

Forest Rehabilitation in the Republic of Uzbekistan

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Summary

The Republic of Uzbekistan is a Central Asian country that borders Kazakhstan, Kyrgyzstan, Tajikistan, Afghanistan and Turkmenistan. The total area is 447,400 km². Approximately, four-fifth of the territory of Uzbekistan is occupied by desert plains; eastern and south-eastern areas of the country include mountains and foothills of the Tien Shan and Pamir-Alai mountains. The climate is characterized by continental and subtropical conditions. The population of the Republic of Uzbekistan amounts to around 28 million people (data of end of 2009) with an annual increase of 483,100 people or 1.8%.

As of January 1, 2008, the State Forest Fund of the Republic of Uzbekistan has comprised 8.66 million ha of which 3.24 million ha are covered by forests including 594,883 ha of artificial forest plantations. The percentage of forest land, i.e. ratio of the area covered by forests to the total territory, is 7.3%.

Based on soil climatic conditions, the forests of Uzbekistan are divided into the following categories: desert, valley-tugai (floodplain) and mountain. The current appearance of the country's forests is very different from the original forests in terms of composition of forest species, density and area distribution primarily due to changing of climatic conditions towards aridity. The decrease in forest areas and deterioration of their condition over the last 200 - 300 years is also connected with anthropogenic pressure such as tree felling, uncontrolled livestock grazing and fires.

All forests in Uzbekistan, both existing and newly established ones, have protective and land reclamation values. This means that the better forests fulfil or will fulfil their forest reclamation functions, according to their value orientation. Therefore, the objectives of reforestation and afforestation for different climatic zones of the country have their own characteristics, though all are aimed at strengthening the reclamation functions.

Artificial afforestation has been initiated on the territory of Uzbekistan as a government policy priority since the late 19th century. Forest science has developed a large number of recommendations on afforestation under various edaphic conditions such as in the sand-desert zone and on the dried bottom of the Aral Sea, the valley-tugai, and in the mountain zones. The country's forestry profession has accumulated a large and sometimes unique experience on afforestation under the most extreme arid conditions.

After independence the role of forestry has become more important. In the social sphere, the need of the local population for use of forest resources has increased significantly as has the necessity in meeting recreational needs within the country.

In the field of ecology, the country now has international commitments relating to the conservation of biological diversity, the mountains of Central Asia being one of the 32 global biodiversity hot spots. One of the major challenges is to address the problems associated

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with combating desertification including afforestation of the dried bottom of the Aral Sea and stabilization of irrigated agricultural landscapes. The growing water shortage pays higher importance to the water conservation role of forests in the mountains, i.e. watershed management in headwater rivers.

As stipulated in the national forest programme, Uzbekistan's forestry is now on the eve of significant reforms. These necessary reforms have taken shape, but their implementation depends on many conditions ranging from professional training of branch' specialists to financial provisions. The implementation of the NFP will inevitably lead to necessary institutional changes in the management of the industry and the involvement in forest management not only of professionals but also of other stakeholders.

1. General Information

The Republic of Uzbekistan is located in Central Asia. It borders Kyrgyzstan (in the northeast and east), Kazakhstan (in the north and northwest), Turkmenistan (in the southwest), Afghanistan (in the south), and Tajikistan (in the southeast). The territory of Uzbekistan stretches from southeast to northwest. The northernmost point is located at the northeast side of the country at the Ustyurt Plateau (45°36' northern latitude) whereas the southernmost point is located at Termez City (37°11' northern longitude), and the westernmost point at the Ustyurt Plateau (56 northern longitude), and the easternmost point, southeast of Fergana Valley (37°10' northern longitude). The distance between extreme northern and southern points is 925 km, and 1,400 km - between western and eastern points (Anonymous, 1).

The territory of the Republic has a general inclination from southeast to northwest leading to an inland lake, the Aral Sea. The main part of the country is located between the largest rivers of Central Asia, Amudarya and Syrdarya. Nearly four fifth are plains, mainly the Turan lowlands and only in the far east there are mountains belonging to the systems of the Tien Shan and Gissar-Alay mountain ranges.

In ancient times, the Great Silk Road passed through the territory of the country linking eastern (Asian) and western (European) countries.

1.1 Geographic Information (Anonymous, 2)

Relief: Based on the topography, the territory of the country is divided into plains, sub-mountain and mountain areas.

The plains cover the Ustyurt Plateau, the alluvial-deltoid plain of Amudarya and Kyzylkum.

- Ustyurt is a wavy plateau with prevailing hills of 200 – 250 m asl; it is delimited by ledges from adjoining plains
- The alluvial-deltoid plain of Amudarya sits at lower elevations. The relief is flat (height up to 100 m asl) with not many hills
- Kyzylkum is an upland plain with hills ranging from 100 m in the northwest to 200 – 300 m in the southeast. There are several mountain formations with elevations of up to 1,000 m. They have rocky slopes sharply cut by dry erosive valleys. Mountains are separated from each other by sandy massifs with distinct forms of aeolian relief. There are closed caves and hollows, some of them below sea level (up to 12 m).

The sub-mountain and mountain part includes mountain ridges of the Tien Shan and Gissar-Alay mountains, and intermountain depressions separating them. The elevation of ridges is up to 4,000 m and higher (reaching 4,643 m at Gissar mountain ridge). There are ridges of the Western Tien Shan located in the extreme northeast: Karjantau, Ugam, Pskem, Chatkal and Kuramin. The Fergana Valley and Tashkent-Mirzachul sub-mountain plains separate the Turkestan ridge (Gissar-Alay) and its western branch (Malguzar and Nuratau) from this group of ridges. Towards the south, there is the Sanzar-Nuratau Valley while in the extreme south of the country there are the Kashkadarya and Surkhandarya Valleys separated by the Gissar mountain ridge.

Climate: The climate of Uzbekistan is continental subtropical with a long and dry hot summer, a cool damp autumn and a mild winter with little snow. The winter period in the plains and lower foothill areas lasts from one and a half months up to two months in the extreme south and up to five months in the extreme north (at Ustyurt). The average temperature in January is about -8°C (at Ustyurt), in the extreme south in Sherabad it is 3.6°C. An absolute minimum in the country is -37°C. The average temperature in July in the northern areas is up to 26°C, and over 30°C in the south. At an elevation of 3,000 m, the temperature is about 10°C. The absolute maximum temperature measured in the lowlands and foothill areas is about 42°C. In summer time, during the afternoon, the temperature on the land surface can reach 60°C, and even 70°C in sandy deserts.

The minimum precipitation in the lowlands amounts to 80 – 90 mm annually. In the east and south, rainfall increases slowly with the increase of elevation. Further up as mountain ridges are approached, precipitation rapidly increases and in some places it can reach and even exceed 890 – 1,000 mm per year. Over 70% of precipitation falls during winter and spring time. Snow cover is formed almost annually, but it is often unstable in the lowlands and foothills, and remains for several days only. Now snow heights vary from several centimeters in the west up to 60 - 80 cm in the east (i.e. in foothills and mountains), and sometimes exceed 100 cm in the mountains.

Inland waters: An extremely non-even distribution of rivers throughout the territory is typical for the country. Rivers are especially underrepresented in the lowlands. When reaching the plains, a large proportion of their water is used for irrigation and they often get dried out. There is a branched river network in the mountains. All rivers belong to the Amudarya Basin and the Syrdarya Basin. Most of the rivers are fed by glaciers with a maximal charge in June. Annual water discharge of the Amudarya is about 79 km³ on average representing half of all runoff formed within the mountain ranges of Central Asia. Out of them around 6 km³ are supplied by the mountain areas of Uzbekistan. The runoff of Syrdarya is around 38 km³, of which 4 km³ lies within Uzbekistan. Most of the tributaries of the Syrdarya are being fully withdrawn for irrigation purposes and do not reach the river.

Lakes are mainly located in valleys and in deltas of large rivers and at the periphery of irrigated oases. The largest lake is the Aral Sea the size of which has substantially decreased due to withdrawal of water from the Amudarya River and the Syrdarya River for irrigation purposes. There are also artificial lakes that have been created as water reservoirs such as Kattakurgan, Chardarya, Charvak, and others.

Soils: Sandy soils prevail in the upland plains of Kyzylkum, grey-brownish soils in the interior mountains and ancient detrital cones, takyr and takyr-type soils in depressions. In the foothill belt and low mountains sierozem soils of three types namely light (from 250 up to 400 m), typical (400 – 700 m), dark (700 – 1,200 m) are commonly found. At the medium elevation belt (1,200 – 2,800 m) brown and brownish mountain-forest soils are dominant and in the highlands (over 2,800 m) light-brown grass-steppe soils prevail. Hydromorphic soils (alkaline

lands, meadow, meadow-marsh and marsh) can be found on low-runoff foothill plains and river valleys. Irrigated soils are classified according to a special typology.

The soils of Uzbekistan, and especially those of desert ecosystems like gray-brownish, takyr, and sandy soils, have a low level of humus (around 1% in upper soil layer). Grey soils, i.e. sierozem, also have low level of humus that is explained by insignificant organic residual and their rapid rate of mineralization.

1.2 Demography

As of January 1, 2008, the population of the Republic of Uzbekistan has been 27.55 million (Anonymous, 3) people and has grown annually by 483,100 people or 1.8%. The natural growth of the population is 508,900, out of them 331,800 (65.2%) live in rural areas. The urban population makes up 37%, while 63% of the total population live in rural areas.

Uzbekistan is a multinational country, with representatives of more than 100 nationalities living there. The main part of the population are Uzbeks, representing almost 80% of the total population. Russians are less than 5.5%, Tadjiks 5%, Kazakhs 3%, Karakalpak 2.5%, Tatars 1.5%, Kyrgyz 1%. Uzbeks, as well as other Central Asian people profess Islam, while Russians and other representatives of Caucasians are Christians.

The Republic of Uzbekistan, as well as other states of Central Asia, is characterized by a relatively “young” population and large proportion of people in an able-bodied age. The relative population density of younger than able-bodied age in the total number of population comprises 39%, of able-bodied age 54%, and older than able-bodied age 7% (Anonymous, 4). The ratio between males and females comprises 1:1.003. According to Goskomstat’s [State Committee for Statistics] data, 249,000 marriages and 16,100 divorces were registered during 2008.

The official language is Uzbek with more than 74% of the population speaking Uzbek. The Russian language is widely used in the cities and over 14% of the population is speaking it regularly. The largest city of Uzbekistan is Tashkent, the capital city of the country, with a population of 2.3 million people (Anonymous, 5). From the administrative point of view, the territory of Uzbekistan is divided into 12 regions, one autonomous Republic, and one capital city.

1.3 Natural Resources

The Republic of Uzbekistan has great mineral and raw material potentials, unique agricultural raw material, significant volumes of semi-finished goods, and a well developed infrastructure. A wide range of minerals (around 100 types), of which 60 are already used in the national economy, can be found on the territory.

The main energy resources of the country are natural gas (confirmed reserves of up to 2.0 trillion m³, including large deposits at Shurtan (0.5 trillion m³) and Alan with an estimated 0.2 trillion m³, coal deposits (at Angren with reserves of up to 1.9 billion t of brown coal), reserves of uranium ores (up to 230,000 t of uranium, including the largest deposit in Uchkuduk), and hydraulic power mainly from large rivers such as Chirchik, Akhangaran, Surkhandarya, and many other smaller streams (Anonymous, 6).

Being ranked 55th in terms of territory and 39th in terms of population, Uzbekistan is among the world leaders as regards:

- Reserves of silver, tungsten and phosphorites, potassium, rare-earth metals and other valuable minerals. In terms of gold reserves Uzbekistan ranks 4th in the world, uranium 7th, molybdenum 8th, natural gas 14th; and in terms of confirmed reserves of copper 10th;
- Area of artificially irrigated lands ranks 11th in the world;
- Production of astrakhan fur [karakul] ranks 2nd, cotton 5th, raw silk 6th in the world;
- Extraction of cadmium ranks 3rd, uranium 6th, gold and natural gas 8th, it is also among the 15 largest countries of the planet concerning extraction of molybdenum, feldspar and a number of other types of industrial raw material;
- Uzbekistan is in the second top ten of countries which produce sulfuric acid, nitrogen fertilizers, mineral lubricant oils and paraffin, cotton yarn and fabrics, tomato paste, dried fruits, harvesting of cucurbitaceous and grapes, shearing wool, rail freight turnover; and
- In terms of exporting: cotton fibers ranks 2nd and uranium ranks 3rd in the world.

1.4. Socio-Economic Situation (Anonymous, 7)

In 2008, Uzbekistan's GDP was UZS 36,839.4 billion (109% compared to 2007) that makes UZS 1,316,000 per capita. In the structure of GDP the production of goods accounted for 45.4%, services 45.3%, taxes on goods and export-import transactions 9.3%. While 79.4% to GDP falls in the non-government sector of the economy and 20.6% in the government sector. The volume of industrial output has made UZS 23,679 billion (112.7% to 2007), consumer goods UZS 7,436.5 billion (117.7% to 2007), and agricultural products UZS 10,479.6 billion (104.5% to 2007).

The share of non-state enterprises in the total number of registered enterprises accounted for 93%, of which 56.0% farm and dehqan entities, 20.8% private enterprises, 0.9% enterprises with participation of foreign capital, 0.4% joint-stock companies, and 21.9% other enterprises. The share of the non-state sector accounted for 79.4%.

UZS 2,193.7 billion of foreign investments were brought into the country in 2008, including UZS 601.9 billion in the form of loans. Foreign trade turnover has reached USD 1.9 billion (121.4% to 2007), including export USD 1.16 billion (60% to the total trade turnover), import USD 0.75 billion (39.3% to the total amount). Exports mainly include energy resources and oil products (25.2%), whereas imports mainly include machines and equipment (53.3%).

The number of people employed in the economic sector in 2008 was around 11 million, representing an increase by 2.8% in comparison with 2007. The total number of people employed including government employees amounts to 15.6 million. The increase in workforce resulted from the higher number of employed people in the non-production sector by 3.2% and in the production sector by 2.6%. About 44% of able-bodied people are employed in the agricultural sector, 20% in the industrial sector, and 36% in the services sector.

In 2008, approximately 623,300 unemployed people registered with the government for assistance in job-seeking. Out of the total number of citizens seeking employment, 72.1% are from rural areas. Due to state programs on development of the services industry, cattle breeding and in-house jobs, 660,900 new workplaces were created during 2008.

In order to support the local economy, various measures provided for in the anti-crisis program (approved in November 2008) have been carried out during 2009. A number of privileges and benefits, including credit and budgetary assistance, have been provided to domestic enterprises. For the purpose of increasing competitiveness of domestic production and stimulating of domestic demand a number of activities on reduction of production costs are currently being carried out. The implementation of a localization program had an import-substituting effect amounting to USD 296.9 million which is 1.7 times higher than the results achieved in the same period in 2008. In addition, various projects are being planned which will be implemented in "Navoi", a newly created free industrial economic zone. Currently, the necessary facilities and external communications in the zone itself are established.

1.5. Land-use (Anonymous, 8)

Agriculture: The gross output of the agricultural sector in 2008 reached UZS 10,479.6 billion, or 104.5% compared to 2007, including crop production (UZS 5,605.5 billion) and cattle breeding (UZS 4874.1 billion). The largest contributions to the agricultural production was made by the Samarkand Region (13.4%) and Tashkent Region (12.1%), followed by the Andijan Region (9.2%), Bukhara Region (9.2%), and Kashkadarya Region (9.1%).

Crop production: The basis of agricultural production of Uzbekistan is irrigation farming at flat oasis locations with well developed irrigation infrastructure. However, irrigation is carried out as a rule by furrows resulting in significant losses of water. In addition, using this technique of irrigation under flat conditions leads to an increase of the water table resulting in a source of secondary salinization of the soil. Up to one third of irrigated arable land of the country is subject to soil salinization of different degrees. During previous years greater attention has been paid to land reclamation of irrigated arable land and significant funds for improvement of the drainage network have been invested. Pilot projects on the use of drop irrigation are being implemented.

The total area of planted agricultural crops expands over 3.6 million ha. After gaining independence from the Soviet Union, one of the priorities has been to achieve self-sufficiency in grain production. During the Soviet regime, the area of irrigated arable land had been allocated primarily to cotton. After independence the distribution of arable irrigated land for agricultural crops shifted mainly towards grain crops reaching 1.56 million ha in 2008. The share crops included cotton plantations (1.43 million ha), vegetables (162,300 ha), potatoes (59,900 ha), gourd plantations (42,200 ha), fruits and berries crops (214,400 ha), and grapes (125,400 ha). In total, 6.73 million tons of grain was threshed, including 6.15 million tons of wheat. The average crop yield per hectare reached 4.28 metric tons. The other harvested crops included 3.4 million tons of raw cotton, 1.4 million tons of potatoes (yield 19.53 metric tons/ha), 5.22 million tons of vegetables, 981,200 tons of gourds, 1.4 million tons of fruits and berries, and 791,000 tons of grapes.

Cattle breeding: The share of cattle breeding in total agricultural production is about 46.5% and has been developed in specific zones on the basis of natural conditions. Astrakhan sheep breeding is based on semi-arid and arid pastures. In foothill and mountain dry zones, there is breeding of meat-fatty sheep and goats; in irrigated zones mostly meat-and-milk cattle breeding as well as meat-fatty sheep breeding and poultry farming. There is also breeding of horses and camels. Silkworm breeding is one of the oldest sectors of agriculture practiced in irrigated zones.

The number of livestock is estimated at about 8 million heads of cattle. Annual production of meat in live weight amounts to 1.29 million tons. Also, 5.43 million tons of milk, 2.43 billion

eggs, 23,800 tons of wool, 896,800 fells of astrakhan sheep, and 23,500 tons of silkworm cocoons are produced.

Industry: The main energy resource of the Republic is natural gas, the extraction of which is concentrated mainly in the Ghazli and Karshi areas. Oil is primarily extracted in the Fergana Valley and Bukhara Region. A new oil field was discovered in the western part of the Fergana Valley. Coal is being extracted near Tashkent, Denau and in the Fergana Valley.

Industrial processing of deposits of nonferrous metals, including zinc, copper, lead, tungsten, and nonmetallic minerals (feldspar, quartz, limestone, calaite) is being carried out. Gold is exploited in the Basin of the Zerafshan River and the Kyzyl-Kum Desert. Extraction of uranium is reported from the Fergana Valley.

In 2008, the industrial sector has produced goods of a total value of UZS 23,679.0 billion representing 112.7% of the value achieved in 2007. The basic sub-sectors of industrial production are fuel and energy, the share of which amounted to 29% of the total volume of industrial production. The contributions of mechanical engineering and metal processing (16.2%), nonferrous metallurgy (12.6%), light (12.9%) and food (9%) industries are significant.

Power generation accounts for 50.1 billion kw/h. The extractive industry also produced 4.8 million tons of crude oil and gas condensate, 685,700 tons of steel and 643,000 tons of rolled iron, about 1.0 million tons of mineral fertilizers, 195,000 cars, 6.65 million tons of cement, 1.17 million tons of cotton fibre and a range of other goods.

The most significant production of industrial output and consumer goods has been reported from Tashkent and the Tashkent Region, the Andijan Region, the Kashkadarya Region, the Navoi and Fergana Regions.

Urbanization: (*Anonymous, 9*): More than 42% of the country's population lives in cities. The largest city of Uzbekistan is Tashkent, the capital city with a population of 2.3 million people. More than half of the Russian population of Uzbekistan lives in Tashkent City. In 1966, there was a destructive earthquake, but the city was quickly re-built. Major parts of the industry of the Republic are concentrated in Tashkent City with main roads passing through it. The city is the center of the country's economy, education and culture. The second largest city is Samarkand (404,000 people). Samarkand City, famous for its architectural monuments, used to be the capital of the Uzbek Soviet Socialistic Republic until 1930. A number of large cities are located in Fergana Valley and include Namangan (300,000 people); Andijan (310,000); Fergana (200,000); and Kokand (176,000). The ancient City of Bukhara (255,000 people) has been the largest cultural and political center of the Uzbek people for a long time, and is famous for its ancient architectural heritage. Nukus City (189,000 people) is the capital of the Karakalpak Autonomous Republic.

Tourism: (*Anonymous, 10*): Uzbekistan offers great potential for tourism development, particularly in the fields of health and wellness, sightseeing and education, as well as nature tourism. Favorable climatic conditions, the beauty and variety of the landscape and natural features, availability of different mineral sources with healing properties, and a diversity of the natural and historical heritage makes Uzbekistan a suitable tourist destination.

Cultural tradition of the people living in the territory of modern Uzbekistan goes back many thousands of years. The ancient and medieval civilizations of Khorezm, Sogd and Maveraunnahr have been founded, and flourished in the country, whose majestic ruins or magnificent architectural complexes in Samarkand, Kitab, Khiva and Bukhara, as well as rich literature in many languages have been preserved. Since the 8th Century Islam has

contributed greatly to the formation of cultural traditions. The mosques, madrasahs and mausoleums of Samarkand and Bukhara are considered to be a model for the world's Muslim architecture.

During Soviet time, numerous museums and libraries have been created in Uzbekistan. Large art, ethnographic and historical collections are located in Tashkent, Bukhara, Samarkand, Khiva, Kokand, Nukus and other cities. Practically every city of Uzbekistan has its own local history museum. There are extensive collections of books and ancient manuscripts stored in the libraries of Tashkent, Samarkand and Bukhara. The museum dedicated to the life and activity of Tamerlane, the greatest conqueror of the 14th Century, was opened in Tashkent in 1996. In ancient Samarkand City the international ethnographic musical festivals are held on a regular basis.

More than 60 sources of mineral water of various chemical compositions can be found in the mountains of Uzbekistan, on the basis of which spa and clinics have been established. There are natural monuments with interesting botanical, geological and hydro-geological features. Also, waterfalls and groundwater wells can be found in the Tashkent, Surkhandarya, Samarkand, and Kashkadarya regions. Many interesting monuments of ancient history have been conserved and include rock paintings and barrows, fortresses, footprints of sites of ancient people, relics of mines and melting furnaces, antiquities, traces of dinosaurs, and others.

Important tourist destinations are located in the mountains of the Tashkent Region while Western Tien Shan represents the largest health resort treatment and health improving area of the Republic of Uzbekistan. There are sanatoria, numerous recreational zones, wellness camps, hotels, as well as tourist and sports complexes with the most modern tourist complex found on the coast of the Charvak water reservoir.

The rich heritage of Uzbek people attracts numerous foreign tourists. More than 1 million foreign tourists have visited the country in 2009 (Anonymous, 11). Tourism has become an important industry in the country with a huge potential for development. After independence, modern hotels as well as small guest houses (on the basis of family businesses) have been constructed in Tashkent and other large cities and tourist centers. The development of tourism for both locals and foreigners, creates the foundation for the development of local handicrafts, production of souvenirs, establishment of new restaurants, cafes, family cafeterias offering national food, and other facilities of tourist infrastructure.

Protected areas: At present, there are nine reserves in Uzbekistan, three of which refer to valley-tugai reserves (Badai-Tugai, Kyzylkum, Zerafshan), four reserves refer to mountain-juniper reserves (Chatkal, Gyssar, Zamin and Surkhan), one reserve refers to a geological reserve (Kitab), and the last one refers to a mountain-nut-bearing reserve (Nurata). The total area of Uzbekistan's reserves amounts to 2,274 km² or a little more than 0.5% of the country's territory. In most countries of the world the area of reserves varies between 3% and 7% or more. In addition, two national parks have been opened for ecotourism, with an area of 5,987 km² or about 1.4% of the country's total area (i.e. Zamin National Park and Ugam-Chatkal State national Natural Park). Reserves and national nature parks are administratively under the jurisdiction of various authorities such as the regional Khokimiyat, the State Committee for Nature Protection, the State Committee for Geology, and the Main Department for Forestry. Unfortunately, such distribution of responsibilities between establishments does not promote the implementation of a uniform nature protection policy in these protected territories.

A brief characteristic of protected territories is presented in the table below.

Table 1: Brief characteristic of protected territories of the Republic of Uzbekistan

Name of protected territory	Prevailing landscape	Year of creation	Area, km²
Zamin State Reserve	Mountain forest	1926/ 1959	268.4
Chatkal State Biosphere Reserve	Mountain forest	1947	356.8
Kyzylkum State Reserve	Tugai-sandy	1971	101.4
Nurata State Reserve	Mountain nut-bearing	1973	177.5
Kitab Geological Reserve	Mountain forest	1979	53.7
Zerafshan State Reserve	Valley-tugai	1975	23,5
Badai-Tugai Reserve	Plain-tugai	1971	64.6
Gissar State Reserve	Mountain-juniper	1973	814.3
Surkhan State Reserve	Mountain forest	1986	276.7
Zamin National Park	Mountain- juniper	1976	241.1
Ugam-Chatkal National Natural Park	Mountain forest	1990	5,745.9

The existing reserves and natural parks do not cover essential components of biodiversity of Uzbekistan. These under-represented vegetation types include populations of pistachio growing in the territory of Babatag forestry enterprise and in Sangardak forestry area of Uzun forestry enterprise, subtropical natural populations of fig, persimmon, pomegranate, sumach, grapes in the Tupolang river basin, and nut-bearing cenosises in most favorable places for their growth in Burchmulla forestry enterprise. For this reason, the network of protected territories of Uzbekistan requires significant expansion.

1.6 Land-use Pattern

In Uzbekistan, physical-geographic features of the territory significantly influence the type of land-use in different parts of the country. Flat lands (i.e. Ustyurt plateau, alluvial-deltoid plain of Amudarya and Kyzylkum) are used as natural low-productive pastures due to their extreme aridity. Distant cattle breeding is being developed here, including astrakhan sheep breeding, i.e. herds of animals constantly migrate in search of acceptable pastures. A significant proportion of this territory belongs to the State Forest Fund. Here, forestry enterprises manage and conserve existing forest plantings as well as establish new plantations both in deserts and in tugai forests along the Amudarya River. Some parts of the deltoid plain of the Amudarya have been used for farming based on artificial irrigation since old times in the ancient Khorezm oasis or during the Soviet rule in Karakalpakstan. More recently, some of the areas have been gradually opened up for extraction of minerals, such as gas, gold, and oil in Ustyurt plateau and on the dried bottom of the Aral Sea.

When discussing land-use pattern in Uzbekistan, it is necessary to also address the issue of the retreat of the Aral Sea in more detail. The problem of drying-out of the Aral Sea is connected to large-scale projects on agricultural utilization of lands of Central Asian Republics during the Soviet time. Diversion of significant parts of the runoff of Amudarya and Syrdarya rivers has distorted the natural water balance of the Aral Sea, resulting in a catastrophic reduction of the water volume in the sea and its surrounding area. Thus, the basin has changed from fresh-water to a strong-mineralized water body. At the same time, the area of the drained bottom of the Aral Sea has been constantly increasing and presently covers more than 4 million ha. Significant parts of this area are saline lands. The intensive

wind activity that is being observed in this region results in the shifting of salt and dust, thus considerably worsening the ecological situation in extensive adjoining spaces. The only realistic means of preventing this negative process is forest reclamation of the drained bottom area. Therefore, significant areas of the drained bottom were placed under the authority of the State Forest Fund for planting purposes.

In this part of the country population density is very low, except for Khorezm oasis and a narrow belt along the Amudarya River in Karakalpakstan. The eastern part of the country is located in submountain and mountain terrain with broad valleys and plateau plains. Here, the bulk of the country's population, the industrial enterprises and agricultural lands are concentrated.

One of such intermountain plains is called the Fergana Valley, where the highest density of population in the country (exceeding 350 persons per km²) can be observed. This is a region of intensive irrigated farming producing the main agricultural crops (cotton, grain). Significant areas are also covered with gardens and vineyards. The rural population mostly grows poplar trees in their farmlands. Industrial production is concentrated in the cities with e.g. a car assembly plant in Asaka City.

Because of the general aridity of the climate, most of the people of Uzbekistan live at the foothills of mountain ranges along the river valleys. Examples for this distribution are the capital city (Tashkent) and many other smaller industrial centers located in the Chirchik-Angren Valley, as well as other cities such as Samarkand, Bukhara and Navoi located in the Valley of the Zerafshan River. Agricultural production, both irrigated farming, and cattle breeding, is dominant in this part of the country. Practically all rural people keep animals and poultry, grow vegetables and fruits on plots of land attached to their houses. Part of the land at the foothills, where precipitation exceeds 350 mm a year, is used for dry, non-irrigated farming (i.e. grain, vineyards, gourds, and oil crops).

In the mountain ranges of the country the population density is smaller. Here, on moderate mountain slopes and on plateaus, local people pursue rain-fed agriculture (i.e. grains, vineyards and gardens) sometimes supplemented by irregular artificial irrigation. Each household maintains animals and overgrazing can be observed practically everywhere. This affects biodiversity negatively, in particular through limited natural regeneration. It is especially disturbing because in the mountains of Uzbekistan a high level of biodiversity can be observed, including many wild relatives of cultivated plants.

2. State of Forests

2.1. Forest Cover of Uzbekistan (Phytogeographical Information)

Based on soil-climatic conditions, the forests of Uzbekistan are divided into the following categories: desert-like plains, valley-tugai (floodplains) and mountain areas.

Forests are very irregularly distributed over the territory of the Republic. The largest forest areas in the desert-like plains are located in the Karakalpakstan, Bukhara and Navoi regions. Small areas of mountain forests can be found on slopes of Western Tien Shan, a western branch of the Turkestan and Gissar ridges. Tugai forests extend by narrow belts along the main water courses of the the Amudarya and Syrdarya rivers.

As of January 1, 2008 the State Forest Fund of the Republic of Uzbekistan extended over 8.66 million ha, with a proportion of forest area of 3.24 million ha. The percentage of forest land, i.e. the ratio of area covered with forests of the country's territory, amounts to 7.3%. On average, there are 0.07 ha of forests per capita. In comparison, the average figure for CIS countries is 3.3 ha.

Table 2: Forests of Uzbekistan (according to the system of the Main Department for Forestry, as of January 1, 2009)

Forest category	Total area	Including forest covered areas	% of forest lands in the country
Mountain	877,000	296,000	6.4
Desert-like plains	6,967,200	2,502,300	
Floodplain	103,300	8,500	
Valley	197,900	39,100	
In total	8,145,400	2,845,900	

The main forest fund holder is the Main Department for Forestry (MDF), the share of which extends over 8.15 million ha or 94.0% of the total forest fund area. The forest area is equal to 2.85 million ha or 87.7% of the total area in the Republic covered with forests.

For a better understanding of forest statistics, adopted during the Soviet period and followed until today, the following definitions are required:

- The area of the State Forest Fund is termed forest land and includes land for afforestation, and non-forest land, where afforestation requires additional reclamational activities for site preparation.
- Forest lands include such categories of lands as forest covered area, non-closed-up artificial (young) plantings, sparse crops, sparse forests, fire-sites, perished stands, cut sites, and glade abandoned sites.
- Non-forest lands include arable land, hayfields, pastures, marshes, sands and other lands.

Table 3: Distribution of State Forest Fund (under the responsibility of MDF) by land categories (01.01.2008)

(Area, thousand ha)

Total area of forest fund lands, thousand ha	Forest lands									Total forest lands
	Covered by forest		Not closed up artificial (young) plantings	Forest nursery and plantation	Non Covered by forest					
	Altogether	Including artificial plantings			Sparse forests	Fire-sites, perished stands	Cut sites	Glade, abandoned sites	Total Not Covered by forest	
8,178.9	2,827.5	594.9	155.9	0.7	711.9	20.6	5.2	217.9	955.6	3,939.7

Non forest lands												
Arable lands	Hay-making	Pasture	Waters	Gardens, Vineyards, mulberry grove and others	Roads, cuttings	Farmstead and others	Swamp	Sands	Glaciers	Other lands	All non-forest lands	
9.0	3.8	1,598.9	62.9	1.7	5.4	3.0	0.8	96.1	0.7	2,456.8	4,239.1	

The basic forest forming species of forest stands in desert like plains is saxaul (*Holoxilon persicum* Bge. and *H. aphyllum* Hjin.). Large areas are also occupied by saltwort (*Salsola Richterii* Kar., *S. paletziana* Litv.), kandyms (*Calligonum*), and tamarisks (*Tamarix*). Most of the forest stands under desert conditions are of low-density (i.e. 0.3 – 0.4) reaching rather low growing stocks of wood: for saxaul stands up to 60 m³ /ha, saltwort stands up to 30 m³ /ha, and tamarisk stands up to only 3-4 m³ /ha.

Vegetation of mountain territories has zonal character and distinctions are made between desert-like and dry steppes, meadow steppes, bushes, deciduous and coniferous (juniper) forests, and subalpine and alpine meadows. Although relatively small in terms of area, the mountain forests of Uzbekistan are diverse by species composition. More than 100 tree and shrub species can be found here. Based on the composition, the mountain forests can be divided into various types such as juniper, pistachio, almond, nut-tree, apple-tree, hawthorn, mixed forests, and shrubbery.

Juniper forests occupy a special vegetation belt at higher elevation, and extend over an area of 193,100 ha represented basically by thinned plantings. They can be found as open stands with densities of 0.2 – 0.5 along the slopes of the Alay, Turkestan, Zerafshan, Fergana, Chatkal, Kuramin ridges and along the southwestern branch of the Gissar and Babatag ridges.

Pistachios in the mountain forests rank second by area and they basically concentrate on the ridges of the Babatag Mountains. Their total area in the Republic of Uzbekistan amounts to 39,322 ha. As such they are long-living with trees reaching an age of 300 years and more, very drought-resistant, but form very open stands with an average growing stock of only 2.54 m³/ha. Natural regeneration of pistachio is very poor, partly because of intensive fruit harvesting and use as cattle pasture.

Walnut-tree forests are presented both as pure and mixed stands and are confined to the slopes of northern aspects and lower watersheds. Pure walnut stands most typically grow at the valley bottom and at the gentle northern slopes of the Fergana and Chatkal ridges.

Mixed maple-walnut and apple-walnut forests develop under poor site conditions on southern slopes with shallow soils. They form open stands (i.e. density 0.3-0.4) with stunted trees. An average stock of mature walnut trees reaches up to 60 m³/ha.

In the flood-plain and valleys of the rivers one can find woody-shrub and grassy plant communities – so called tugai, mainly located on islands and in strips along the rivers. The basic forest forming species of tugai are Asiatic poplar (*Populus diversifolia*, *P. pruinosa*), Russian olive (*Elaeagnus angustifolia* L.), willow (*Salix songarica* Anderss.), and tamarisk. Their total area in the country is estimated at 103,300 ha. The largest concentrations of tugai forests can be found in the delta of the Amudarya River in the Republic of Karakalpakstan, as well as along the Syrdarya River, in the Fergana Valley, in the lower reach of the Chirchik River, near to Samarkand, and along the Zerafshan River. For their existence, tugai vegetation requires peculiar ecological conditions such as high water table, periodic floods

combined with dry hot climate, low air humidity and absence of precipitation during the summer period. Present-day Tugai forests are of low productive stands with a density of 46-64 m³/ha. However, there are exceptions like in Khorezm and Karakalpakstan where tugai stands have been producing up to 200 m³/ha of wood, including 40 m³/ha for industrial purposes.

2.2. History

For an objective assessment of the current status of forests it is necessary to know the history of their formation (Griza *et al.*, 2008). This will allow an evaluation of recent changes, which have affected the development of forest resources, and planning for their sustainable management and conservation. In this context, mountain forests such as juniper and nut-fruit forest types are discussed in more detail.

Most authors (Ovchinnikov, 1958; Korovin, 1962; Konnov, 1966) associate the origin of juniper forests with the Quaternary period, basically with the Holocene (20,000 to 25,000 years ago). Most researchers of juniper forests indicate that the current appearance of these forests differs sharply from the original appearance in the composition of forest species, density and area of distribution. The main reason for this is the change of environmental conditions towards a more arid climate. Insufficient moisture supply has created conditions for a reduction of mesophilous deciduous species in the composition of the vegetation cover, expansion of steppe vegetation, and formation of pure open juniper forests. Latest research (Beer *et al.*, 2006) conducted in the juniper forest zone shows that juniper had occupied large areas in this zone (about 4,000 –6,000 years ago) and probably even has prevailed in the area until today covered with nut-fruit forests. Besides the fact that in the past the juniper forests area was much larger in comparison with the present area, the forests also showed a much denser stocking level. The reduction in the juniper forest area over the last 200–300 years is associated with anthropogenic pressures such as felling, unregulated grazing and fire.

Different scientific opinions can be found in the literature about the origin of walnut forests, though most of the researchers believe in the Tertiary nature of their origin (Popov, 1938; Arnoldi, 1946; Sadovskaya, 1954; Rubtsov, 1955; Samsonov, 1966). They found evidence that walnut forests are a relict of mesophilic forests of the Tertiary period, because walnut associated species such as apple, pear, maple, and pearlbush are also relicts of the same period. Based on the paleontologic analysis, Sadovskaya (1978) believes that in the Fergana Valley during most of the Middle-Miocene epoch there was a warm and humid climate favoring mixed forests made up of tugai deciduous broadleaf species with a greater admixture of subtropical plants. At the end of the Middle-Miocene epoch, tectonic processes led to a rise of landscape in Central Asia resulting in a vertical zoning with clearer climate differentiation between a warm and humid zone, which is typical for plains and foothills, and a much colder zone in the mountains (Utkina, 1968, 1992). As a consequence, species composition in the forests changed leading to a reduction in the share of subtropical species and an increase in the number of boreal species. In addition, the significant rise of the mountain terrain around the Fergana Valley resulted in overall lower temperatures and drier climate. This has caused the extinction of representatives of thermophilic vegetation, migration of species from one vegetation zone to another, xerophytization of flora of plains and foothills, reduction of forest lands, and depletion of their composition. Thus, areas of open forests and forest-steppes have emerged replacing ancient woodlands.

All in all, today's forest landscape in Uzbekistan was shaped after formation of the mountain ranges had been completed. These forests sharply differ from the initial appearance due to changes in forest growing conditions that have taken place over a long period of time. This

has caused changes in species composition, distribution of forest areas and other parameters. Over the last decades, human activities have been greatly influencing forest coverage and conditions

2.3. Forest Biodiversity

Biological diversity of Uzbekistan includes more than 27,000 species, with more than 15,000 breeds of animals and a total number of plant species, mushrooms and algae of approximately 11,000 species. The flora of Uzbekistan includes 4,800 species of vascular plants, which relate to 650 genera and 167 families. The number of endemic species is relatively low, in the range of 8% (or about 400 species) of the total species richness. Relict endemic species include 10-12% of all endemics. 305 flora representatives are included in the Red Book of the Republic of Uzbekistan.

According to the International Red Book (IUCN Red List Categories and Criteria, 2001), the following tree and shrub species in Uzbekistan are included in the various categories:

- Critically endangered: *Calligonum calcareu*, *Lonicera paradoxa*, *Malus niedzwetzkyana*, *Pyrus korshinskyi*, *Ribes malvifolium*, *Zygophyllum bucharicum*;
- Endangered: *Armeniaca vulgaris*, *Betula tianschanica*, *Calligonum molle* (endemic of Uzbekistan), *Calligonum elegans* (endemic of Uzbekistan), *Calligonum matteianum* (endemic of Uzbekistan);
- Vulnerable: *Amygdalus bucharica* (Central Asian endemic), *Calligonum paletzkianum*, *Malus sieversii*, *Rhus coriaria*; and
- Close to endangered - *Amygdalus petunnikovii*, *Restella albertii*, *Juglans regia*, *Juniperus seravshanica*, *Populus pruinosa*, *Pistacia vera*, and *Fraxinus sogdiana*.
- There is lack of information on a few other tree and shrub species with regard to the identification of their vulnerability.

The total fauna of the Republic of Uzbekistan includes 97 species of mammals, 424 species of birds, 59 species of reptiles and 83 species of fish. Out of them, 24 species of mammals, 48 species of birds, 16 species of reptiles, 18 species of fish, 78 species of invertebrates (Anonymous, 12&13) are included in the Red Book of the Republic of Uzbekistan.

The lands of the State Forest Fund provide the basic habitat and concentration of biological diversity in Uzbekistan.

Desert-like ecosystems are the main habitat of rare and endangered animal species, such as Indian honey badger, caracal, Persian gazelle, marble teal, serpent eagle, imperial eagle, griffon vulture, balaban, houbara bustard, and pin-tailed sand grouse. About 50 species of birds are adapted for living under conditions of sandy deserts with saxaul tangles and shrubs serve them as a place for nesting. In the sandy deserts of the country, there are about 320 species of flowering plants related to 31 families and 134 genera.

Floristic composition of the tugai type of vegetation is represented by 285 species of vascular plants relating to 35 families and 105 genera. There are about 40 species of typical tugai plants. Abundance of moisture allows amphibians to settle in tugai ecosystems. Reptiles, such as lidless skink and grass snake can be found here, while racerunners can be found in drier places. Pallas' coluber and water snake as well as lebetina vipers can frequently be spotted here.

The most typical representative of birds is a pheasant species. Carrion crows, magpies, small sparrows can be seen frequently. There are also colonies of herons, glossy ibises, cormorants, kites, tyuviks and others. Mammals are presented by predators (e.g. jungle cat, jackal, fox, wolf, badger), rodents (e.g. tamarisk gerbil, pest rat, trans-Caspian vole), and ungulate (boar, Bukhara deer).

Flora diversity of mountain forests includes 47 species of trees and 96 species of bushes. Typical inhabitants of mountain forests are birds (e.g. white-winged woodpecker, magpie, starling, Bukhara titmouse, turtle-dove, wood pigeon, paradise and spotted flycatcher, whitethroat, oriole, birds of prey and others), mammals (e.g. badger, boar, ibex, argali, Siberian brown bear, snow leopard, fox, wolf, stone marten, Menzbir marmot) and others.

Degradation of habitats and direct extermination has affected, first of all, large carnivorous and hoofed animals. The turan tiger and cheetah have disappeared; striped hyena, caracal, front-Asian leopard are endangered. The habitats of many species have changed in terms of area and quality and their numbers have sharply decreased.

Aquatic and semi-aquatic ecosystems have seriously changed because of increase in salinity and pollution with significant alterations of overall hydrological regimes.

Agricultural biodiversity has also suffered seriously. Uzbekistan, being the homeland of many wild ancestors of cultural plants, and possessing a huge potential of traditional forms of cultural plants and animals, has lost wealth in many respects. Underestimation in the past of the importance of traditional forms of agricultural biodiversity has resulted in their large-scale replacement by exotic species reducing and endangering traditional species (Anonymous, 12).

2.4. Forest Tenure, Legislation and Policy

The following laws have directly or indirectly influenced the forestry of Uzbekistan: the Constitution of the Republic of Uzbekistan (1992); Laws and Regulations on "Nature Protection" (1992), "State Committee of the Republic of Uzbekistan on Nature Protection" (1996), "Protection and Use of Flora" (1997), the Land Code of the Republic of Uzbekistan (1998), The Law on Protected Natural Territories" (2004). The Forest Act of 1999 regulating all matters concerning the management and protection of forests is most important in the context of forest rehabilitation.

According to Article 4 of the Law "On Forest" (1999), forests are state property and national wealth, subject to rational use and protection by the state. Key issues addressed in this law are presented below.

(a) All forests are an integral part of the State Forest Fund and include:

- forests of state importance, i.e. forests under the authority of state forestry bodies; and
- forests being used by other establishments and legal entities.

The State Forest Fund does not include:

- trees and groups of trees, field-protecting forest belts, as well as other wood and bush vegetation on agricultural lands;

- protective plantings on the strips along railways, highways, channels and other water bodies;
- trees and groups of trees, as well as green plantings in cities and other habitations; and
- trees and groups of trees on farmlands and gardens.

(b) The establishment, maintenance, protection and use of wood and bush plantings, not included in the State Forest Fund, is regulated in accordance with the Law on Protection and Use of Flora.

(c) Lands of the State Forest Fund can be given for use to legal and private entities.

(d) Forest use can be of permanent and temporary nature.

(e) Permanent forest users are forestry enterprises, establishments and organizations, which are provided with lands of the State Forest Fund under a permanent tenure agreement.

(f) Temporary forest use can be of short-term (i.e. up to 3 years), and of long-term (i.e. up to 10 years).

Long-term planning in the forest sector has in many respects maintained the features of the Soviet style of planning system. These are economic plans, where the quantity indicators of various specific types of works are planned including sowing, planting, supporting measures for natural regeneration and afforestation. Forestry management, its monitoring and activity evaluation are still carried out by out-of-date methods using inefficient approaches developed during Soviet times.

As Uzbekistan is located in an arid zone with sharply continental climate, the activities on forestation and creation of new forest plantations require significant financial and manpower resources. Limited financial resources, allocated from the state budget, do not allow to enhance the volume of activities on reafforestation and forestation as well as its quality, and therefore there is a need for development of more sustainable and effective strategies of forestry management by involving the local population. Despite the low percentage of forest land, the forest fund lands nevertheless provide different opportunities and benefits for local people. Unfortunately, these opportunities are not fully used as yet. Strengthening of the role of local communities through ensuring better access to natural resources and effective participation in the process of planning and management of forestry will help to gradually restore degraded forests. Participation of local communities will enable reafforestation and forestation to be much more sustainable and less expensive. However, presently, participation of local stakeholders in the processes of planning and management develops at very slow rates.

Weak institutional capacity for carrying out inventory, monitoring and evaluation of forest resources is the reason for the lack of accurate information about the lands of the State Forest Fund. This in turn is a barrier for planning and carrying out all types of activities in the forestry sector. In addition, participation in international conventions has raised obligations of Uzbekistan to adhere to international standards and agreements.

These and some other circumstances provide the basis for reforming the forestry sector. Adaptation of forestry to market-oriented conditions requires integrated consideration of its problems and ensuring transition from the simple use of forest resources to their efficient management for conservation and sustainable development of forestry in Uzbekistan. For this purpose, the Main Department for Forestry with technical and consulting assistance of the Food and Agricultural Organization of the United Nations (FAO) has developed the National Forestry Policy of Uzbekistan, which will be submitted this year for review and approval by the national government.

The National Forestry Policy contains a development concept, forest policy for a 10-year period and a short-term action plan for a five-year period. The Action Plan will be developed after approval of the forest policy. The section on forest policy includes objectives (long-term task), primary tasks, and basic directions of development and necessary conditions for its implementation. The section, devoted to the implementation strategy, includes the main targets and concrete actions which should be undertaken in order to achieve assigned objectives. The basic conditions for successful implementation of the National Forestry Program include improving forest legislation, improved dialogue and partnership between forestry organizations and other stakeholders, enhancement of institutional potential and organization of an effective system of monitoring and evaluation.

2.5. Forest Administration and Management

The state management in the field of conservation, protection, use and reproduction of forests is carried out by the Cabinet of Ministers of the Republic of Uzbekistan, local state bodies, the Main Department for Forestry under the Ministry of Agriculture and Water Resources of the Republic of Uzbekistan and the State Committee of the Republic of Uzbekistan on Nature Protection (Resolution of the Cabinet of Ministers. No. 98, 2000).

In the field of forest relations, the Cabinet of Ministers of the Republic of Uzbekistan is in charge of the:

- Implementation of a uniform state policy on protection and rational use of forests;
- Control of the State Forest Fund;
- Establishment of legal orders on determining categories of forest protection;
- Establishment of the order of collecting fees and their rates for forest use;
- Organization and implementation of state control over preservation, protection, use and reproduction of forests; and
- Establishment of the order of conducting state inventory of forests and maintaining a state forest cadastre and some other issues.

In the field of forest policy implementation, the local state bodies are in charge of the:

- Provision of State Forest Fund sites to legal and private entities upon approval of the state forestry bodies, except for forests of state reserves and forest reserve zones of the state national nature parks;
- Conducting state inventory of forests and maintaining a state forest cadastre;
- Exercising state control over preservation, protection, use and reproduction of forests;
- Making decisions on restrictions, suspension and termination of the activity of enterprises, establishments and organizations in cases of causing harm to the state of forests;
- Establishment and regulation of the norms of cattle grazing in the forests and other types of use of forest resources in collaboration with the state forestry bodies; and
- Organization of environmental education for the public in the field of preservation, protection, use and reproduction of forests.

The Main Department for Forestry (MDF) under the Ministry of Agriculture and Water Resources of the Republic of Uzbekistan and its regional bodies function as the state forestry bodies. Presently, the main tasks and functions of the MDF are as follows:

- Monitoring and control over forestry legislation, application of technical specifications related documentation on the implementation of forestry and hunting operations;
- Forest management including forest operations, reproduction, conservation and protection of forests, state reserves, natural parks and other protected natural territories within the forestry fund area;
- Implementing a uniform technical policy and standard aimed at overall expansion and rational use of the forestry fund area;
- National forest inventory and studying of forest land, fauna and flora;
- Promotion of scientific innovation and best practices in forestry;
- Development and implementation of measures on reforestation and protective forestation, organization of erosion control planting operations on hillsides, in ravines and wastelands;
- Implementation of measures on combating desertification on agriculture land;
- Protection of forests from fires, unauthorized cuttings and other forestry violations, protection of forests against pests and diseases including improvement of the systems of forest protection;
- Conducting conservation activity and maintaining hunting facilities in subordinated territories;
- Departmental management and supervision of hunting facilities, ensuring observance of rules, norms, terms of hunting on forest fund territory;
- Organizing development and implementation of an uniform strategy for decorative gardening on the basis of an assessment of needs of local and foreign markets;
- Implementation of measures for the preparation and production of medicinal and food plants, products of subsidiary farming, gardening, and creation of a specialized divisions for these purposes;
- Increasing the level of economic independence of forestry enterprises, and specialized forestry enterprises on production of medicinal herbs, adapting them to a market economy for the purpose improving their financial situation;
- Attraction of foreign investments, creation of joint ventures, development of private entrepreneurship, and small businesses in the sphere of forestry; and
- Capacity development of personnel for forestry enterprises and organizations.

The administrative structure of the Main Department of Forestry consists of various departments and organizations including an inventory and survey section, the Scientific-Production Center of Decorative Gardening and Forestry, the Training Center; the Forestry Seed Production Center; the Department of Reserves, National Nature Parks and Hunting Facilities; and the Scientific and Production Center for Herbs.

There are also 67 forestry offices in the Republic of Karakalpakstan and all regions of the country, which are responsible for forest protection (i.e. against fires, pests and diseases), registration, inventory, reproduction of forests, regulation of forest use and organization of conducting of other forest-related activities. In addition, there are eight specialized forestry offices dealing with non-wood forest products (mainly cultivation and processing of medicinal and food herbs), six reserves, six forest hunting facilities, Zaamin National Nature Park, seven forest experimental stations, two specialized enterprises, 10 production sites, and one specialized forestry and state enterprise for the development of forestry technologies and operations.

3. Forest Degradation

3.1. Understanding Forest Degradation in Uzbekistan

So far, there is no generally accepted definition, glossary or standard for the term “forest degradation” in the country. However, it does not mean that there is no phenomenon itself, which is expressed in different degrees of both loss of quality of forest plantings, and reduction in forest area.

The loss of forest quality includes the following aspects:

- Reduction of productivity of plantations due to various reasons;
- Impoverishment of species composition of forest biomass;
- Unbalanced age structure of plantations, especially under-representation of young growth; and
- Absence or insufficient regeneration of basic forest forming species.

The reduction in forest area is defined as follows:

- Fragmentation of forest area, and, as an initial stage, gradual reduction of stand density over time;
- Formation of degraded forests, fire-sites, destroyed stands, non-regenerated timber cuttings sites; and
- Reduction in the size of forest area.

3.2. Causes of Forests Degradation, Impacts of Forest Degradation and Loss

Both natural and anthropogenic factors can be considered to be the causes of forests degradation.

Natural factors:

Among the natural factors that influence the forests condition, the following are most important in Uzbekistan:

- Transformation of the earth surface’s relief and periodic climatic changes influence vegetative cover in the long-run;
- Influence of pests, diseases; and
- Droughts, floods, landslides, volcanic eruptions, fires from lightning, falling of a celestial body on the earth’s surface.

These factors are so significant that they can cause a complete change of vegetative formations. In terms of history, such changes caused by any of these events may take long time intervals and mostly will be imperceptible for any specific human generation.

Anthropogenic factors:

Anthropogenic factors have quite different effects. With the development of human civilization its influence on the environment has been growing steadily having negative effects on the natural environment in general and on forests in particular. Population growth can be named as the primary factor. In 1913, the population of Uzbekistan was estimated at

about 4.33 million people (Anonymous, 11). At the end of 2009, this figure has reached almost 28 million. This means that the population has grown almost 6.5 times during less than one century. Most of the population of Uzbekistan still resides in rural areas resulting in growing pressure on forest resources. Growing populations require larger resources to satisfy vital needs, including forest resources. With the acceleration of scientific and technical progress these human needs become more and more diverse and extended, and the impact of human civilization on the natural environment has reached global scale. Major types of human activities causing forest degradation are summarized below:

- Expansion of agriculture land: While in 1913 cultivation areas extended over 2.2 million ha, in 2008 3.6 million ha were under irrigation alone. It should be noted that lands along rivers are cultivated in the first place as there are no significant efforts required for construction of irrigation systems. However, since tugai forests in Uzbekistan are located right on the riverside, the agriculture area has been primarily encroached into tugai forests. However, plowing up is not limited to tugais, it is also actively performed on dry foothills, plateaus and mountain slopes.
- Growth in livestock: In 1916, the number of livestock in Uzbekistan is estimated at approximately 1.4 million heads of cattle and 4.3 million heads of sheep and goats. In 2008, these numbers had increased to 8 million cattle and 13.6 million sheep and goats. Though, during the former Soviet Union most cattle were kept stalled, today almost the entire livestock is dispersed on rural localities and pastures in surrounding territories. Extensive overgrazing is alarming and involves loss of grass cover, regrowth and undergrowth. The soil suffers from condensation, destruction of surface layer and soil structure causing wind erosion, increase in surface runoff and reduction of interflow. And this, in turn, causes mud streams, reduction of river discharge, and loss of soil fertility, particularly in mountain areas. Deterioration of soil-hydrological conditions inevitably affects productivity of forest plantings in these territories.
- Harvesting of non-wood forest resources: Grass production in the territory of the State Forest Fund, especially on forest lands, results in complete destruction of natural vegetation of forest species, undergrowth and even re-growth. The collection of medicinal plants, food and other non wood products for local use contributes to the loss of diversity in plant composition. Full harvesting (for example, of walnut, pistachio, hips) not only leads to unavailability or very small natural regeneration, but also represents a real threat to the forest fauna.
- Demand for commercial timber and fuel wood: The total annual wood harvest in the country is less than 50,000 m³. Such a quantity cannot satisfy the current demand for commercial timber and fuel wood. After the collapse of the Soviet Union commercial wood is basically imported to Uzbekistan from Russia, though poplar woods grown on farms and dehkan facilities are available on the local markets. However, current prices are not affordable for the majority of the local population and this pushes people to fell forests, basically poplars and juniper species suitable for construction purposes. Not all of the rural population has access to natural gas for everyday life and heating purposes. Therefore, people often cut wood in nearby forest plantations;
- Large-scale industrial development causes environmental pollution (air, soil, and water), negatively affecting forest condition. For example, massive deterioration and even destruction of forest plantations and gardens can be observed within the range of harmful emissions of the Tadjik Aluminium Plant in the upper reach of the Surkhandarya.
- Withdrawal of water from the rivers for artificial irrigation, and power generation through the construction of huge dams and operation of water storage reservoirs (i.e. water discharge during winter time in order to cover power shortage) completely change natural water regimes of rivers. Regeneration of tugai forests, in particular poplars, fully depends on the availability of summer water floods. These water floods may not always occur in the lower reaches of the Amudarya, where the largest

remaining areas of Uzbekistan's poplar forests are located. Therefore, the future of the tugais, especially those with poplar species is of greatest concern.

- Industrial development: The construction and operation of industrial facilities such as mines, factories, highways, railways, gas and oil pipelines, etc., not only negatively affect the area where such facilities are located, but also the surrounding environment. Adjacent forest areas have either been completely removed or their growing conditions considerably reduced.
- Change in land tenure: Transfer of land-use rights to the farmers has complicated development of the field-protecting reforestation in the country. Thus, agroforestry on irrigated arable lands in the desert zone has emerged as a powerful stabilizing factor of these fragile anthropogenic ecosystems subject to water and wind erosion, secondary salinization, high mineralized water table and others. In the mid 1980's, there were about 40,000 ha of such plantings in Uzbekistan, and by 2006 only about 25,000 ha were left. New protective plantings have not been established on arable lands, whereas existing plantations become mature and are cut down.
- Global warming: Climate change in the territory of Uzbekistan is expected in terms of an increase in average annual air temperature of 1.3 – 1.9°C by 2030 and of 3.3–4.4°C by 2080 and an increase in annual precipitation of 5–18% (Spektorman *et al.*, 2007). Besides other consequences, these climatic changes will likely cause alterations also in the natural forest cover. The climate in the deserts zone will become more arid (especially by 2080), that is warmer and dryer. Such conditions may result in a reduction of the productivity and deterioration of the health conditions of tree species. The influence of climate change on the flood-plain forests and plantings in the valleys will also be felt more strongly due to deterioration of water-supply on irrigated lands, reduction of river runoff and its artificial regulation.

Vulnerability assessments of forests in the territory of Uzbekistan have shown that due to climate change the forest formations in mountains will be exposed to great risk. In mountain regions, the increase in temperature will result in an upward shift of the distribution of all tree and shrub species accompanied by all ensuing consequences, including changes in species composition and loss of biodiversity (Botman, 2007).

3.3. Desertification

The UN Program on Environment (United Nations, 1992) and the UN Convention on Combating Desertification define the term “desertification” as “land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities”. Desertification results in degradation of vegetative cover; degradation of soil cover, change of relief, occurrence of changes caused by anthropogenic impact and change of hydrological regimes.

The condition of vegetative cover is a primary indicator of desertification. The long-term sustainable decrease of productivity of natural vegetative cover over large territories is one of the most widespread and visually determined processes of desertification. Degradation of lands is aggravated by overgrazing (35%), forest clearing (30%), agriculture (27%) and industrial activities (1%). It is also necessary to mention here the consequences of natural disasters such as droughts, floods and landslides.

The impacts of the Aral crisis, as well as other anthropogenic factors, have led to gradual desertification in Uzbekistan and, as a consequence, to soil degradation, and decrease in fertility of irrigated lands. Occupying only 10% of all agricultural lands, the irrigated fields contribute over 95% to the gross agricultural products. Over the last 15-20 years, the area of

saline lands has grown by 0.8 million ha and presently covers over 2 million ha, including 0.85 million ha of medium-saline and severe-saline lands. Humus content in the soil has decreased by 30-50%. Presently, the soils with low and very low humus content occupy nearly 40% of the area of irrigated lands, and the total area of low-productive arable lands comprises more than 0.5 million ha.

In this context, the issue of combating desertification is presently of high priority in the Republic of Uzbekistan. About 10 million ha of pastures require radical improvement. Overgrazing and felling of forests for different purposes have caused significant reduction of tree-shrub vegetation in the desert zone. Desertification is greatly spreading in foothill areas of the mountain ranges (Shivaldova, 2009).

Shoaling of the Aral Sea is one of the most striking examples of environmental degradation caused by human activities. The reason for this problem was a decision by the USSR Government to expand the size of irrigation areas in Central Asia in order to achieve self-sufficiency in the cotton industry. Intensive development of irrigation since the 1950s in the Central Asian Republics has resulted in a substantial reduction of water inflow to the sea from its main tributaries such as the Amudarya and Syrdarya. In 1960, the Aral Sea was the fourth largest lake in the world, but since then it has lost two thirds of its volume and twice as much of its surface. The water level has decreased by 16 m, and its salinity has become close to that of sea water. The fishing industry has discontinued its operations as the majority of the fish stocks of the Aral Sea basin have died out, and the deltas of the Amudarya and Syrdarya have changed due to shortage of water. The withdrawal of river water has led to extensive decrease of the level of underground waters, and the retreating sea has also affected the climate locally. The exposed bottom of the sea has become a strong source of aerosols causing pollution of agricultural lands and negative influences on human health. Irrigated lands suffer from salinization and flooding due to insufficient management resulting in a decrease in crop harvests. In addition, the drainage waters have a high level of salinity and are also polluted due to a high concentration of fertilizers and pesticides significantly influencing the health of people in the region.

4. Forest Rehabilitation

As already noted, there is no officially accepted glossary or standard on forest terms in the country. Presently, forest terms which have been accepted during the Soviet time are used. There are differences in the understanding of equally sounding terms in Russian language [forestry related] literature and in internationally accepted interpretation. Moreover, there are terms and concepts, which have not been previously used in forestry of Uzbekistan. Therefore, in this section, the terms will be used in their international interpretation (FAO, 2002).

Forest rehabilitation is the process of restoring the capacity of a forest to provide goods and services again, where the state of the rehabilitated forest is not identical to its state before degradation. In Uzbekistan, it means reforestation and afforestation. However, afforestation refers not only to forest plantings within the forest lands of the State Forest Fund, but also outside the Fund area, e.g. on irrigated agricultural lands, called field-protective afforestations. As a rule, afforestation is carried out on non-forest land, e.g. on the dried bottom of the Aral Sea while reforestation is carried out on forest lands not covered with forests.

Forest restoration is the process of restoring a forest to its original state before degradation (i.e. same functions, structure and composition). Practically all forests of the country are exposed to degradation to a different degree. Due to significant variability of habitat

conditions, a number of forest types close to natural composition have been delineated, though there are no reference sites where the original state of each type of forest could be preserved. Therefore, it is practically impossible to carry out forest restoration under the conditions reigning in Uzbekistan.

4.1. Targets of Reforestation and Afforestation in Uzbekistan

In Uzbekistan, all forests, both the existing ones and those newly created, have a protective function. This means that the better forests perform or will perform their forest reclamation and protection functions, the higher the value they have. Therefore, the objectives of reforestation [reproduction of forests] and afforestation are different in the various climatic zones of the country, though all are aimed at strengthening reclamation and protection functions. The objectives are as follows:

- In the desert zone, the main focus is on afforestation of the dried bottom of the Aral Sea for preventing or reducing salt and dust erosion from the soil surface as well as stabilization of shifting sand. In addition, new forests are planted for the enrichment of forage areas, creation of protective forest stands along the borders of oases located in the Bukhara, Navoi, Samarkand, Jizzakh, and Syrdarya regions to prevent the impact of dust storms, dry winds and other negative natural phenomena. Protective forest belts are also created around industrial sites (e.g. Bukhara refinery plant, Shurtan gas and chemical plant, Kungrad soda plant), along railways, roads and pipelines.
- The conservation of tugai forests aims at embankment stabilization, purification of waters flowing into the river, including those originating from irrigated arable lands.
- The creation of forest plantations in the valley zone is intended to improve timber production, recreation, and sanitary-hygienic purposes. The most important objective for irrigated lands in the arid zone is the creation of field-protective forest plantations which stabilize this fragile and vulnerable anthropogenic landscape through improvement of microclimate, soil erosion control, biodrainage, as well as recreational, aesthetic and other functions. Forest plantations on irrigated lands have higher productivity and thus also high carbon sequestration ability.
- In the mountain zone, the establishment of forest plantations primarily aims at reducing surface water run-off and mudflows. Afforestations of small watersheds have water protective and water regulative roles with positive effects on river flow rates and seasonal distribution. The creation or improvement of nut-bearing forests aims at increasing their yields. For all the natural zones of the country, the conservation of biodiversity is a priority objective, including the conservation of wild crop relatives.

4.2. National Policy on Reforestation and Afforestation

In 2006, the Main Department of Forestry developed and approved a Forestry Development Program for the period of 2006 - 2010. The program in particular includes the sections devoted to reforestation [reproduction of forests] and afforestation, enhancement of the environmental and protective functions of forests, and expanding the forest covered lands of the Republic.

The program contains specific average annual figures on the creation of protective plantations in the Aral region, on volumes of planting in the second stage of the Bukhara green barrier, on the creation of industrial plantations of nut-bearing and fast-growing forest

species and so on. The program has a technocratic nature and is intended primarily for the use by foresters.

As mentioned earlier, the national forest policy was developed under the technical assistance of FAO in 2009. The objective of the country's forest policy was defined as conservation and sustainable management of forests to provide environmental and socio-economic benefits and contribution to sustainable development for the whole country. The national forestry policy consists of three sections: development concept, problem solving strategy for a 10-year period and short-term action plan (for a 5-year period). The latter will be developed after approval by the Government of the development concept and the problem solving strategy.

For achieving the goals, the following three broad issues will be addressed: (a) rational use of State Forest Fund resources, (b) conservation, protection and development of existing forests, and (c) expanding forest covered lands through afforestation.

For the first time in the history of forestry in Uzbekistan, the national forestry policy was not only widely discussed by many stakeholders, but also the program has envisaged the development and introduction of a joint forest management system, and the creation of a mechanism for the participation of the local population in forest planning.

Further, the national policy on reforestation and afforestation calls for "Improving the effectiveness of reforestation and afforestation" through the following activities:

Restoration and afforestation of lands, located in the desert zone for combating desertification:

- Development of the national program and action plan on combating desertification and expanding protective afforestation on the dried bottom of the Aral Sea and Priaralie and subsequent approval of the developed documents by the Main Department of Forestry in collaboration with corresponding government and international organizations and the local population; and
- Improving the condition of existing degraded desert forest ecosystems. Expansion of the forest area on forest lands through afforestation by means of natural regeneration, and improved agricultural techniques for the establishment of artificial plantings as well as through the reduction of existing anthropogenic impacts on the forests.

Restoration and creation of forests in mountainous terrain:

- Restoration and improvement of the conditions of existing sparse forests in mountainous areas through planting, seeding, conducting of measures to promote natural regeneration and forest reclamation works;
- Monitoring of soil erosion processes and creation of the system of protective forest plantations through terracing of steep slopes in watershed areas with risks of mudflows; and
- Restoration and improvement of the condition of natural forests in the mountain zone. The emphasis in the sub-mountain zone is on the establishment of industrial plantations of nut-bearing trees and other species, and regulation of cattle pasturing with involvement of the local population.

Restoration and creation of tugai forests:

- Restoration of degraded tugai forests located along the rivers and on river islands, through enhancement of protection and conservation, as well as through measures to promote natural regeneration and seed reproduction in suitable areas.

Restoration and creation of forests in the valley zone:

- Expanding the areas of planted fast-growing and nut-bearing species in order to create plantations for harvesting timber and nut products.

Another direction of solving the problems of forestry development in Uzbekistan anticipates the “Enhancement of protection of forests and conservation of their biological diversity” through the following activities:

- Raising public awareness about the forest. Involving state, non-governmental organizations (NGOs), local population, and mass media;
- Ensure participation of local communities and other stakeholders in the conservation, protection and guarding of forests through creation of economic and moral incentives (e.g., guaranteed rights for using corresponding lands of the State Forest Fund and forest resources, etc.);
- Enhancement of legal framework of forestry enterprises on protecting forests from damage and threats of anthropogenic nature (e.g., illegal felling, grazing, fire, unauthorized collection of plants, fruits and nuts, etc.);
- Strengthening the protection of forests against forest pests and diseases through the application of preventive measures, improvement of equipment and rising capacity of human resources;
- In order to fulfill commitments under the UN Convention on Biological Diversity it is required to expand protected natural territories (reserves, national parks, sanctuaries, and others up to 10% of the total country area), taking into account the needs of people residing in these areas;
- Development of an action plan in accordance with the international program on the improvement of forest legislation and forest management (FLEG program, special attention is paid to combat illegal timber felling); and
- Ensuring safety and protection of forests located on lands of other holders of the Forest Fund with their own means.

4.3. Methods of Reforestation and Afforestation

The methods applied in reforestation [reproduction of forests] and afforestation depend on the specific natural-climatic zone of the country and intended functions of forest plantations. Therefore, these methods are described separately for each natural-climatic zone as follows.

4.3.1 Sand-desert zone and drained bottom of the Aral Sea

Fixation of shifting sands: In Uzbekistan they occupy over 1 million ha. When protecting oases from shifting sands, it is necessary to fix the first row of dunes on the entire windward slope length, and subsequent rows on 2/3, 1/2 and 1/3 of the windward slope height through planting of saxaul crops and creating pastures on 1/4 of windward slopes height.

The operation begins by removing loose sand from the dune and leveling of the top. The width of fixed zone ranges from 50 to 250 m, when protecting linear objects up to 400 m (250 m from the windward side and 150 m from the leeward). In the rear sands, where lowlands occupy less than 50% of the area, the sands are not fixed, but in the lowlands the saxaul crops need to be created, which block dunes and gradually overgrow them.

In order to create forest crops on shifting sands, it is required to fix them preliminary using mechanical shields, or with chemical binding materials. Mechanical shields can be standing

and semi-standing, row-type and cellular, lying belted and solid. Solid or narrow-banded covers can be made from the chemical binding materials.

Forest crops on shifting sands along mechanical shields are created through planting of seedlings of sandy species. After completion of the sand fixing by chemical binding materials, tree plantations are created applying a planting scheme of 1 m x 4 m (2,500 plants/ha) at a distance of 10 - 25 cm from the leeward side of covers.

Desert and semi-desert areas of Uzbekistan

For these areas, it is most common to create pasture protective plantings made up of shrubs and semi-shrubs. Such plantations can be created in sandy deserts, gypsum deserts and foothill semi-deserts. Each of these desert and semi-desert belts have their own specific methods of plantation establishment, taking into account their specific soil and climatic features.

As an example, an agro-technical approach for creating plantations in the gypsum desert is briefly described. Gypsum desert is the most common type of desert in Uzbekistan, occupying an area of 13 million ha in Kyzylkum and Ustyurt. Here, the most extreme aridity of the climate is combined with site conditions dominated by loamy gypsiferous soils.

For the creation of protective plantings (shrub-semi-shrub and pasture) the following species are used: black saxaul (*Holoxylon aphyllum*), salsola rigida (*Salsola orientalis*), aellenia (*Aellenia subaphilla*), Kochia prostrate and different types of wormwood and glasswort. Pasture-protective plantings are planted in belts with a width of 3 - 5 m each with spacing between rows equal to 5 - 10 times of belt width. In the gypsum desert, the following methods of processing and reclamation of gypsiferous gray-brown soils are recommended:

- ordinary moldboard plowing to a depth of 20-22 cm;
- deep plowing to a depth of 32-35 cm;
- creation of moisture accumulative trenches; and
- creation of sand accumulative trenches.

The method of soil treatment is selected depending on the specific site conditions of the location of planting. For example, creation of moisture accumulative trenches is used on strongly compacted soils (takyr, gray-brown).

Due to a weak permeability, the rain water does not penetrate deep into such soils, but flows down the slope. Precipitation of 4-5 mm form a runoff on a wet surface of such soil, which can be used for keeping the soil wet and leaching it from the salt. This is the only way of reclamation of such soil for phytoreclamation, as plowing does not improve its original state. Moisture accumulative trenches are created using single-moldboard trenching plows. They are established perpendicularly to the slope gradient so that the water flowing down the slope surface can freely slide into the trench. Trenching plows cut the trenches with a depth of 35 - 40 cm and a width at the soil surface of 60 - 70 cm.

Trenches are made in the autumn for the accumulation of snow or in early spring on moist soil. The trenches are established at least 10 - 15 m apart from one another so that the runoff water collected from the surface in between the trenches provides sufficient moisture loading for each trench. Due to runoff of spring rains the soil in the trenches is moistened to a depth of 100 -120 cm. The best sowing period is November - January. Seeding is carried out mechanically or manually to a depth of 0.5 – 1.5 cm (Instructive Guidance, 1987)

Afforestation on the dried bottom of the Aral Sea

The drained bottom is composed of light and heavy soils. Afforestation is currently possible on light types of soils. There is a variety of bottom sediments that can be described with the help of two groups corresponding to different methods of forest reclamation. The first group includes sandy and sandy-loam plains, as well as loamy sediments. The second group includes all types of shifting sands. The principle difference in the methods of establishing protective plantations in these two groups of sediments is that the first group includes sowing and planting without fixation of the relief surface, but with processing of soils, whereas the second group requires obligatory fixation of the sandy relief surface.

Three types of protective plantations are created on desert and sub-desert plains, namely pasture-protective, reclamation-forage, and soil-protective as described below.

- Pasture-protective strip plantings improve the microclimate and reduce erosion processes in spaces between the strips. Best results in the creation of such plantations were obtained when preparing the soil by chisel and disc harrow. The strips are created in tree rows with a row width of 3 m (coverage width of chisel) with a distance of 5 m between them. The distance between the strips is around 90 m. In the spring, along the rows of chisel plowing, it is required to sow seeds with burying using a spike-tooth harrow or plant seedlings at 1 m in a row. The main species is a black saxaul and Richter saltwort.
- Meliorative-forage strip plantations for growing forage shrubs and semi-shrubs are created between the pasture-protective belts. Preparation of soil for such plantations also consists of autumn strip chisel-plowing. Meliorative-forage strips are placed at intervals of 18 - 20 m. The following seeds of forage shrubs and semi-shrubs are sown along the tilled strips: aellenia (*Aellenia subaphilla*), kuyreuk (*Salsola orientalis*), and teresken (*Ceratoides eversmaniana*). The seeds of these species are sown in autumn, winter and spring; they are buried in the soil by means of a spike-tooth harrow.
- Large shrubs are used to create soil-protective plantings. Their main purpose is to reduce wind erosion of soil, stabilize the surface, and increase forage productivity in the area. Preparation of the soil is also carried out by chisel. However, placing the strips differs from the first two types. The strips are placed uniformly over the area at intervals of 10 m. Soil-protective plantations are created by sowing seeds or planting seedlings. Plantations are established as pure saxaul stands or from saxaul and saltwort by clean rows. This is necessary as mixing the two species within the same row will lead to high competition and saxaul will overgrow the saltwort.

The same types of plantations and the same technology of creation are used in alluvial deposits of the coastal zone, i.e. in the delta of the Amudarya (Recommendations, 1979).

The procedure of creation of soil-protective plantations on mobile sands of drained bottom of the Aral Sea is the same as on mobile sands of the desert zone.

4.3.2 Mountain zone

Forest rehabilitation in mountain areas includes the following activities:

- Terracing of mountain slopes with creation of forest, nut-bearing and fruit plantations, orchards and vineyards;
- Creation of erosion-preventive plantations along ravines, riversides, water storage reservoirs and mudflow reservoirs; and
- Afforestation in the riverbeds of permanent and temporary streams.

There is a wide assortment of species suitable for rehabilitation in the mountain zone. When choosing the species, the area's altitude, drought resistance and demand towards soil fertility need to be taken into account. Species are divided into fruit and nut-bearing trees, timber trees, and shrubs. On mountain slopes, the following types of soil treatment are recommended whereby it is mandatory that all operations be performed along the contour lines only:

- On slopes with a steepness below 8° - continuous plowing of the soil;
- On slopes with a steepness of 9° to 12° - strip tillage or tilled terraces;
- On slopes with a steepness of over 12° (up to 40°) – terracing; and
- Special sites (1 m x 1 m and others) are also constructed on the slopes.

Terraces serve both as method of soil preparing and hydrotechnical structures that serve to intercept runoff from the surface between terraces. Based on the method of construction they are classified into tillage, bulldozer, terracing and terracing with explosives.

Terraces are positioned obligatorily along the contour lines at distances at which the flowing water would not wash away the slopes. Terraces must intercept all the emerging runoff water and at the same time meet the requirements for growing main wood species. On the slopes of 15-20° at the most effective width of 2-3 m they are best positioned at a distance of 6 m from one another along the slope, on the slope with a steepness of 21-27° 7 m and over 27° 8 m. The width of terraces and the distance between the terraces can be different and depends on several factors; there are specific formulas for their determination.

Planting sites are mostly constructed in the areas of slopes, unsuitable for terracing, with different steepnesses and availability of a large number of stones, outcrops of rocks, as well as channels with deep gullies. Sites of a triangular cross-section with the length of 2 m and a width of 1 m are constructed manually on such slopes. They are positioned in the staggered order, the elevation between the site rows along the slope is 3 m, and the distance in the row is 6 m. The number of sites at such locations is 900-1,000 sites per one ha.

Mixed species planting is encouraged for protective plantations, because they are most productive, sustainable and have best protective properties. When mixing species, it is important to consider inter-species interactions in terms of growth behavior in order to avoid unnecessary competition. Forest crops on slopes can be created both by sowing and planting into suitable planting sites. For those species with large seeds such as walnut and black walnut, almond, apricot, oak, chestnut it is also possible to establish a stand by sowing.

Willow, poplar, sometimes Russian olive and sea-buckthorn are planted as seedlings from rooted cuttings. Willow can be planted as stake in wet sites. For the rest of forest species, it is recommended to plant one-year (fast-growing species) or two-year (slow-growing species) standard seedlings with well-developed root systems. Birch and pine is better to plant as 2 to 3-year-old seedlings, and spruce and juniper of 3 to 5-year-old seedlings. Forest crops of juniper are better planted by planting material with a closed root system that increases the survival rate of crops up to 90%.

The Republican Scientific Production Center of Decorative Gardening and Forestry (the former Central Asian Scientific Research Institute of Forestry) has also developed a large number of other recommendations on reforestation [reproduction of forests] and afforestation, such as, for example, field-protective afforestation, conducting activities in the flood-plains (tugai forests) in Central Asia, on the cultivation of industrial plantations of poplar, walnut, pistachio, and others.

4.4. Research Projects on Reforestation and Afforestation

The assignment and all the activities of the Republican Scientific and Production Center of Decorative Gardening and Forestry (RSPC DG&F) are related to research projects on reforestation and afforestation. Due to the nature of applied research activities and features of the forest sector of Uzbekistan, the entire scientific research focus of the Center is aimed at both conservation and improvement of existing forests and creation of forest reclamation plantations in various natural zones of the country.

For the desert-sand zone of the country and the dried bottom of the Aral Sea applied research is carried out in the following categories of protective plantations:

- Soil-protective, fixation of shifting sands;
- Pasture-protective belts;
- Pasture reclamation-forage belts;
- Protective plantations around oases, villages, and industrial sites;
- Protective plantations along channels and roads;
- Protective plantations along pipeline routes; and
- Creation of various forms of plantings on light sediments of the dried bottom of the Aral Sea.

In the valley zone of the country, research on protective afforestation on irrigated and dry lands has focused on the following aspects:

- Creation of the systems of field-protective forest plantations;
- Garden-protective belts;
- Plantings along channels and roads, and around water storage reservoirs;
- Large-scale forest plantations, including plantations of fast-growing species;
- Species selection and technology of establishing plantations on salt affected soils;
- Detailed growth and yield research on cultivation of forest plantations using irrigation by mineralized waters;
- Afforestation on pebbles; and
- Establishment of industrial plantations of walnut, pistachio, poplars and willows.

For the mountainous zone of the country research on protective afforestation has been conducted on the following types of plantations:

- Riparian water-regulating plantations;
- Plantations along permanent and temporary watercourses, on slopes and bottom of the ravines;
- Large-scale plantations on the slopes with steepness of over 15°;
- Plantations on mountain slopes of over 20° enabling the capture of additional precipitations in the catchment area; and
- Plantations on steep, eroded slopes with poor site conditions, especially in the upper catchments.

For all these types of protective plantations, guidelines were developed prescribing the following aspects: range of suitable species for appropriate zones based on growth and site conditions; methods of mixing species in plantations and planting density; principles of spatial distribution of protective plantings; methods of soil preparations, methods of plantation establishment such as sowing, planting, use of vegetative reproduction, as well as planting techniques; effective constructions and width of field-protective forest belts; and agrotechnology for the maintenance of plantations. In addition to the forest plantation

guidelines, a set of torrent control facilities for the mountain zone and rules of final harvest and sanitary felling were developed. Furthermore, various measures on facilitating natural regeneration were identified and a pest and disease control systems developed.

Research on forest seed orchards and nursery techniques have been conducted and include:

- Technology of collection, storage, and preparation of seeds for sowing;
- Principles of creating permanent forest seed stands and seed orchards;
- Studies of crop rotations in nurseries;
- Reclamation and rehabilitation of soils;
- Irrigation regimes;
- Use of mineral and organic fertilizers;
- Site preparation for sowing and planting;
- Nursery techniques of various sown species;
- Nursery techniques for seedlings and cuttings in seed and transplanting beds; and
- Development of rules of temporary storage, transportation and planting of seedlings and saplings.

Research on breeding, hybridization, improvement by grafting was carried out using walnut, pistachio, sea-buckthorn and other species. The Zhondor form of black saxaul, which is resistant to pests and diseases, was selected in nature for improvement purposes while several fast-growing hybrid poplars of Uzbek selection were breed.

Other areas of scientific research and experimental development works were pursued on mechanization of forest operations as well as on the protection of forest from pests and diseases by using chemical agents and biological control methods.

4.5. Analysis of Past and On-going Activities of Reforestation and Afforestation

As it was mentioned earlier, the activities on reforestation and afforestation in different natural zones of Uzbekistan have their own specific patterns. Below some examples of these activities in the valley zone and mountains are described in more detail.

In the valley zone, as evidenced by archival materials, the rights of way from both sides of the canals equal to their width were legitimated in 1894. It was recommended to plant willows on these rights of way in order to stabilize the banks and reduce evaporation. In 1898, during land development near Tashkent, foresters recommended to create forest belts with a width of 200 m at a distance of 2 - 4 km from one another. Belts had to be placed perpendicularly to prevailing winds. In 1915 – 1916, after completion of the construction of the canal in the Mirzachul Steppe and at the beginning of land development, it was planned to create plantation of trees on the entire irrigated area in the form of belts along irrigation canals, roads and streets of the villages, and around the fields to protect them from dry and cold winds.

In order to stop sand shifting to and destroying irrigated lands in Fergana Valley, protective afforestation began already in 1919. Sand holding protections in the form of belts with a width of 100 m have been created here. In the same year, protective afforestation began in the Syrdarya Region. The Mirzachul forestry enterprise established plantations in the rights of way of canals on an area of 550 ha. The works on fixing the most dangerous shifting sands, threatening irrigated lands of Tashkent, Samarkand and Fergana regions started in 1924.

In 1937, the planting of forest shelter belts was scheduled for an area of 1,000 ha. The first system of field-protective forest plantations was created in agricultural farms (sovkhoz) "Pakhtaaral" in the Mirzachul Steppe. Protective plantations were created here along the permanent canals in the form of 1 - 2 rows, mostly of poplar and willow. Especially large-scale planting works began in the Mirzachul Steppe after 1956, when development of virgin lands commenced. Plantings were carried out on 6,000 ha of perennial stands, including 3,000 ha of field-protective forest belts, a green zone around the city of Yangier on an area of 300 ha, as well as other plantings.

Large-scale works on forest rehabilitation and afforestation in Uzbekistan began in the 1960's.

In the Bukhara Region which is surrounded by deserts, afforestation activities were projected to be carried out by zones. The first zone with a width of 3 km has covered desert territory adjacent to irrigated lands. Activities on the creation of a green barrier to stop shifting sand dunes and to break dry winds were projected to be carried out within this zone. The second zone with a width of 10 km covered irrigated cotton fields bordering the first zone, i.e. desert. In this zone, four row field protective forest belts with placement of 300 - 400 m from one another have been created. The third zone with a width of 5 km covered cotton fields located far from the desert. Here, three row forest belts, placed from one another at a distance of 300 - 500 m, have been created. By 1979, about 1,000 ha of forest belts have been established here.

Extensive activities on afforestation were also carried out in the Ferghana Valley. From 1960 onwards, such activities were expanded to the Kokand's group of districts where the wind activity was particularly strong. In addition to the field-protective forest belts, 4 state forest belts were created on 250 ha, located at a distance of 20 - 30 km from one another. Considerable works were also performed in Central Fergana, where plantings for fixing shifting sands, in addition to the field-protective forest belts, had to be established. In total, more than 3,000 ha of forest plantations were established here.

Field-protective afforestation on large scales has been carried out in the South of the country, particularly in the Karshi Steppe and Surkhan-Sherabad Valley (Molchanova, 1979). In total, about 40,000 ha of field-protective forest plantations, including on non-irrigated sub-mountain lands, were established.

In Central Asia, there is a famous saying that "water is life". Mountain forests directly influence the water regimes of rivers and, therefore, special attention has been paid to mountain afforestation and reforestation. At the first congress of Turkestan forest rangers (1898) it was stated that "mountain forests should be recognized for their protective functions in preventing soil erosion and rapid snow melting, formation of mudflows and protecting springs and upper reaches feeding the entire river system of the country".

Deforestation along mountainous rivers has caused formation of mudflows and destruction of irrigation systems. Because of these events, afforestation activities along the river basins that feed irrigation canals were carried out. The first works on afforestation of mountain slopes have been initiated in the basin of the Aman Kutan River, near Samarkand (1871). Unsuccessful experience of plantation establishment, along the entire tilled areas, has resulted in the need for terracing the slopes. Afforestation in mountain areas began in the Ferghana Valley in 1884 particularly in the tract of the Peshkaut of the Shakhimardan river basin. At the same time, planting trees in Fergana City has been a common practice.

The operations on terracing of the Aktash tract, which is near to Tashkent City, began in 1896. Plantations of walnut, American ash and poplar extending over 55 ha were created in

1898. These plantings had erosion-preventive objectives, as often mudflows have been destroying irrigation canals downstream. It took up to two weeks for the local population to repair canals, while there was no water for irrigation.

During these works, the following operational aspects were tested empirically: different profiles of terraces, their ability to receive rain water of up to 100 mm per day without being destroyed, width of extension, distance between terraces, place of planting of trees on the terrace, range of suitable species, and many others. Terracing was conducted manually by trench-terraces, which have trapezoid shape in transverse profile, the so-called Aktash type terraces.

The capacity of terraces, depending on the steepness of the slope, was different from 0.49 to 0.89 m³ per running meter. The basis for calculating the capacity assumed a daily maximum of precipitation of 100 mm. The steeper the slope the closer the distance between the terraces, less capacity to absorb runoff was required. On the contrary, the terraces with bigger capacities were constructed on gentle slopes with large distances between the terraces. In order to avoid water runoff at the bottom of a terrace, bulkheads at a distance of 21 m were constructed.

Afforestation works continued until 1960 by planting trees within the areas between the terraces. Soil preparation was carried out by creation of holes with the size of 40 cm x 40 cm x 50 cm, and later on, this was increased to a size of 1.5 m x 1 m.

Since 1960's, the works on creation of terraces have been mechanized (Botman, 1968).

In the desert zone, fixation of sands by methods of forest reclamation was initiated in the late 1920's in the Bukhara region by the Bukhara Sand-Fixation Party, founded in 1924 by the Forest Department under the National Commission of Agriculture of the USSR. Forest crops of saxaul and saltwort have been created using mechanical ground cover shields from bulrush and other local materials. Most of the forest-crop works in the desert were performed during the postwar years by aerial sowing, solid seeds scattering from camels, cars and tractor trailers and by planting of seedlings using tree-planting machines on plowed belts.

Thus, afforestation in Uzbekistan looks back to more than a hundred years of history and has strongly focused on ameliorative activities, which is associated with local soil and climatic conditions and lifestyle. Currently, there are 2.83 million ha of forest covered lands in SFF, including 5.95 million ha of artificially created plantations or 21% of all forests. In addition, there are 1.56 million ha of so-called forest crops without crown closure (young plantation), which can replenish the area of artificial plantations in case of sufficient survival rate at a certain age (generally at an age of four years).

As it was mentioned earlier, in 2006, the Main Department of Forestry developed and approved a Forestry Development Program for 2006-2010. This program is aimed primarily at strengthening the measures on conservation and accelerated reproduction of forest resources, enhancement of ecological and protective functions of forests, rational use of forest fund lands, and expanding the forest lands of the Republic.

The works on sowing, planting and performing measures on promoting natural regeneration on the area of 42,000 ha of the State Forest Fund are carried out every year. These include 13,100 ha of new forests created through sowing of seeds of forest species, 17,900 ha through planting of seedlings and saplings of different wood and shrub species, and 11,000 ha where enhancement of natural regeneration is carried out.

Out of the total volume of seeding and planting operations, more than 80% are undertaken in the desert zone of Priaralie and on the dried bottom of the Aral Sea (Republic of Karakalpakstan, Bukhara, Navoi and Khorezm regions). In these territories, every year reforestation and afforestation operations are carried out on an area of over 34,000 ha using the main sand-tolerant species such as saxaul, saltwort and kandym. In the mountain zone, the main species planted belong to three genera of archa, walnut, almond, and pistachio. In the valley zone poplar, maple, plane, elm, gleditschia, and fruit species were used while in the tugai zone the mostly poplar, willow and oleaster were planted.

Natural regeneration all over the territory of the forest fund, in general, shows unsatisfactory progress due to various reasons explained earlier in this paper. Because the establishment of forest plantations through sowing and planting is labor-intensive and expensive, more and more attention is paid to expand the forest area through activities promoting natural regeneration. The main activities on promoting natural regeneration of forests include:

- Conservation and protection of undergrowth;
- Retaining seed-bearers during timber harvesting;
- Cleaning cluttered areas and liberating natural regeneration;
- Preparation of the soil for promoting natural regeneration;
- Fencing of felling and cutting areas; and
- Maintenance of undergrowth.

At present, activities on natural regeneration are carried out on an area of 11,000 to 13,000 ha each year. In the coming years (2007-2011) reforestation works are scheduled to be carried out in an area of 211,000 ha.

Despite the significant volumes of planned and ongoing works on reforestation and afforestation, their final effectiveness is relatively small. It is connected to the rather difficult and complex forest growing conditions of the country, quality of performed work, weak conservation and protection of new plantations, and lack of qualified personnel.

Growing of planting stock for artificial reforestation and afforestation, and improving of green spaces and beautification have been implemented in more than 50 specialized subdivisions of the forestry enterprises. Presently, the area of forest nurseries comprises over 700 ha. Out of these, 200 ha are considered to be permanent (organized in 25 forest enterprises) and 500 ha are temporary. More than 80% of the forest nurseries are located in irrigated, while others are situated in desert and sandy zones. Of these, 46% are used for germination, 44% for transplanting, and 10% for supporting activities of forest nursery operations.

The annual production of planting stock is over 50 million seedlings and saplings and fully meets the needs for forest plantings. In addition, part of the planting stock is sold for planting of trees in cities and other localities of the republic. The variety exceeds 60 species of trees and shrubs. This includes 18.5 million sand-tolerant species, 18.1 million fast-growing species, 12.8 million nut-bearing species, 0.4 million coniferous species and 0.6 million decorative species.

4.6. Forest Rehabilitation Outputs and Future Directions

Due to the nature of forestry in Uzbekistan, the efficiency of activities on reforestation and afforestation in general benefits the country's economy. The economic, social and environmental aspects of forestry can be highlighted as follows:

Economic role of forests

The natural conditions and the nature of the forest vegetation in Uzbekistan are responsible for the relatively minor economic role of the forestry sector. Commercial felling in natural forests of the country is prohibited (only sanitary cuttings are allowed). Moreover, the species composition of forests does not favor timber harvesting for commercial purposes. The income from the forests of Uzbekistan consists of commercial and fire woods, medicinal and aromatic plants, hunting and fishing on lands of the State Forest Fund. In 2002, the total amount of income from these types of products and activities was USD 314.090 (FAO, 2005). In addition, the planting stock of forest, fruit and decorative species of trees and shrubs are also cultivated for sale. Also, 40 tons of honey and 1,300 tons of vegetables are being produced. Annually, the forestry enterprises, on average, harvest 130-150 tons of nuciferous products, including 90 tons of walnut, 15 tons of almond, and 35 tons of pistachios. Fruits and berries are harvested and processed at about 2,500 tons. There are also some dozens of small wood processing plants producing windows, doors, furniture, and products made from canes for the local market.

Social role of forests

The social role of forests is mainly determined by the fact that there are local people living in the territory of the State forest fund, including in areas close to the forests. For local communities forests represent their natural environment and serve as a source to meet vital daily needs. Due to recent significant socio-political and economic changes, the needs of the local population for forest resources (i.e. grazing, firewood, non-wood forest products), partly satisfied illegally, have highly increased. This is connected to a lack of dialogue between the local people and authorized forest bodies or this dialogue has been one-sided in the form of law enforcement. Therefore, cooperation of the forestry sector with local communities becomes more and more urgent, though only very few steps have been made in this direction.

Gaining independence and breaking relations with other former Soviet Republics have created a demand for satisfying recreational needs inside the country. Opportunities exist but have not been used fully until now. It is quite natural that for a country with an arid climate, the recreational potential is associated with forests and water. However, the number of tourist routes and rest houses located in the forest or nearby is very limited. Although the cases of renting out to tourist residences in mountain forest areas by the local population are rapidly increasing.

Growing urbanization also increases the need for enhancing the urban environment in the desert zone, thus resulting in the creation of urban and suburban forest plantations. Forestry provides jobs, though their number is quite insignificant (less than 8,000).

Ecological role of forests

The ecological functions of forests are recognized at state level and their importance grows with the worsening of the ecological situation in the country. It includes conservation of biological diversity and combating against desertification (including on the dried bottom of the Aral Sea, and stabilization of irrigated agricultural landscapes). The increasing water shortage attaches growing importance to the water conservation role of forests in the mountains, i.e. watershed management in places of formation of river runoff. In all natural zones of the country the soil protective function of forests becomes more and more important. Afforestation on the territory of the State Forest Fund, and more importantly on irrigated agricultural lands, has high carbon sequestrating potential, but has not been used thus far. This potential contains not only an ecological aspect related to the mitigation of climate change, but has also an economic value that can be realized in cash income. Despite the fact that it is difficult to evaluate these forest functions in monetary terms, in Uzbekistan it has higher priority compared to all other forest uses.

It has been noted already that a National Forest Policy has been developed in the country. Based on a thorough analysis of the current situation of the country's forestry sector in general, and efforts towards reforestation and afforestation in particular, the policy outlines systemic directions and the necessary changes for implementation suitable to raise the forestry sector of the country to a higher level. Therefore, the main task today is to adopt the new forest policy and ensure its gradual implementation.

5. Capacities in Forest Rehabilitation

5.1. Institutional Capacities

In order to improve the activities in reforestation and afforestation, general measures to strengthen the capacity of the authorized bodies for forestry will be required.

The structure of forest administration in Uzbekistan has been discussed in subsection 2.5. During the years after independence, forestry has been developing inertially and has not undergone any deep and systemic reform. The status of the authorized body for forestry has been reduced (it was changed from the State Committee for Forestry [1991] to the Main Department under the Ministry of Agriculture and Water Resources [2000]), as well as its ability to perform its tasks. This is due to the fact that forestry was not a priority direction in the country's development.

However, since gaining independence, the value of the forest sector has objectively grown and now this situation is further changing with the Government's proposal for assistance to FAO in the development of a national forest policy. Currently, the draft of the medium-term document "Strategies for solving forestry development problems", which is a part of the NFP, is ready and in case of its approval and implementation, the forest sector will be reformed. It should also result in institutional changes in the authorized body for forestry [MDF].

According to the new policy, the Main Department of Forestry should be the authority in charge of formulating and implementing the country's forest policy, which requires in particular:

- Involvement of stakeholders in forest management;
- Establishment of cross-sectoral cooperation and coordination with local authorities;
- Evaluation of its activities in accordance with corresponding international treaties; and
- Establishment of regional cooperation and communication with communities.

Addressing these new challenges will require creation of new structures, such as:

- Subdivision on cross-sectoral cooperation and coordination with local authorities (or the National Coordinating Council of Forestry, or to assign a person for such cooperation);
- Subdivision on community based forestry and joint forest management;
- Subdivision on international cooperation; and
- Subdivision on public relations.

Effective implementation of these tasks will require other structures to perform regulatory, supervisory and managerial functions. Currently, all these functions are assigned to MDF.

In addition, in order to enhance the institutional capacity of MDF, it will be helpful to restructure MDF as an independent subdivision under the Cabinet of Ministers of the Republic of Uzbekistan. It is advised to delegate to the Main Department of Forestry the main responsibilities for the management of all protected natural territories, forestry fund and forest lands outside the forestry fund area.

It is required to increase the capacity of forestry departments of universities by a revision of curricula in accordance with the forestry development strategy, close cooperation of MDF with scientific research institutions for identifying research topics and using results of their research and available scientific knowledge.

5.2. Civil Society Involvement

There is only one NGO in Uzbekistan specializing on problems of the forestry sector: "Ecoles". This organization has implemented several projects on afforestation and landscape gardening. However, conservation and improvement of forest conditions of Uzbekistan can be reviewed in a broader context, namely as part of the problem of environmental protection. In the mid-1990's, environmental issues have attracted wide public attention. Thus, non-governmental organizations working in this field, not only in regional, but also in district centers, were created in Uzbekistan. Specialization of these NGOs was very diverse: environmental education, biodiversity conservation, desertification, drying of the Aral Sea. At this time, the following ecological NGOs were founded and became operational: Zoological Society of Uzbekistan, "Ecology", Association "For ecologically clean Fergana", "Union of protection of Aral Sea and Amudarya", Center of Ecological Law "Armon", Scientific Advisory Center "Ecoservice", Youth Ecological Network of Uzbekistan, Republican Community Center "Atrof-muhit va soglom hayot" ["Environment and healthy lifestyles"], Ecological Resource Center "Ecomaktab". For example, at present about 70 NGOs are operating and dealing with environmental protection issues in Uzbekistan (Turabekova Sh.).

In order to join the efforts of NGOs on increasing the effectiveness of public participation in environment protection and implementation of joint activities in addressing environmental issues, the Republican Association Ecoforum of NGOs of Uzbekistan was established in 2007. Several coalitions of ecoNGO have successfully implemented various projects within the framework of EcoForum including water-related subjects, environmental education and education for sustainable development, biodiversity conservation, development of ecojournalism, and others. In the dissemination program, the Ecoforum offers a web site (www.ecoforum.sk.uz), electronic newsletters, and exchange of information via the electronic network of EcoForum members.

Working with young people is an important arm of EcoForum's activities. There are environmental NGOs working with schoolchildren and students; school eco-clubs successfully operate in different cities of the country; ecological summer camps and trips are organized; youth is involved in nature protection activities initiated by NGO coalitions. The cooperation with the youth ecological network of Central Asia is developing.

During 18 years of development, considerable work has been performed in the field of environmental protection, significant experience in addressing ecological problems and overcoming their negative impacts has been gained. However, the seriousness and the magnitude of the existing problems have required combined efforts of state bodies, public associations, civil society institutions and citizens to improve the ecological situation in the country and in the region. As a logical and timely consequence in this regard the Ecological Movement of Uzbekistan was established. One of the most important tasks of the Movement is to increase active participation of communities in environmental protection and improvement

of the ecological situation, fulfilling systematically existing laws and other government regulations on environmental issues and promoting further improvement and development of legislation in this area.

One of the priorities is promoting unconditional fulfillment of legislative acts aimed at addressing existing ecological problems, ensuring rational use of resources allocated for this purpose. The Ecological Movement actively engaged in the improvement of ecological awareness of the population, the development of a system of ecological education and training. It also deals with international cooperation in the field of environmental protection, consolidation of efforts, coordination of the activity of non-governmental organizations operating in the field of environmental protection. Since its establishment, the Ecological Movement has conducted a large-scale informational campaign in the mass media through various meetings, promotions, contests and other activities. The Ecological Movement of Uzbekistan is represented in the Lower Chamber of Parliament (15 seats). Representation in the Legislative Chamber of Oliy Majlis of the Republic of Uzbekistan will enable the Ecological Movement to have a direct impact on the effective improvement of environmental legislation, ensuring its unconditional fulfillment.

5.3. Education on Reforestation and Afforestation

Until 2003, there was a Tashkent Forest Training College located in the Tashkent Region, which trained 45-60 forestry technicians annually. Due to lack of qualified teachers, material and technical difficulties this institution was restructured. There is a Sariassiya Professional College operating in the Surkhandarya Region, which trains 15 forestry technicians annually. Currently, the college experiences the need for qualified teaching staff, new educational programs, and material (e.g. textbooks).

There are 3 institutes of higher education:

The Tashkent State Agrarian University (TSAU) has educated 117 - 216 bachelors and 8 - 11 masters annually during 2004 - 2008.

Preparation of forestry specialists has begun in TSAU since 1944. To date, the number of graduates of the University exceeds 2,000 people, including 15 doctors and 50 candidates of science (PhD). Until 1990, TSAU was considered to be the main educational institution for Central Asian countries. At that time education was conducted at the Forestry Faculty. Presently, it is conducted in the Department of Forestry of the Agronomy Faculty. Students are taught in the following subjects: dendrology, forestry, tree breeding, forest fires and fire control measures, scientific research methods in forestry, landscape gardening, mechanization of agricultural production, hydrology and hydrometry, geodesy and topography, forest management and forest use, forest valuation, economics and management of forestry, accounting and statistics in forestry.

In 2004, the students had the choice of two specializations: 1) Agroforestry reclamation, protective afforestation and 2) Forestry management. In 2005-2006, they could choose between 1) Agroforestry reclamation and protective afforestation, 2) Forestry management, 3) Tree planting and landscape construction. Since 2007, only one specialization, namely Forestry Management, is offered.

Presently, there are 3 professors, 4 associate professors and 3 assistants working in the Department. Currently, there is a forest seed laboratory operating in the department; the students receive practical training in different forestry enterprises of the Republic.

Faculty of Forestry in the Nukus Branch of the Agrarian University. In 2008, the first graduates were 15 bachelors who received diplomas in forestry engineering.

Department of Forestry of the Samarkand Agricultural Institute (2005). Presently, there are 17 students at bachelor level being taught in this department. Resource base and pedagogical capacity are inadequate.

The Production Center on Training of Forestry Specialists conducts 24-hour training courses, where the trainees are familiarized with existing and newly adopted legislative documents, economics and forestry management. Classes are held in the form of lectures, with practical sessions using videos and computers.

Every year, 20-25 heads of forest enterprises, 30-50 chief foresters, 35-40 chief accountants and economists of farms undergo short-term trainings in the Production Center on Training of Forestry Specialists.

The Republican Scientific and Production Center of Decorative Gardening and Forestry, as well as the Tashkent State Agrarian University train postgraduate and Ph.D. students in forestry subjects (Anonymous, 14).

There are various difficulties encountered in forestry education, including problems with specialized educational literature in Uzbek language, translation of forest terms and their application under specific conditions of the country, insufficient knowledge of students, and not all of the graduates are working in the specialized area they have studied.

5.4. R&D Needs in Forest Rehabilitation

During Soviet times, the Central Asian Scientific Research Institute of Forestry was the main regional institution in forestry, with branches in Turkmenistan and Tajikistan. Since independence, it has become the Uzbek Scientific and Research Institute of Forestry (USRIF), and its responsibility has been limited within the borders of the country. The organizational structure of the Institute included the following divisions: field-protective afforestation, breeding and seed production, mountain forest reclamation, desert forest reclamation, radiobiology, forest crops, mechanization, agrichemical laboratory, and forest operations and machinery.

Almost until the end of 1990's, the Institute has been working on scientific research areas, inherited from the Soviet times, within five-year research periods. At this time, there was an active outflow of qualified personnel, especially young persons. At the end of 1980, the institute employed about 50 people with academic degrees and by the end of 1990, this number decreased to 20.

In 2005, the USRIF was changed to the Republican Scientific and Production Center of Decorative Gardening and Forestry (RSPC DG&F). Its tasks now include a new area, in which it has not been engaged previously, related to the development and implementation of a unified strategy for development of decorative gardening. The scientific part of the Centre consists of scientific research projects which have been acquired on a competitive basis. Scientists form temporary creative teams which are not employed by the Center. Presently, there are about 10 professionals with academic degrees at the age of over 55 employed by the Center.

The main needs of forest science of Uzbekistan in general and research on reforestation and afforestation in particular can be summarized as follows:

- Ensuring continuity of the Uzbek School of Foresters, at least, its main directions, as almost all qualified scientific personnel is near retirement age and its number is decreasing rapidly, while there is lack of young scientists;
- Working out in coordination with MDF of priority research programs on the most important areas of practical forestry (forestry reclamation of deserts and dried bottom of the Aral Sea, mountains and farming lands, creation of industrial plantations to obtain timber and nuts of different nut-bearing species, conservation of genetic resources and forest biodiversity);
- Breakdown of these programs into stages, joint monitoring and adjustment of their implementation;
- Increase of funding of scientific research through various sources and their concentration, including the state grant funds, for research outlined in the priority programs;
- Conducting training for scientists, e.g. foreign language (mostly English) learning program, computer classes (Word, Excel, PowerPoint, Internet, statistical processing of field data, etc.);
- Access to new scientific publications and participation in scientific conferences, familiarization with the new directions of forest research and new methods of its implementation;
- Improvement of material and technical conditions of the research work; and
- Effective use of accumulated knowledge, critical analysis of available scientific recommendations, their adaptation to modern conditions and further development as well as broad use in forestry production.

5.5. International and Regional Cooperation on Forest Rehabilitation

Specialists of the Main Department of Forestry actively participate in international events such as workshops, conferences and symposia organized by international organizations.

The Main Department of Forestry has appointed national correspondents to collect data on the forestry sector and conduct an international assessment of forest resources of the country for FAO. In the frame of FAO/EEC UN in Central and Eastern Europe, Uzbekistan has delegated its representative to the Group of Experts of Eastern Europe countries, which is assigned to assist FAO and EEC UN in their activity in the region and to provide feedback. The objective of the Group of Experts is to increase the effectiveness of international activity (FAO/EEC UN), aimed at promoting contribution to multi-functional forest management and sustainable development of the countries of Eastern Europe through enhancement of the private forest sector, as well as forest policy and institutional framework, promoting discussions, dialogue and exchange of information among the countries.

Below are the international projects which have been implemented on the lands of the State Forest Fund under the jurisdiction of the Main Department of Forestry:

- Afforestation of the dried bottom of the Aral Sea by local salt resistant plants. The project was implemented on the basis of a contract between the Main Department of Forestry of the Republic of Karakalpakstan and the Aral Sea Salvation Fund during 2003-2008. The total area of planted trees amounts to 10,000 ha.
- Afforestation of the dried bottom of the Aral Sea and agrotechnology of cultivation of poplars in the Fergana Region, which was implemented by the NGO KOFUTIS (France) during 2002-2005. The project consisted of two components: one of them

included the cultivation of saxaul in the Aral Region, and the second one established plantations of fast-growing hybrid poplars of French breed;

- Creation of forest crops on the dried bottom of the Aral Sea under the Program Section 416 (b) (USA). Funds in the amount of UZS 800 million were used for planting forest crops on the dried bottom of the Aral Sea during 2004-2006;
- For the purpose of improving the ecological situation in the Aral Sea Region and reclamation of the dried bottom of the Aral Sea a GTZ-supported project (since 2000) has been implemented, involving the establishment of forest plantations on the dried bottom of the Aral Sea;
- For the purpose of developing the National Forest Program and improving the forest legislation in Uzbekistan the Main Department of Forestry with the support of FAO has implemented the project "Development of the National forest policy and improvement of forest legislation" TCP/UZB/3101 (A). Within the framework of the project, the draft of the National Forest Policy and the draft of the Forest Code have been worked out with participation of international experts, local communities, agencies, ministries and other stakeholders. These documents were discussed on May 5-8, 2009, in Samarkand at the sub-regional FAO workshop on exchange of experiences and opinions with representatives of the forestry sector of Azerbaijan, Kyrgyzstan, Kazakhstan, Tajikistan and Turkey.

Current international projects:

- Project of the Government of the Republic of Uzbekistan, the Global Ecological Fund (GEF) and the United Nations Development Program (UNDP) "Achieving ecosystem stability on degraded lands in Karakalpakstan and Kyzylkum desert". The project has been implemented since 2008. The prerequisites for the start of the project were the phenomena of degradation and desertification of lands in the Karakalpakstan and Kyzylkum deserts. The project is being implemented within the framework of the International Convention to Combat Desertification and the International Convention on Biological Diversity;
- Project of the Government of the Republic of Uzbekistan, the Global Ecological Fund (GEF) and the United Nations Development Program (UNDP) "Enhancement of sustainability of the national system of protected natural territories by focusing on the reserves". The project has been implemented since August 2008. Prerequisite for the start of the project was inefficiency of biodiversity protection from various threats. The project intends to demonstrate the new approaches to management with the purpose of expanding the system of protected natural territories in Uzbekistan;
- Project of the Government of the Republic of Uzbekistan, the Global Ecological Fund (GEF) and the United Nations Development Program (UNDP) "*In-situ* conservation of wild crop relatives by strengthening information management and its practical application"; and
- Project of the Government of the Republic of Uzbekistan, the Global Ecological Fund (GEF) and the United Nations Development Program (UNDP) "*In-situ*/on farm conservation and use of agro-biodiversity (fruit crops and their wild relatives) in Central Asia".

6. Future Steps

There is no reason to discuss development perspectives of reforestation and afforestation outside the context of the general state of the forestry sector. Currently, the forestry sector is under pressure to implement the necessary changes. Therefore, the most important issue for forestry of Uzbekistan is the approval and implementation of the developed National Forest

Policy. This will be an important step in the transition of the forestry sector from simply forecasting the scope of forestry activities to the elaboration of the development strategy of the sector.

It is assumed that NFP will be implemented on a step-by-step basis. Currently, the drafts for the elaboration of a national concept and strategy for forestry development have been prepared. Following approval of these documents, an Action Plan, i.e. a short-term document for the next five years with detailed elaboration of activities, terms, volumes and sources of funding, responsible persons and other activities, will be developed.

In addition, prior to implementation of the Action Plan, or in parallel with its implementation it is required to meet the following main conditions:

- Development and adoption of the Forest Code and relevant regulations, making additions and changes to other normative documents;
- Strengthening institutional capacity of forestry organizations, namely restructuring of MDF as a separate subdivision; transfer to MDF of main authorities on the management of all protected natural territories, as well as forest covered lands to the Main Forestry Department; improvement of working conditions of forestry employees, provision of necessary requirements for vehicles, technical equipment and other equipment; increasing budgetary financing of the Republican Training Center under the Main Department of Forestry; improving training programs; improvement of dialogue and cooperation of MDF and its subdivisions with interested organizations, including government agencies, NGOs, local population, private sector, schools, mass-media; enhancement of the capacity of forestry training institutions through revision of their programs in accordance with the forestry development strategy, establishing closer cooperation of MDF with RSPC DG&F in selection of subject areas, use of research results and existing scientific knowledge;
- Allocation of funds and introduction of mechanisms for the implementation of the National Forestry Program: using available limited budgetary resources for priority programs and priority types of activity; increasing the revenues of forestry enterprises through development of collection and processing of forest products, land lease, sale of seedlings, recreational activities, ecotourism and hunting, as well as exempting the forestry activities from taxes. In order to increase funding for the forest industry from the state budget, it is required to raise awareness of the members of Oliy Majlis, heads of public organizations, Ministry of Economy and Ministry of Finance, and the whole society about economic, social and environmental importance of forests; increasing the investment by local authorities to forestry through joint projects; creation of conditions for attracting private investments to the forestry sector; and
- Broadening the knowledge base on forestry: in order to make necessary well-grounded decisions on forest management, it is required to conduct an inventory of forests and to create a corresponding database and monitoring system. For this reason the necessary technical infrastructure and qualified personnel need to be created in the MDF.

This preliminary work will enable the implementation of the main directions of forestry development in the country.

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Desert forest ecosystem in Uzbekistan (Photo taken by Nikolai Lyutsian)



Former bottom of the Aral Sea (Photo taken by Nikolai Lyutsian)



Pistachio forest in Uzbekistan (Photo taken by Nikolai Lyutsian)



Tugai forest in Uzbekistan (Photo taken by Nikolai Lyutsian)



Walnut forest in Uzbekistan (Photo taken by Nikolai Lyutsian)



Juniper forest in Uzbekistan (Photo taken by Nikolai Lyutsian)