On organization of forestry and division of forests into wood-and-paper production and silvicultural zones”. This gave rise to the implementation of scheduled silvicultural operations in Kazakhstan.

The first scheduled reforestations based on specially designated government budgets did not exceed several dozen ha, but were carried out practically all over the forest territory of the Republic. Step by step, the area of forest plantings expanded as follows: 1935 - 496 ha, 1936 – 1,786 ha and by 1939 the area reached 2,000 ha.

The Great Patriotic War (1941-1945) crippled the economy of the Republic irretrievably and many projects on forestry development were minimized for a long time. However, in spite of the tough situation in the country, in 1943, the Soviet government decided to categorize the forests depending on their economic value and forest coverage in the regions. Alongside these lines, the forest sector and the forest industry were divided according to their specialization. In 1946, the Ministry of Forest Sector (MFS) of Kazakh SSR was established, thus initiating the development of forest management in Kazakhstan.

From 1947 to 1977, the forest sector and forest management have progressively been developed in Kazakhstan. All forests including the ones of forest industry agencies, communication lines, internal affairs, iron industry, cellulose and paper industry, woodlands of state farms, recreation enterprises, other ministries and departments apart from governmental national parks, which were under the command of a special department affiliated to the government were placed under the control of the Ministry of Forestry. At the beginning of 1948, 24.64 million ha or 95.6% of all forest resources were brought under the jurisdiction of the Ministry of Forestry. Its remaining part (1.14 million ha) was within the limits of national land reserves (717,200 ha), national parks (213,600 ha), some state farms (140,000 ha) and other land users (69,500 ha). The forest sector administration was created including the Ministry – regional departments of forest sectors administrations – forest farms – forest districts, which maintained its structure until today. Only their names and functions were changed.

The establishment of a separate ministry opened great perspectives for accelerated development of the forest sector. At that time, priority was given to agricultural afforestation, implementation of rotational grazing, construction of ponds and water reservoirs in order to provide high and sustainable yields in steppe and forest steppe regions (1948) as well as taking urgent measures on protection of soil from water and wind erosion (1967).

Thereat, the leading role was given to afforestation of agricultural land. Apart from protection and recreation of forests in national forest reserves the forest sector was also given the responsibility of protecting forest plantings grown for different purposes on land of agricultural enterprises. During seven years, 60,700 ha of such forests were planted in Kazakhstan. One of such a valuable project (national forest belt “Cherry Mountain – Caspian Sea”) was carried out within the West-Kazakhstan Region.

From around 1953 to 1967, problems related with forest planting and forest rehabilitation were given very low priority because of the establishment of corn growing farms on virgin lands. After 1967, when the problem of immediate soil protection against water and wind erosion became especially acute, attention was given again to the issues of agricultural

afforestation. Within two years (1968-1970), forest farms created 124,200 ha of erosion-preventive field-protective tree belts.

The work on creation of artificial crops in the state forestry fund continued. Artificial stands were created mainly by planting (58%). The crops of black saxaul (*Haloxylon aphyllum*) were established by seeding (42% of total rehabilitation volume). Preservation of young forests reached a share of 71.5%. By 1968, the total area of artificial crops in the Republic was brought to 720,000 ha, out of which 33% were occupied by coniferous, 41% by saxaul and 20% by hardwoods.

Before 1995, about 2.0 million ha of forest crop were created in Kazakhstan by planting and seeding methods, 45-50% of which were lost due to different reasons at different development stages and the rest has been shifted to official forest area categories. As a result, forest areas in Kazakhstan grew up to 1.0 million ha by means of artificially created plantings and their share in total structure of lands covered by forests constituted 10%. Besides, by the start of reforms out of the existing 245,000 ha of unclosed forest stands, 110,300 ha were transferred to the official forest area. Thus, there were about 1.92 million ha of artificial forests in Kazakhstan together with the existing protective plantings (323,000 ha), state forest strips (16,800 ha), protective plantings along railroads (70,000 ha) and highways (60,000 ha) and plantings on the dry floor of the Aral Sea. Nowadays, forest management in the country including the system of forest exploitation and forest restoration is gradually changing to new terms of a market economy.

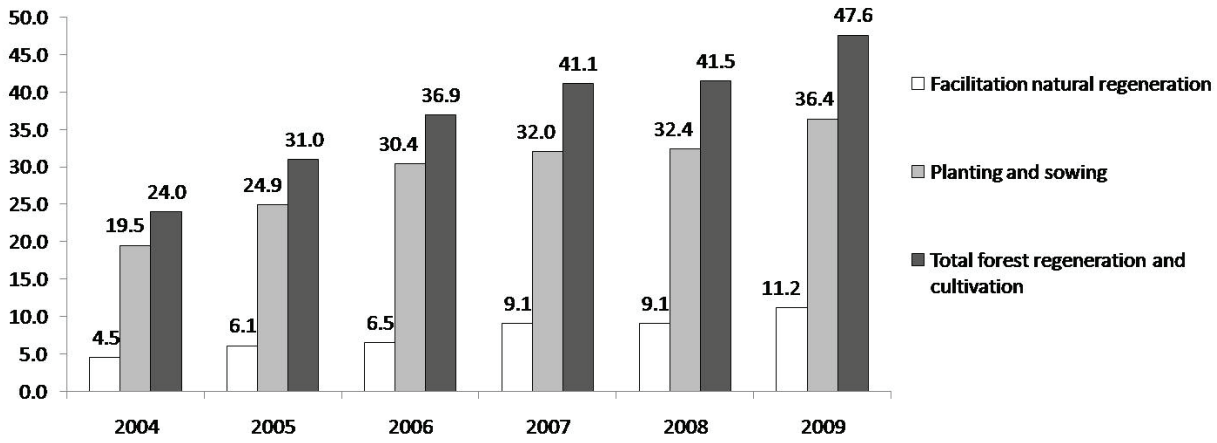


Figure 6: ***Forest regeneration and afforestation in Kazakhstan***

During the last years, specific large-scale measures have been undertaken for the preservation of forests in Kazakhstan and for increasing forest cover. A distinct state forest management policy has been introduced, a new Forestry Code adopted, new programs such as “Forests of Kazakhstan” and “Zhasyl yel” have been developed and implemented, as well as regulatory and legal acts on forest management improved. State forest establishments are financed by means of governmental and local budgets. The main forest management policy of Kazakhstan determined by the Forestry Code of the Republic is regulating ownership and allocation of forests in order to ensure the conservation of forests, their rational and non-exhaustive use, their protection and regeneration.

At present, forest nurseries in the country produce about 23 million of seedlings of coniferous, broadleaved and fruit and berry species, which are still insufficient for achieving

the forest rehabilitation targets. Six hundred twenty three (623) permanent forest-and-seed plots, 323 plus trees, 39 ha of seed orchards are managed for the improvement of seed production. About 38,478 ha of genetic reserves have been put under special protection, 9 ha of archived clones, 6 ha of stock plantations of alien crops, 93 ha of provenance trial (provenance trial is established with local woody species of the former Soviet Union for verification and adaptation to the environment of Kazakhstan) and other test species have been established.

Given the above, the current principle challenge of the Republic's forest management is rehabilitation of forest resources towards close-to-nature forests and increase of their productiveness using natural and artificial methods of forest regeneration.

The basic principle of forest rehabilitation remains valid representing the obligation to replant clear-cut areas, fire-affected sites, and open stands by economically valuable species within the shortest period of time. In addition, rehabilitation also includes the regulation of afforestation efforts on bare lands in order to increase the size of woodland.

Decisions on a reasonable proportion between natural and artificial methods of forest rehabilitation should be based upon sound site-specific scientific analysis. However, natural processes should play a dominant role in order to ensure success and quality of forest rehabilitation by means of progressive cutting methods and technologies, preservation of young growth on harvested areas, protection of crops from destruction by cattle, and supplementary seeding of areas intended for natural reforestation.

2.4 Biological Diversity of Forests

In spite of the fact that the forests of Kazakhstan occupy a small territory of the country and the amount of woodland in separate areas varies between 15.5 and 0.2%, a maximum concentration of biological diversity including 70% of all types of higher plants and more than 75% of hunting species of animals can be observed.

The following red-listed rare species of animals can be met in the forests:

Mammals: snow leopard, Menzbir marmot, red dog, Tien Shan brown bear, European mink, marbled polecat, pine marten, rock marten, Central Asian lynx, argali
Birds: Altai snow cock, black stork, ibis-bill, bearded vulture, golden eagle, booted eagle, fish-hawk, Pallas' sea eagle, vulture (neophron), saxaul desert jay, whistling thrush, paradise flycatcher, tit-warbler
Reptiles: slender racer
Amphibians: Ranodon sibiricus (only in the softwood forest belt of Dzungarian Ala Tau)

Natural forests and artificial plantations form an invaluable ecological resource deserving all kinds of protection, conservation and expansion. The species composition of the forests is extremely diverse. Woody plants and brushwood are represented by 622 species, whereby shrubs dominate by number of species (82%). The majority of trees and shrubs species lives in discontinued natural forest areas and interchange with meadows and steppe vegetation. Coniferous forests in the north are represented by pines, silver fir, and larch, while spruce and Siberian pine forests grow in the east and southeast. Among soft-wood broad-leaved species birch is the most commonly encountered and saxaul is the most abundant among hardwood broad-leaved ones.

In Kazakhstan, there are about 600 species of rare and endangered plants which are subjected to special protection. A considerable proportion of them is included in the Red

Book of the Republic of Kazakhstan. There are 287 flowering plants such as *rhaphidophyton, spiraeoideae, pastinacopsis, nedzwedzkia, cancriniella, dorema karataviense, ferula sugatensis, artemisia cina* and others. The Red Book contains 2 species of gymnosperms (elfin form of *Pizla Schrenkiana, Juniperus seravschanica*); 3 species of ferns (shield-fern of *mynzhylki*, maidenhair, and southern maidenhair); 3 species of mosses (*sphagnum teres*, large-leaf *pahiphissindense* and *orthotrichum laevigatum*); 1 species of lichen (*cladina rangiferina*); and 10 species of fungi (*phellorinia strobilina*, champignon de table, steppe sponge mushroom and others). Harvesting of plants having economic value, such as soaproot, roseroot and other is prohibited or limited. *Ostrowskia magnifica, pskem onion,* and *Pyrethrum kellerii* are protected in conservation parks and wildlife reserves.

According to the Forestry Code of the Republic of Kazakhstan, all forests are classified as protective ones and have great ecological, scientific and other values. Besides, they are unique by their significance and represent valuable resources and natural habitat of animals and plant genes. Depending on their designated purpose, forests are divided into corresponding protection categories. Each category has a strictly defined mode of use and combination of measures on preservation of biological diversity.

Thanks to the measures taken on strengthening protection of state natural reserves during the last five years, the area of specially protected natural reservations (SPNR) has been increased twice and reached 22 million ha, of which the area of SPNR having status of legal entity is 4.8 million ha. Altogether, the area of SPNR of different categories constitutes 8.0% of the total territory of the Republic. The Committee of Forest and Hunting Management is in charge of 10 state wilderness areas (hereinafter called SWA) – 1,224,300 ha, 9 state national nature parks (hereinafter called SNNP) – 1,730,700 ha; and 3 state nature forest reserves (hereinafter called SNR) – 1,707,000 ha. During the coming three years it is planned to create one wilderness area, two national parks, and one reserve as well as enlarge territories of two wilderness areas and one national park. After these measures the extent of specially protected nature areas will amount to 23.2 million ha (Figure 7).

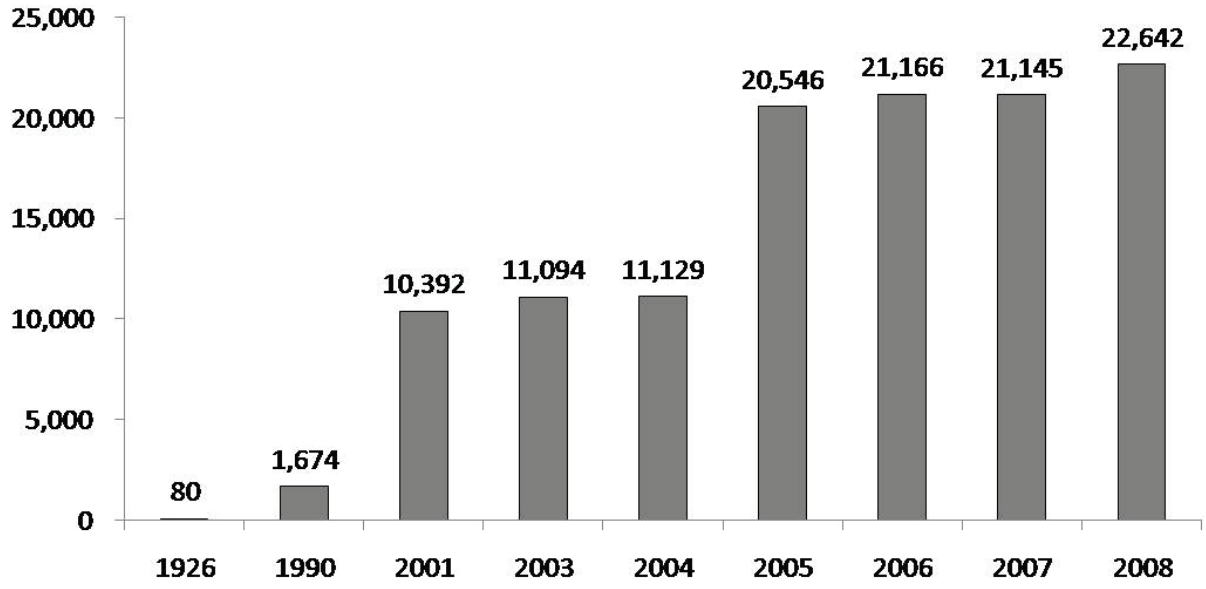


Figure 7: ***Specially protected areas (in thousand ha)***

On July 7, 2008 at the 32nd Session of the Committee of World Heritage a decision was taken to include the "Sary-Arka – Steppes and Lakes of North Kazakhstan" into the List of World Heritage of UNESCO. "Nursumand", "Korgalshyl" state wilderness areas became the first protected territories in Kazakhstan and Central Asia obtaining recognition as World Heritage objects. This is the result of the law on specially protected natural territories established on July 7, 2006 regulating the creation, enlargement, protection, recreation, stable use and management of specially protected nature forest reserves (SPNR) and state nature reserve fund objects of special ecological, scientific, historical-cultural and recreational value. As depicted in Figure 8, total financing of protected areas in Kazakhstan has significantly increased in recent years.

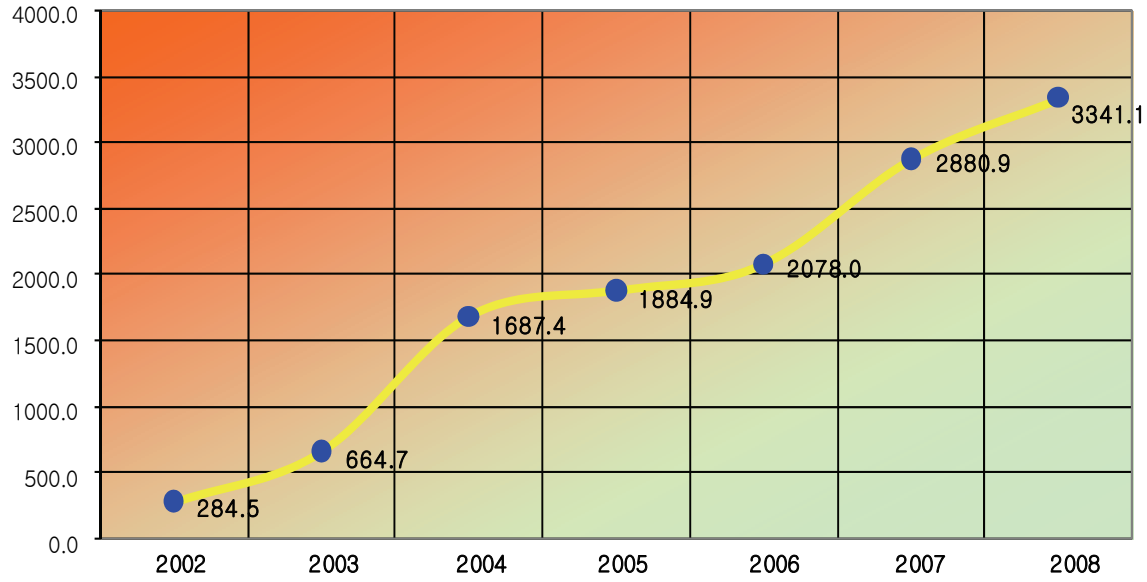


Figure 8: ***Financing of specially protected natural areas (in million Tenge)***

2.5 Land ownership, legislation and policy

The Forestry Code of the Republic enacted on June 8, 2003 regulates public ownership, use, and the disposal of the forestry fund. It also provides the legal foundation for the protection, rehabilitation and improvement of forests and their rational use (Article 2). Thereat, it is determined that forests are one of the most important components of the biosphere having global ecological, social and economic significance.

Basic principles of the forest legislation are as follows:

- Recognition of the value of forests for the Republic performing important functions such as regulating local climate, protecting agricultural fields and soils, water protection, sanitary and environmental hygiene, as well as their sustainable development (steady increase of forests);
- Conservation of biological diversity of forests as important resource for the state nature-reserve fund, and cultural heritage;
- Multipurpose use of forests including rational, continuous, and sustainable utilization of forest resources generating economic returns;

- Implementation of forestry operations and monitoring functions in the field of protection, maintenance and use of the forestry fund area, forest rehabilitation and afforestation;
- Reparation of damages caused by violation of the forest legislation; and
- Accessibility of information on forest condition as well as participation of society and public organizations in the protection and preservation of the forestry fund.

All forests of natural and artificial origin and lands not covered by forest plantations necessary for the development of forest management form the integrated forest fund consisting of state and privately owned forests (Article 6).

The State Forestry Fund of the Republic of Kazakhstan refers to governmental property and is under Republican ownership. Hereunder, the land is assigned for permanent land-use (Article 22), offered to forest institutions and other governmental establishments of the authorized body (Committee of Forest and Hunting Management (CFHM)) for the protection and maintenance of the forestry fund, rehabilitation of forests and afforestation, organization of multiple-use of forest resources as well as for the purposes connected with the activity of SPNR.

Ownership, use and allocation of private forestry fund lands shall be exercised by private land owners who must maintain forest management and forest use by ecologically appropriate means and methods, protection and maintenance, and improvement of sanitary conditions of forests including fire protection provided for by the forest legislation. Besides, they must provide SPNR with the relevant reports on forest resources monitoring including area control and health status of forests (Article 27).

2.6 Forest Management and Administration

At present, the state administration in the field of protection, maintenance and use of forestry fund, forests recreation and forestation (Article 11 of the Forestry Code) is executed by the Government of the Republic of Kazakhstan, the authorized agency (CFHM) and its territorial bodies (regional inspections providing control over forestry activity) as well as by local executive bodies (regional administrations of natural resources and environmental control).

Measures on protection, maintenance, recreation of forests and forestation, rational use of forest resources, maintenance of permanent seed plantations and seed plantings, processing and storage of seeds as well as other forest activities is carried out by governmental enterprises (GE) of forest and hunting management, which are directly subordinated to the local executive bodies – regional departments of natural resources and environmental control of Akim of the provinces.

SPNR (wildlife areas, national parks, state natural reserves and other environmentally protected sites) are under the direct control of the Committee of Forest and Hunting Management (CFHM).

The activity of CFHM and regional departments of natural resources and environmental control is coordinated and controlled by the Ministry of Agriculture of the Republic of Kazakhstan, which is the executive body of state administration in the field of protection, maintenance and use of the forest fund, recreation of forests and forestation.

The CFHM and its regional territorial bodies (management) carry out functions of governmental control in the field of protection, maintenance and use of the forest fund,

recreation of forests and forestation by means of controlling compliance with the forest legislation.

In accordance with the Forestry Code, controlling forest legislation in the field shall be carried out by the governmental forest inspectors on the basis of the following aspects:

- Upon the result of scientific research and monitoring of the state forestry fund when proving negative consequences in the field of protection, maintenance and use of the forest fund, recreation of forests and forestation;
- According to the work plan of the authorized and territorial bodies not more than once a year;
- By the extent of forest fires in the state forestry fund;
- By appeal of persons and legal entities; and
- For the purposes of controlling corrective actions for the elimination of violations discovered during regular checks within the terms specified in the instructions.

Regarding discovery of violations of forestry legislation the following measures shall be taken: a protocol on administrative violations of law shall be drafted; instructions on elimination of violations of the legislation requirements shall be issued; a resolution on calling guilty persons to administrative responsibility and, if necessary, on withdrawal of the harvested forest resources, means of transport, tools for their extraction, for temporary storage until rendering of a judicial decision shall be elaborated. The issues related to measures on elimination of violations of the legislation, calling guilty persons to account, consideration and execution of administrative offence cases are particularly regulated within the Instructions approved by the Order No. 457 issued by the Minister of Agriculture on August 29, 2003. In specially protected nature reserves CFHM carries out functions of both control and management of activities.

3. Degradation of Forests

3.1. Understanding Forest Degradation in Kazakhstan

Despite work undertaken in the field of protection, maintenance, rehabilitation and rational use of forests, and preservation of their biological diversity, there is an observed tendency of degradation of forest ecosystems in the country. Destruction of forests and reduction of their areas cause considerable changes in biological diversity.

According to the existing terminology degradation of forests is a slow process of loss of productivity and dying-off of growing stock under the influence of anthropogenic or natural factors resulting in the deterioration of the forest environment. The meaning of the term degradation in the ecological dictionary (lat. degradatio – reduction, movement back, deterioration) is a gradual lowering of energy potential and system capacity, which is practically irreversible on a real time basis. Degradation means deterioration of organisms', population's or ecosystem's adaptability from one generation to another, caused by unfavorable conditions of existence, inbreeding or illnesses.

3.2. Causes of Forest Degradation

In Kazakhstan, each type of forest has its own set of factors causing forest degradation. The forests of the forest steppe zone (birch stands mixed with aspen and willow) suffer from

reduction in area because of extensive agricultural cultivation of steppe land around woodlands. In most cases plowing was carried out up to the very forest edge and woodlots with small areas were completely uprooted and destroyed. This resulted in a change of the hydrological regime and soil formations on which these forests were formed. In addition, clear cuttings in birch forests over many decades followed by natural re-growth without systematic tending operations resulted in the formation of low-quality stands.

For the last 10 years the forested lands of pine forests of the Irtysh region in the East-Kazakhstan and Pavlodar regions have been reduced to 162,400 ha with timber stocks decreasing to 16.8 million m³. Large-scale illegal cutting became more frequent.

Steppe pine forests have been over-logged suffering from large forest fires in the past. According to up-to-date satellite image interpretation ribbon-like relict pine forests of the Irtysh region (Pavlodar and East-Kazakhstan regions) are destroyed by forest fires and damaged by depredators practically on half of their area, comprising over 300,000 ha. Furthermore, they were permanently affected by radio nuclides as a result of nuclear tests at the Semipalatinsk nuclear test base in earlier times. However, this influence on forests has not been well studied yet.

For two centuries, large areas of pine woods have been destroyed entirely in the Turgai region as well as in a number of other regions of Central Kazakhstan. Mountain forests were under pressure by excessive cattle grazing, which lead to degradation of ground cover and destruction of natural regeneration. Unregulated cuttings in mountain forests, particularly in East-Kazakhstan and forest fires resulted in a reduction of tree species diversity and substitution of coniferous species by the less valuable broad-leaved and shrub species.

During the last 100 years the lower boundary of spruce forests location in the Zailiyskiy Alatau Mountains of the Northern Tien Shan have risen by 100-150 m up the hill slopes, therefore the range of spruce forests distribution shortened. The same happened in the mountains of Dzungarian Alatau, where the range of Silver fir shortened almost by three times. From 1966 to 1993, the productive capacity of softwood forests decreased by 7% (from 161 to 150 m³/ha), the area of Silver fir stands representing a special value due to its location at the edge of the natural area was reduced by 16% (from 459,000 to 384,000 ha).

Here, in the foothills the Severs apple tree grows on an area of 20,000 ha. Apple-tree forests, the traces of which are found in earth deposits of the Middle Cretaceous, represent a unique and worldwide renowned genetic resource. It is generally recognized that Severs apple trees commonly grow in wild fruit forests of Kazakhstan. The tree is the progenitor of current graded diversity of this most important fruit culture, its intra-specific polymorphism is of great importance for further selection and maintenance of this important fruit. Species of common apricot, hawthorn, barberry, honeysuckle, ash berry, wild rose, sea buckthorn and currant are also growing here and are equally important for genetic selection.

The distribution of wild fruit forests has decreased drastically during the last century. The main factors of degradation of these forests are the economic activities of people. First of all there are excessive cattle grazing, fires and negative impact of harmful organisms (depredators and illnesses). Degradation symptoms include reduction or absence of second growth, ageing of plantations or change of age structure, and steppification of forest land.

Lowland forests and riparian woodlands are subject to degradation in connection with the breakdown of hydrological regimes as a result of unjustified river control and breakdown of prevailing environmental conditions for their growth. Riparian woodlands have suffered from extremely strong negative effects in connection with withdrawal of a considerable amount of their areas for agricultural purposes during the reformation of the country's economy.

The condition of oak woods along the floodplains of the Ural River is of special concern. It is the only natural forest of this species in Kazakhstan. In spite of the fact that English oak (*Quercus robur*) is included in the Red Book of the Republic and any type of felling apart from sanitary cutting is prohibited, the area of its distribution has gradually decreased year by year. According to forest fund records of 2008, nowadays the area of oak woods is 2,600 ha, whereby 100 ha (3.8%) are occupied by young growth, 700 ha (27%) by middle aged plantations, 100 ha (3.8%) by ripening and 1,700 ha (65.4%) by mature and over-mature (old) stands. Uneven distribution of forest crops by age composition combined with the absence of young regeneration and principal plantings are already old demonstrating irreversible degradation of oak woods.

The condition of saxaul forests being considerably damaged by illegal logging and excessive cattle grazing also gives reason for concern. Organization of forest management in these forests in many cases does not take into account that these haloxylon deserts are the only source of pastures for local people of this region. During the design of forestry measures in these forests the carrying capacity and degree of their stability for the use as grazing areas are not sufficiently considered.

As a whole, the amount of desert zone forests (haloxylon deserts) in Kazakhstan decreased from 10 to 6 million ha. The lowering of saxaul grassland density (crown closure) is indicative of their degradation. It has been established that during the last 30 years stocking density decreased from 0.52 to 0.47. In recent years, haloxylon deserts have lost their ability of natural regeneration, as a result of which young growth is now only present on 11% of their total area. Low density and unsatisfactory progress in natural regeneration of this species and reduced artificial regeneration and afforestation due to insufficient investment clearly cause soil erosion by wind and total growing stock degradation on the dominant part of deserts such as Kyzylkum, Muyunkum sands and Sariyesik-Atyrau. Owing to their intensive use, the haloxylon deserts continue to degrade which results in massive desertification. Nowadays, 66% of the Kazakhstan territory is exposed to this process. Consequently, the problem of inventory and integrated assessment of haloxylon deserts' biodiversity as well as taking measures on their preservation is particularly urgent.

From 1997 to 1998, 3,308 forest fires occurred in the territory of 240,000 ha of forest area by damaging and completely destroying 4.3 million m³ of standing timber. During 1999, a total of 937 large natural fires were detected of which 946 were forest fires. The area affected by forest fires amounted to 26,500 ha.

Fires are especially catastrophic for coniferous woods. During the last years, the damage caused by forest fires increased ten times. The total sum of damage caused to forest management by fires was estimated at over 900 million Tenge only for the last three years. The largest forest fires were registered in the East Kazakhstan, Pavlodar and Kostanai regions. Up to 70% of all forest fires on forestry fund lands were caused by people.

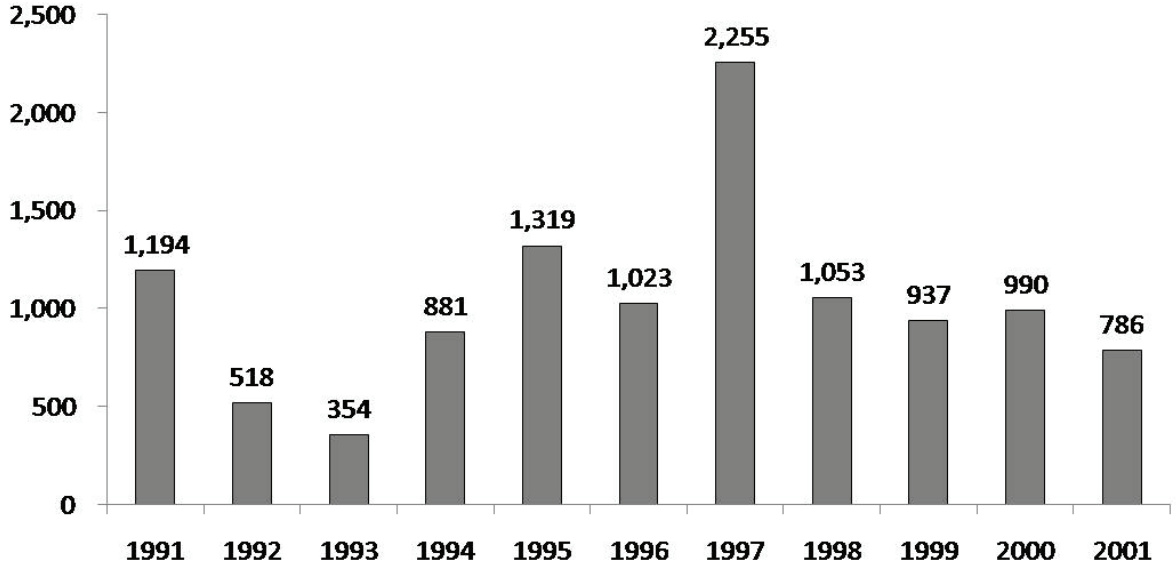


Figure 9: ***Frequency of forest fires in the period 1991-2001***

Fires cause considerable damage to forests. In the past, fires destroyed either totally or partially 250,000 ha of wood land (Figure 9). In 1997 alone, an area of 204,000 ha was affected by fire.

Insect attacks and illnesses have a destabilizing influence on forest ecosystems and their stability. Annually, centers of contamination by hazardous organisms are registered on an area of 100,000 to 300,000 ha. Alongside with that, weakening of sanitary and forest-protection measures during the last years as a consequence of shortage of funds for these purposes have resulted in the loss of many thousand ha of forests (Figure 10).

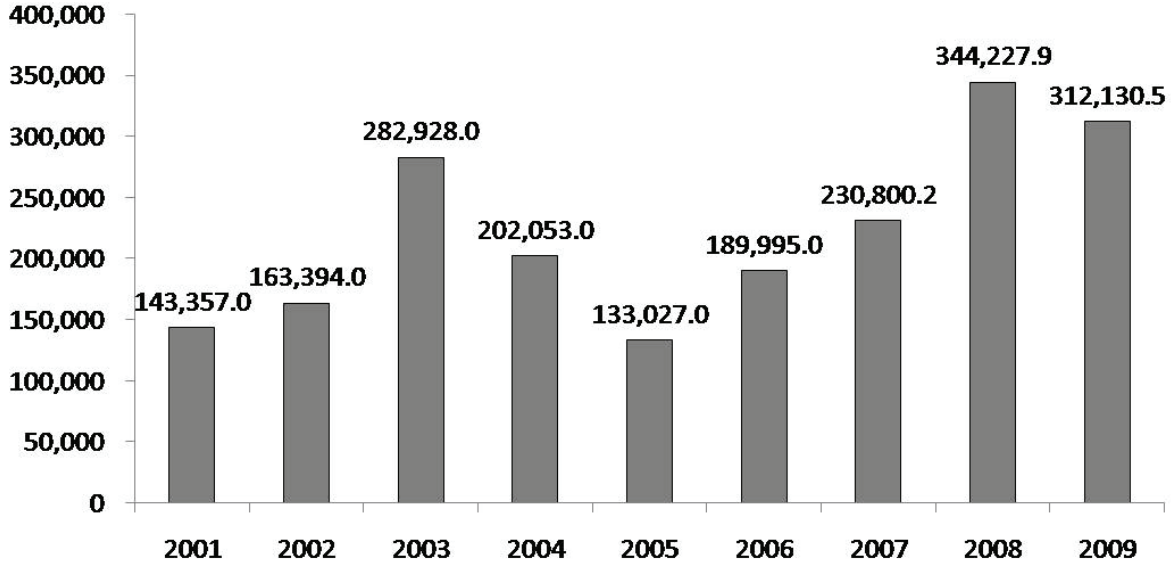


Figure 10: ***Forest areas affected by diseases and depredators***

The most severe hazards in the forests are caused by destructive insects (Figure 11) such as gypsy moth (*Lymantria dispar*), pine looper (*Bupalus piniarius*), under-bark bugs (*Aradus cinnamomeus*), European pine sawfly (*Neodiprion sertifer*), apple-leaf moth (*Hyponomeuta malinellus*), leaf-roller moth (*Cacoecia*) and seedworm (*Cydia pomonella*); and illnesses such as cancer, pitch streak (*Cronartium flaccidum*), pine fungus (*Fomitopsis annosa*), cenangios (*Cenangium femtginosum*), and fir-needle rust (*Chrysomyxa ledi*).

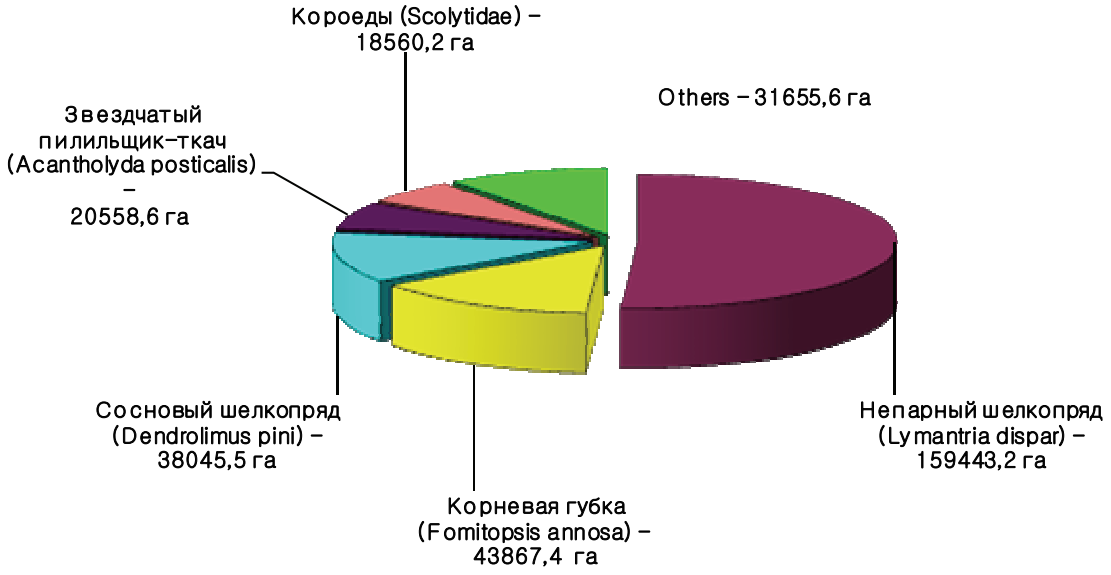


Figure 11: ***Forest disease and depredator centers as of January 2009 (in ha)***

During the last years yellowing of coniferous forests has been observed caused by a number of reasons such as lowering of ground water, drought, and fires. Forests are seriously affected by air pollution resulting in decline of their biological functions and destruction. One example is the die-back of relict Ridder pine wood in the city of Leninogorsk in the East-Kazakhstan province.

3.3. Impacts of Forest Degradation and Loss

Fundamental and applied scientific research substantially contributes to the assessment of the current status of forests and performance in the conservation and sustainable use of biological diversity. However, due to considerable shortage of funds during the last decades, applied scientific research in the field of conservation and sustainable management of biological diversity of forests has been insufficient.

No attention is paid to ecological and environmental education and training. Such training requires the development of national educational standards for different training levels and retraining of specialists in the field of environmental protection including the area of conservation and use of biological diversity.

Consumer attitude towards forests prevailing in the Republic during the last years led to a decline of its exploitable timber volume and considerable loss of vital protective functions. As wood is an important commodity in the market and a means to become rich, illegal cutting and arsons are widespread. In addition, the production of seeds and planting stocks practically stopped as many tree nurseries ceased their operations and thus the extent of silvicultural work drastically declined. The annual volume of new plantings (or seeding) did not exceed 9,000 ha.

The process of desertification of land increased as a result of intensive resource utilization and increasing anthropogenic impact. Especially, wild-fruit tugai and lowland forests were subject to strong degradation. During the last 35 years over 100,000 ha of these forests were destroyed in the Kyzylorda region alone.

Valuable coniferous forests of the Irtysh river regions and Kazakhstan Altai have been exhausted by timber cutting and fires. Continuous felling of forests in the river basins of Bukhtarma and Uba in the East-Kazakhstan region is responsible for the considerable loss of water in the Irtysh River. Because of the increasing demand for energy fire-wood, harvesting by people considerably increased. Consequently, in the South-Kazakhstan Region, clear-cut areas increased by 3000 ha during the last three years. During the last decades, the area of forest stands of turanga, oleaster and willow in the lowlands of Syrdariya, Ili, Karatal and other rivers were reduced by three times.

3.4. Desertification

Desertification is a significant global ecological and socio-economic problem. In the second half of the 20th century and with the rapid increase of the world's population, the absolute exploration of productive land and unprecedented rise of technological pressure on the natural environment, desertification became the main threat to social and economic safety and survival of mankind.

According to the UN Convention to Combat Desertification, desertification is defined as "*land degradation in arid, semi-arid and dry sub-humid areas resulting mainly from adverse human impact*".

The territory of Kazakhstan is practically entirely part of the arid zone and two thirds of it is already exposed to different levels of desertification. In 1994, the Republic of Kazakhstan signed and on July 7, 1994 ratified the UN Convention to Combat Desertification. Within the framework of assumed obligations a program of actions on desertification control has been developed. The document has been prepared by a multidisciplinary team under the jurisdiction of the Ministry of Natural Resources and Environmental Protection of the Republic of Kazakhstan, consisting of leading scientists, specialists of ministries, departments, scientific and survey institutions.

The reasons for the current desertification process in Kazakhstan are determined by a combination of natural conditions and specific aspects of use of land, water and forest resources. The landscapes of Kazakhstan as a whole differ by low tolerance of human impact. In the medium and long-term, an additional impulse to desertification is given by a wide range of climatic factors. Moderate intensity of anthropogenic impacts does not result in desertification and degradation of the environment. This occurs only in case of loss of self-regeneration capacity.

All in all, desertification processes are highly diverse, but in spite of this, the most common determining factors can be distinguished as follows:

- Destruction of vegetation cover due to the unsustainable use of pastures;
- Reduction of biological diversity, degradation of vegetation and wildlife species;
- Depletion, soil salinization and pollution of ground water and drying up of water sources;
- Strengthening of erosion of arid lands by heavy use for agricultural purposes without considering characteristics of soil cover; destruction of vegetation and soil cover for road and industrial construction, geological prospecting work, resource development, construction of population centers and irrigation structures;
- Destruction of forests;
- Destruction of fragile soil cover by heavy motor transport;
- Repeated salinization, alkalization and flooding of irrigated land; and
- Social and professional degradation related to culture and education of local population, loss of traditional forms and methods of management.

4. Forest Rehabilitation

4.1. Aims Pursued with Forest Rehabilitation

The situation of forest rehabilitation and afforestation in Kazakhstan has become critical due to a significant increase of non-afforested cutover stands, burned-out forests, and artificial open stands in the forestry fund area as well as poor financing of forest restoration work. Ongoing forest degradation poses a challenge to professional foresters of the Republic. Therefore, the main objectives of forest regeneration in the Forest Code of RK (Article 71) are defined as the timely forest rehabilitation on cutover stands, burned-out forests and other state forestry fund areas previously occupied by forests, improvement of forest species composition, and increase in their productivity.

Furthermore, Article 73 specifies that “measures on forest reproduction on the state forestry fund lands should be taken on the basis of the ecological and sanitary and epidemiologic requirements, by methods that ensure the establishment of highly productive and sustainable stands in the shortest possible period taking into consideration forest site conditions and economic feasibility. Therefore, the major long-term task of the forest management is rehabilitation of forest resources, increasing their capacity and nature protection characteristics using natural and artificial methods of forest rehabilitation. Overall, the obligation to rehabilitate cutover stands, burned-out forests and open stands of artificial origin by economically valuable species within the shortest possible period of time as well as controlled afforestation of treeless lands to increase the percent of forested area of Kazakhstan remains the main principle of the forest rehabilitation process.

4.2. National Policy on Forest Rehabilitation

Several long-term, medium-term and short-term concepts and programs for the forest industry sector development have been prepared in the Republic since 1992. However, none of them has been accepted by the Government of Kazakhstan due to the lack of necessary budgetary funds. Unfortunately, an appropriate forest policy which would include the system of long-term measures and principles, rules and regulations aimed at sustainable

development of all types of forest work including forest reproduction has still not been developed in the country.

Forest scientists such as S.Baizakov, A.Medvedeva, S.Iskakova and others, proposed to the Government to develop a project for a new national forest policy until 2020. The proposal has been accepted and recently work on the program document has begun. The following fundamental principles on the forest rehabilitation program are offered to be introduced into the national forest policy:

Forest reproduction and enlargement of forest lands on the forestry fund area shall be financed by the Government as outlined in the plans. Special attention shall be paid to the issues of improving forest seed production, enlargement of seed orchards, and rehabilitation of tree nurseries as well as the application of new technologies (such as container cultivation of the ball-rooted planting stock under controlled environmental conditions, and on degraded areas – with the use of mycorrhiza) for enhancement of the quality and volumes of plantings, sowing and natural regeneration processes. Priority should be given to forest rehabilitation on burned areas and cut-over lands including in the ribbon-like relict pine forests of the Irtysh region (625,000 ha), the Kazakh upland (Akmola and Karaganda Provinces), plain forests of Kostanai Province, and saxaul forests in the south and southeast of the Republic.

4.3. Methods of Forest Rehabilitation

Forest rehabilitation methods in Kazakhstan are in principle based on forest types. The forest type classification has been developed in line with research by the great Russian forest scientist G.F. Morozov promoting the approach of matching species composition and the type of forest planting with habitat conditions.

According to Article 73 of the Forest Code, forest reproduction on forestry fund areas should be carried out subject to ecologic, sanitary and epidemiologic requirements by methods that ensure highly productive and stable plantations within the shortest possible period of time. Accordingly, all regulatory and legal documents on forest management consider natural forest regeneration (without human intervention) as a priority both after timber cutting and for forest rehabilitation after fires, windfalls and other harmful interferences.

Seeding after mechanical soil scarification is undertaken in areas with poor natural regeneration insufficient for a complete rehabilitation. In case these measures are not enough, forest plantations (homogeneous stands - HS) are created by seed sowing or planting stock (i.e. 5-8 year-old trees with root balls) raised in tree nurseries.

A permanent tree gene bank (PTGB) has been established during the last five years to produce seeds with valuable hereditary characteristics and high genetic merits. These selected strains represent the basis of the seed plantations and mother-tree archives. In natural forests they separate the special-quality trees and forest plots as well as genetic reserves for preservation of the Republic's plants genetic material and its further use as genetically valuable material for forest rehabilitation. At present, this work is in progress and as of 01.01.09 the forest lands in different regions contain permanent seed plantations (164 units/2130.4 ha); temporary seed plantations (351 units/9275.6 ha); mother-tree archives (9 units/57.0 ha); plus trees (851 units); quality plantations (82 units/2096.0 ha); and genetic reserves (70 units/69620.0 ha). However, PTGB does not provide the forest management with genetically valuable seeds in full as yet. Therefore, they concentrate mainly on natural enclosures with high and mean productive capacity for certain forest sites, i.e. in normal stands.

North and Central Kazakhstan

Rehabilitation of pinewoods and birch forests in the northern and central parts of the country is carried out mainly by artificial plantings which are cultivated in tree nurseries during two to three years. Depending on the individual peculiarities of relief and soils as well as the availability of natural young growth of the principal species, homogeneous stands are created on the overall tillage or band tillage, i.e. by leaving inter-band spaces. The planting plans are very diverse and mostly depend on the growing conditions, used machines and mechanisms for soil preparation, method of planting and technology of protection against weeds and other undesirable vegetation. Mechanized plantings are carried out on areas accessible for machines and where natural forest rehabilitation processes are not feasible, mainly on glades, wastelands and burned-out forest lands. In open stands and cutover lands, which do not recover by natural means with the main species, artificial planting is carried out manually on partly prepared soils such as spots, furrows, holes and others. The main plans of homogenous stand creation presume the planting of 3,000 to 8,000 young plants on one ha. After 5 to7 years, 60% of stocking density is considered to be sufficient for establishment purposes.

Mountain areas of Kazakhstan

In the mountain areas of Kazakhstan Altai, North and West Tien Shan rehabilitation of fir tree (*Picea*), pine tree (*Pinus*), Silver fir (*Abies*), larch (*Larix*) and Siberian pine (*Pinus sibirica*) stands is carried out with 2 to3-year-old seedlings (for Siberian pine 5-year-old seedlings are used):

- In spots with dimensions of 1 x 1 m (600-800 spots for 1 ha), where plants are set out in clusters of five pieces;
- In furrows (with a slope ratio of up to 20 degrees) 0.6 to 0.7 m in width, which are carried out along the slope (cross-slope) 2.5 to 3.0 m distance from one another, the distance of plants in a furrow is 0.6 to 0.7 m, thereat one ha is set out with 4,000 to 4,700 plants;
- By terraces (the slope ratio is 20 to 30 degrees) 3.4 to 4.0 m in width, the distance between the terraces is 6.8 to 8.2 m. Planting is performed in two rows, 1.5 m between rows, 0.7-0.8 m in a row, one ha is set out by 4.0 to 4.6 pieces.

Homogeneous stands of apple tree (*Malus*), apricot tree (*Armeniaca*), Persian walnut (*Juglands regia*), almond *(Amygdalus*) and pistachio (*Pistacia*) plantations are established in the sub-zone of fruit-and-broadleaf mountain forests in South Kazakhstan. The area of these forests is rather inaccessible and therefore homogenous stands are established only on an area of 100-200 ha per year. Persian walnut and pistachio plantations are established by seed sowing and almond plantations by planting of two-year-old seedlings. Thereat soil preparation is carried out mainly by mechanical methods (spots, terraces), and manual planting. One ha contains 600-700 spots, where 5-10 seeds are sown or 5-6 seedlings are planted.

Desert regions

In the desert region of the country homogeneous stands of *Saxaul haloxylon* are established. The success of saxaul cultivation depends on the type of soils, degree of their salinity and ground water level. Taking into consideration the peculiar features of desert soils, strip soil preparation is applied for homogeneous stand establishment. At a strip-width of 1.4 m the inter-strip space equals to 2.8 m. Other spacing such as 2.8 X 2.8 m, 4.2 X 5.6 m is also used. The soil is worked at the depth of 25-27 cm. Sowing is carried out in autumn in the year of seed harvesting, particularly for seeds that do not stand long-time storage and thus

would loose germination power soon. About 2.5 – 5.0 kg of seeds is sown on one ha depending on quality class. The weight of 1,000 seeds is five grams on average. The highest (100%) survival rate of plantings is achieved with 1,100 viable germinating seedlings on one ha. Every year, 20,000 to 35,000 ha of homogeneous stands are created by this method. However, the survival rate of such species is very low (25-30%) due to the harsh natural climatic conditions, and sometimes all young seedlings perish due to late spring frosts.

Lowland forests

Rehabilitation of lowland forests along rivers such as the Ural, Irtysh, Ishim, Tobol is aimed at strengthening their water protection properties. The array of species for homogeneous stand establishment is very diverse and rehabilitation is carried out with the main tree species or shrubs depending on the habitat conditions:

- along the flood bed of the river Ural – English oak (*Quercus robur*), poplar white (black) (*Populus sp.*), white willow (*Salix sp.*), and
- along rivers such as Irtysh, Tobol and Ishim – balsam poplar (*Populus balsamifera*), weeping birch (*Betula pendula*), march elder (*Salix sp.*) and others.

Planting shall be made in spring by 1 to 2-year-old seedlings of annual rooted cuttings (willow, poplar). At overall tillage, spacing shall be 3 m between the rows and 1 m within a row, 3,000 to 3,500 pieces of plants shall be planted out on one ha. On the second (upper) river terrace on the shrub plots, the soil is prepared by spots with a size of 1.5 x 1.5 m. In each of the prepared 500 to 600 spots four seedlings are planted per one ha, corresponding to a density of 2,000 to 2,500 plants per ha.

Riparian woodland (tugai) rehabilitation along the floodplains of the rivers Syrdariya, Chu, Ili, Karatal, Aksu, Charyn and Lepsy which flow in the desert zone, aims at the preservation of the intra-zonal (i.e. within the forest site zone) vegetation performing important soil protection and water-protective functions. These forests consist of different shrubs such as willow (*Salix sp.*), tamarisk (*Tamarix sp.*), salt tree (*Halimodendron sp.*) and other timber species such as Asiatic poplar (*Populus diversifolia*) and oleaster *(Elaeagnus angustifolia*) as well as along the Charyn River – sogdiana ash tree (*Fraxinus sogdiana*). Riparian forests have been considerably damaged by fires and destructive insects. Their rehabilitation strongly depends on floods during the spring period. Thereat, the shrub vegetation rehabilitates considerably faster than tree vegetation requiring several decades for their recovery. Therefore, rehabilitation measures in these forests focus on the enrichment of the species composition by introducing fast growing and high-productive tree species such as poplar – *Populus*, tree-like willow - *Salix caprea* and other timber species.

Plantings were made on partially treated (furrow) areas as well as spots with the size of 1.5 m x 1.5 m. One-year-old rooted cuttings (poplar, willow) or one-year-old seedlings of oleaster and ash tree are mostly used for this purpose. About 2,000 to 2,500 plants were set out on one ha.

4.4. Forest Reclamation

Apart from forest rehabilitation, the work on forest cultivation, the so called forest reclamation, is also carried out in the country. Forest reclamation means creation of protective plantings (PP) on the land not forming part of the state forestry fund. According to their protective properties, these plantings are divided into:

- Field-protective forest belts (i.e. shelterbelts) of 9 to 12 m in width located on plains and on watershed areas for protection of fields from harmful effects of dry hot winds, snowstorms and wind erosion;
- Water regulation forest strips up to 15 m in width located on arable slopes for regulation of surface water (moisture) flow, reduction of soil erosion and improvement of environmental conditions of agricultural fields;
- Ravine forest belts (natural relief micro degradations) and gully forest belts (the result of water erosion of soils) are created with 15 to 21 m in width alongside the draws and ravines as well as inside them for protection from water erosion and for improvement of the environment on adjacent fields;
- Forest strips on irrigated lands alongside irrigation and water collection channels for evaporation control, lowering of ground water level, protection of fields from hot dry winds and dust storms;
- Forest strips and plantings on pasture lands to increase the carrying capacity as well as to protect animals from wind and hot weather;
- Coulisse (in strips) and massive (unstriped) forest ranges on sandy soils degraded by excessive grazing unused in the agricultural sector for sand stabilization and transformation of these lands into productive agricultural lands;
- Forest strips along the roads for protection from snowing and sanding;
- Protective and decorative plantings in and around rural settlements for environmental improvement; and
- Forest range on pit bings for their reclamation.

Generally, forest improvement plantations represent a system of different types and locations of forest strips (blown, partially blown, thick – i.e. not blown and other), which depend on tree and shrub distribution, species range and topography. The range of trees and shrubs is very diverse and is determined by the forest site of the planting zone, biological properties of timber species and the purpose of the protective planting.

One of the most important projects of forest reclamation is implemented in the dried bottom of the Aral Sea (DBAS). Intensive and irrational growth of irrigated agriculture in the past and aimless river flow withdrawal led to the loss of water and salt balance of the Aral Sea. Starting from 1961 the flow of water to the sea considerably decreased. In 1965, it was only 30 km^3/year and further declined to 3.5 to 7.9 km^3/year in the period 1980 to 1990. In some years the flow of river waters of the Syrdariya and Amudariya (in Uzbekistan) did not reach the sea at all. Consequently, the water level has decreased continuously until reaching 22 m at present. Nowadays, the Aral Sea has ceased to exist as a historically integrated water reservoir. In 1986, the Small Sea was completely separated from the Big Sea and later on, a number of separated water reservoirs were formed as illustrated below.

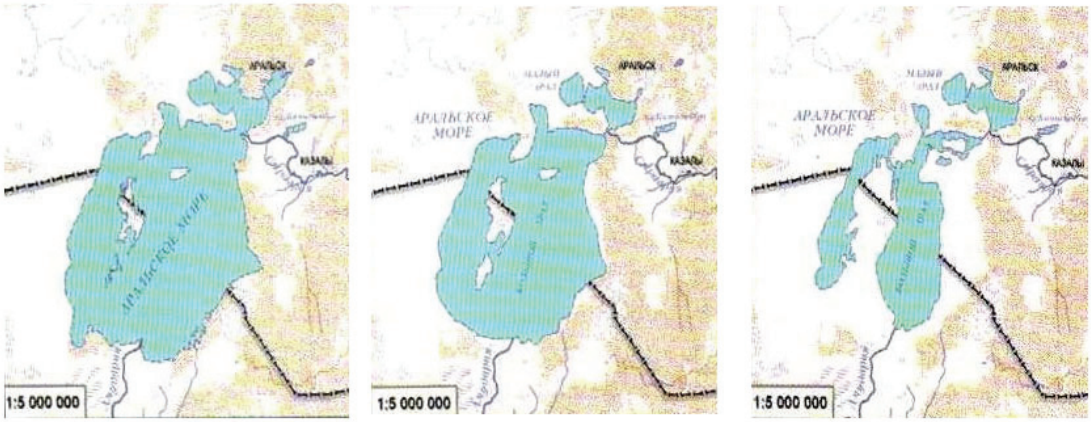


Figure 12: ***Progressive aggradation of the Aral Sea***

The retreating Aral Sea leaves behind a desert-like landscape (depicted in the images below) extending over an area of 36,000 km^2 causing an ecological crisis in the region. The land is covered by a thick layer of salt and different residual chemical compounds which are moved around by strong winds over long distances of 250-300 km. This has an adverse effect on agricultural crops, natural plantations, air quality and water and health of people and animals. Every year, 75-100 million tons of toxic salt and dust is removed from the DBAS.

Figure 13: ***Saline lands on the bottom of the Aral Sea (left picture); salinization of former croplands (right picture) (Photos taken by Z.B. Novitskiy)***

Under these conditions, a specific hydro-geological environment is gradually developing. A new ground water table with a depth between 0 to 3 m develops. The high salt content of the soil of 50 to 100 g/l gradually comes down along with the simultaneous soil detachment as one moves towards the original sea line. Timber and shrub vegetation can be met here only at 15-20% of the total area of the DBAS, out of which 36,500 ha are occupied by saxaul (*Haloxylon sp.*). They are mainly open stands at the age of 12-18 years with few trees per unit area.

In spite of the fact that every year there is no lack of seeds in such plantations, there is no natural colonization of saxaul due to shifting of seeds through wind and dryness during the spring period. This makes human intervention necessary in order to accelerate the process

of forest reclamation by creating stable, multi-year and productive tree and shrub communities using native wild species of plants resistant to stress, dry conditions and extreme salt content. From 1988 on, 54,000 ha of artificial protective plantings (APP) have been established on the lands of the DBAS. Their survival rate was very low (5-10%). However, at the age of 3-5 years individual surviving plants started to bear fruits thus supporting natural regeneration.

The main objective of forest reclamation work on DBAS is the prevention or considerable reduction of soil erosion processes. This was achieved by massive planting of 1-2 years old seedlings of saxaul (*Haloxylon sp.*), tamarisk (*Tamarix sp.*) and sarsazan (*Halocnemum sp.*) in rows with a distance of 5-6 m between rows and a distance of seedlings within rows of 1.0-1.5 m. First, the areas with sand and sabulous deposits were reclaimed. The content of ready soluble salts at a depth of soil layer of 5-30 cm should not exceed 45 g/l and groundwater depth should be between 1.5-2.0 m. In a next step, reclamation should be made on the lands of bottom deposits with wind-shifted sands and soils of higher salt content (50g/l). Further on, it is possible to establish reclamation plantings on the fine-textured bottom deposits with the wind-shifted sand layer with a soil depth of more than 10 cm and a maximum salt content of up to 60 g/l. Favorable forest site conditions (i.e. soils of primary development) allow the establishment of reclamation plantings by sowing of seeds of black saxaul, tamarisk and halocnemum. The strategies of their establishment are similar to those explained for planting homogenous stands.

4.5. Research and Development for Forest Rehabilitation

Until the 1930s, there were no scientific organizations in Kazakhstan addressing forest management problems. Therefore, the first research on forest reclamation and forest rehabilitation and afforestation was carried out by Russian scientists. Further on, several forest experimental stations were established in the country such as in Lebyazhinskaya oblast and Semipalatinskaya oblast. However, because of limited capacities for decision-making in all arising forest management problems, special laboratories and departments were organized at the newly created research and development and educational institutions of the country (Departments of Agriculture, Water and Forest Management, Botany, Forest Faculty under the umbrella of the Kazakh Agricultural Institute, 1948). In these institutions, systematic scientific research on forest management, planning and the establishment of homogenous stands was undertaken.

In 1975, the Kazakh Research and Development Institute for Forest Management and Agriculture (KazRDFMAI) was established. As a consequence, there was a significant progress in research work on forest cultivation and rehabilitation including the development of new types of homogeneous forest stands adapted to the specific site conditions of Kazakhstan. The development also included investigations on protective forest cultivation, especially on the establishment of shelterbelts in agricultural fields and introduction of new timber and shrub species.

Nowadays, scientific support to forest management is provided by the Scientific and Production Center (NPC) of Forest Management (former KazRDFMAI) as well as the Forestry Department of the Kazakh National Agriculture University (KazNAU).

On the basis of the scientific recommendations approved by the Committee of Forestry and Hunting Management (CFHM), a specialized organization called “Kazforestproject” has been charged with the task to carry out extensive fieldwork (forest inventory) in certain forestry enterprises with focus on the establishment of homogenous stands for a ten-year period. Based on the results obtained in forest inventory, the Republican State Enterprise (RSE)

"Kazgiproleshoz" will carry out design and exploration works for homogenous stand establishment taking into consideration the necessary expenses for each specific area. Scientific research, forest inventory and planning are financed by funds of the State Republican budget.

4.6. Evaluation of Past and Current Forest Rehabilitation

The increase of forest cover of Kazakhstan owing to homogenous stand establishment by sowing and planting of forest crops and protective afforestation generally occurred in the middle of the last century, notably during the 1970s and 1980s. During that period, the annual volume of work on forest rehabilitation varied between 80,000 and 88,000 ha including sowing and planting of forest crops on 70,000 to 76,000 ha and support to natural regeneration on 9,000 to 12,000 ha. These achievements were made possible because of sufficient financing, close interaction within several Union Republics, mutual exchange of scientific information and practical experience and certainly also increased capacity of professional staff.
From the mid 1990s onwards, efforts towards forest rehabilitation and afforestation, particularly planting of protective forests, almost stopped due to lack of funds. In addition, the homogenous stands on lands of the State Forestry Fund were reduced by more than 10 times (from 70,000/75,000 ha in the 1980s to 5,800 ha in 2000). The general provisions, plans, concepts, feasibility studies and other program documents concerning forest rehabilitation and afforestation pursuant to the directives and governmental regulations were generally not financed and thus not implemented.

Starting from 2003, forest rehabilitation and afforestation have regained momentum because of the new Forest Code and forest management programs as well as corresponding funding made available by the government.

At present, the regulatory and legal provisions for forest management continue to improve. Forest enterprises are financed by means of the Republican and local budgets. The programs "Forests of Kazakhstan" and "Zhasyl Yel" are being implemented based on the main policy on forest management of Kazakhstan determined by the Forestry Code of the Republic of Kazakhstan. This code regulates the ownership and command over the forests aiming at increasing ecological and resource potential of forests, rational use and sustainability of the forest resources, their protection, safeguarding and rehabilitation.

One of the resolutions of the Government of the Republic of Kazakhstan (No. 17, dated 10.01.2001) "On the approval of the sectoral program of the greenbelt creation around Astana city for 2002-2010" assists in mitigating negative climatic conditions around the capital city and creation of comfortable conditions for the life and recreation of the population. A green zone will be established by planting homogenous stands on 25,000 ha, whereby 20,300 ha will be newly established while on 4,700 ha measures for tending and maintenance of previous years' plantations will be carried out.

4.7. Summary of the Work on Forest Rehabilitation and Further Instructions

There is no doubt that the measures on forest rehabilitation and afforestation in the Republic implemented over a period of more than one hundred years deserve recognition. During this period, an excellent theoretical basis (regulatory, legal and methodological) has been created including typology of forests and scientific investigations allowing for a rational and sustainable forestry. On the basis of this inventory, works assessed the condition of forests

and the necessity of artificial rehabilitation of those areas, where there was not enough regeneration. In order to regenerate these areas through artificial forest cultivation, arrangements were put in place such as tree nurseries for the production of planting stock, special tools (ploughs, harrows, cultivators, etc.) and mechanisms like seed sowing machines, planting machines and other equipment. The major work on forest rehabilitation and afforestation was carried out in accordance with forest management plans.

However, based on the analysis of forestry activity and the condition of the existing homogeneous stands, the quality of the work performed in many ways depended on timeliness and total volume of available funds. In practice, forest management had always been funded below the required level and achieving of planned quantitative targets "by all means" did not encourage the quality of forest restoration work. Unfortunately, at present, this attitude still occurs as a survivor of the past. For example, there is a saying that "first you should provide a meal to people and then plant a forest".

All in all, further success related to the forest rehabilitation problem in Kazakhstan should proceed from the scientific basis of natural and artificial methods of forest rehabilitation. Thereat, emphasis should be placed on natural processes of forest rehabilitation which may be achieved by the implementation of progressive tree cutting methods allowing a high rate of survival of young growth on the cutting areas, its protection from damage or destruction by cattle and hazardous organisms as well as by seeding of areas intended for natural forest regeneration.

5. Possibilities in Forest Rehabilitation

5.1. Possibilities of Institutional Capacity

Forest administration, forest management and exploitation are performed today on a sufficiently stable legal basis. Nevertheless, for increased legal and institutional efficiency for forest rehabilitation it is reasonable to put in place procedures providing:

- Governmental support to private entrepreneurs cultivating forests (plantations) for different purposes at a level similar to that enjoyed by rural manufacturers; and
- Incentives to forest owners (state reimbursements) using genetically improved (highly productive, resistant to depredators and illnesses, etc.) seeds and planting material for forest rehabilitation and afforestation.

Forests and forest management will continue to be predominantly based on the governmental system of management. However, since it is considerably more difficult to manage large forestry enterprise areas, it will be necessary to down-size the areas to a level similar to that of forest management units in European countries.

5.2. Civic Engagement

In Kazakhstan, forest recreation and afforestation are generally managed by governmental institutions financed from state budgets. Their interrelation with private enterprises has not been observed hitherto.

Private initiatives are mainly limited to tree planting in gardens including small fruit trees, taking place on summer cottage (garden) plots allocated to people in suburban zones of

large cities. Promotion of tree planting in cities and villages is often organized by social organizations such as “Tabigat” association, Public Fund “Zhasyl yel Kazakhstan - XXI” and others, as well as by large enterprises and educational institutions. The work is mainly performed within the framework of actions planned by the local government bodies and financed from the local budget or more rarely by means of a separate project.

Unfortunately, separate projects are not always supported by local authorities and sometimes these initiatives are even discouraged. An example of this is the attempt to establish an industrial poplar plantation on using waste waters of the “Sorbulak” sewage pond round Almaty which failed because of the lack of timely financing.

Civic engagement into forest cultivation can be effective provided there is governmental support to promote forest product markets in this sector. At present, only the wealthy people can cultivate forests as far as this process requires long-term (not less than 10-15 years) investments. One of the approach of civic engagement in forest cultivation is the land lease (family contract) already approved in agriculture or leasing forests for a long-term period gradually being introduced in forest management. It is necessary to support private forest cultivation and to direct such investments to all forest areas, particularly for the production of timber for local resources. The natural and ecological potential of regions will improve and this will guarantee employment of the local population thus improving the standards of living at village level.

5.3. Education on Forest Rehabilitation

Soviet academic institutions traditionally focus their education in forestry on fundamental knowledge and forest management questions such as forest fire protection, forest pest and disease control, production of planting stocks in tree nurseries, establishment of homogenous stands and forest reclamation, forest regulation and rational use of other forest values. During the soviet period, higher education was well organized and professional, basically connected with substantial practical training conducted at field level.

At present, the situation is quite different. The standard educational programs of special disciplines in forestry do not meet the up-to-date requirements of forest sector development. In this context, the readiness of graduates to successfully implement field activities is weak, the material and technical facilities in educational institutions have become outdated, the quantity of materials, equipment, practical training aids are insufficient and the scientific and methodological literature is incomplete. There is also a shortage of skilled teachers in special disciplines.

In order to improve training of forest sector specialists it is necessary to:

- optimize the network of specialized secondary and higher educational institutions in the field of forest management;
- develop the content of educational programs taking into consideration recent scientific achievements and forest management demands as well as state-of-the-art methods in wood products manufacturing;
- develop the innovative technologies, forms and methods of training including distance education;
- develop the educational and methodological basis and information support of educational programs corresponding to the best national and foreign standards; and
- monitor current and long-range demand in specialists in the forest sector and carry out analysis of graduates’ employment.

5.4. Demand for Research and Development Activities

In order to improve the forest rehabilitation process and increase the amount of forests in the Republic, the scientific support of the forest sector should be directed to the following tasks:

- development of an integrated and environmentally safe system of forest fire protection, prevention of illegal cuttings and other forest damages, forest protection from depredators, diseases and other man-made impacts based on site-specific and regional ecological land characteristics;
- preservation of forest biodiversity by the monitoring of forest health and careful use of forest resources, development of forest seed genetic stock and the electronic database of selected and seed production facilities;
- development of selected genetic and biotechnological investigations, cellular engineering and micro-clonal propagation, crop variety testing and breeding of ligneous plants;
- improvement of the existing methods and technologies of forest planting on degraded lands of the ribbon-like relict pine forests of the Irtysh region, the Ural river lowland, in the wild-fruit belt of North and West Tien Shan and in the desert zone of the country, as well as planting of stable homogenous stands on the dried bottom of the Aral Sea;
- development of new methods and technologies for the establishment of industrial plantations of fast-growing trees; and
- investigations in the field of landscaping in cities and populated localities as well as protective plantings (greenbelts) around them, taking into consideration diversification of woody plants and brushwood and application of high technologies in planting of ball-rooted planting stock and mycorhiza.

5.5. International and Regional Cooperation in Forest Rehabilitation

At present, the Republic implements six international forest-related projects:

- World Bank Project “Preservation of Forests and Increase of the Amount of Forests in the Republic” (2006-2011), the purpose of which is preservation and rehabilitation of biomes of the ribbon-like pine forests of the Irtysh river region and saxaul plantations of Kyzylorda region, maintenance of the forestry-based industry of the Republic, development and adoption of ecological standards of grazing in haloxylon deserts and improvement of the overall forestry management system;
- GEF/UNEP Project “Establishment of Training Center Network for SPNR Staff by Using Available Experience” (2006-2008);
- UNDP/GEF Project “Preservation and Sustainable Use of the Biological Diversity of the Kazakhstan Part of the Altai-Sayanskiy Ecoregion” (2007-2011), the purpose of which is preservation of the globally valuable biological diversity in this part of the country;
- GEF Project “Complex Preservation of High-Priority Globally Valuable Wetlands as Habitat of Migratory Birds with demonstration on the ground in the following three areas: Alakol-Sasykkol and Tengiz-Kurgaldzhinskaya Lakes and the Ural River Estuary” for the purpose of elaboration and demonstration of new approaches to conservation and sustainable use of biological resources of the globally valuable wetlands;
- Joint participation project of Russia, China, Kazakhstan and the Islamic Republic of Iran with the support of the International Program of Environmental Conservation (UNEP, 2005-2010) “Development of Wetland Flyways for the Preservation of the Siberian Crane and Other Water Birds in Asia” for the protection of flyways of the

Siberian white crane and other water bird populations, the fly-lines of which run through the Asian countries including Kazakhstan; and

- Project of the Government of RK/GEF/UNDP "Preservation of *In-Situ* Mountain Agrobiodiversity in Kazakhstan" (2006-2011) for the purpose of *in-situ* conservation and sustainable use of biological diversity of the mountain wild-fruit apple tree (Malus), apricot (Armeniaca) and other wild-fruit tree forests.

International cooperation in the field of forest management and forest rehabilitation in particular are determined by the multipurpose character of the management of forests and the importance of their role in the improvement of environmental conditions. Therefore, the priority in international cooperation should be directed towards existing agreements signed by the Kazakhstan Republic with regard to sustainable development, protection and use of plant and animal life, water bodies, the atmosphere and specially protected nature reserves. Such agreements include the UN Convention on the Conservation of Biological Diversity, the UN Convention to Combat Desertification, the UN Framework Convention on Climate Change and others.

However, many values of forests are exterritorial and can have positive or negative effects on the ecology of neighboring countries, particularly through forest fires, depredators and diseases as well as desertification processes. Therefore, Kazakhstan should establish agreements with neighboring countries on the following issues:

- Protection and prevention of near-border forests from fire and spread of harmful forest organisms;
- Joint monitoring of near-border forests with respect to their sanitary state and regular sharing of information on the current forest fire and phytosanitary situation;
- Joint establishment of trans-border specially protected zones and nature reserves; and
- Organization of a Coordination Council on ODAM issues; i.e. development of a feasibility study and the international program on desert reclamation, addressing the specific problems of forest reclamation of deserts within the transboundary region of the adjoining Republics of Kazakhstan and Uzbekistan.

6. Future Steps

The expanded reproduction of forests and growth of forest areas within the forestry fund will be financed by the Government. Thereat, special attention will be placed on the improvement of forest seed production, enlargement of seed orchards, the renewal of the tree nurseries system employing new technologies (e.g. container for growing ball-rooted planting stock under controlled environmental conditions), to the quality and volumes of plantings and sowing, and support to natural forest regeneration. As a matter of priority, there will be considerably intensified work on the afforestation of burned areas and cutover lands (625,000 ha) in the ribbon-like pine forests of the Irtysh river region, Kazakh upland and the plain forests of Kostanai region, and in the saxaul plantations in the south and southeast of the Republic.

For the establishment of homogenous forest stands with coniferous species, preference will be given to the block-strip method with sufficient inter-block spaces. Plantations established by this method are less sensitive to fires and are more resistant to diseases and depredators. In addition, the process of forest recovery and ecological development by means of natural regeneration will be promoted, thus considerably reducing the investments needed for forest rehabilitation.

With respect to the rehabilitation of haloxylon deserts, an array of methods such as natural seed and vegetative propagation, annual artificial plantings and sowings will be employed.

Corresponding measures in supporting market relations in the field of forest cultivation will be taken. Thereat, the land lease system will be approbated, which can considerably help to expand forest areas involving various stakeholders in this business. The experience of the state support of manufacturers which is currently successfully applied in the agriculture sector of Kazakhstan will be used in private forest breeding and forest plantation of fast-growing species. Priority will be given to the south and southeast of the Republic possessing cheap labor forces, irrigated areas and unfavorable natural climatic conditions. Private forest plantations will be turned into one of the most important entrepreneurial business aimed at considerably expanding forest areas and local timber resources, improvement of natural and ecological quality of the regions, guaranteeing employment of local people and thus raising the living standards in the country.

All in all, the new forest policy of the Government is directed towards progressive development of the forest sector in all directions, particularly proper protection of forests, expansion of the forest area, and site-specific management and operations in order to increase overall forest productivity. Thus, in Kazakhstan the forest sector strives to improve existing preconditions for successful forest rehabilitation and cultivation comprising the presence of sufficient land for forest expansion, the provision of a sufficiently large labor force, adequate planting stock production, as well as sufficient financing. Generally, in the years to come, the implementation of programs on extended forest reproduction and expansion of forest areas alongside with their proper protection should be considered as the main focus of progressive development in the forestry sector.

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Mountains and foothills in Kazakhstan (Photo taken by Stanislav Kuznetsov)

Mountain forests at Lake Kolsay, Kazakhstan (Photo taken by Stanislav Kuznetsov)

Steppe ecosystem in Kazakhstan (Photo taken by Alexey Melnikov)