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## REVIEW OF DESERTIFICATION AND FOREST DEGRADATION ISSUE IN KAZAKHSTAN

<sup>1</sup>SARSEKOVA D., <sup>2</sup>AYAN S., <sup>1</sup>KİTAİBEKOVA S.

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**ABSTRACT:** Natural and anthropogenic factors are the causes of desertification and forest degradation in Kazakhstan. The key natural factor contributing to desertification processes in Kazakhstan is the intra-continental state of the country, determining continental and arid climate, the scarcity and irregularity of the water resources' distribution, causing wide spreads (up to 30 million ha) and saline lands (127 million ha). These natural features of Kazakhstan cause poor resistance of the environment to human impact. It is estimated that about 75% of the country is subject to high environmental risks. Anthropogenic factors that lead to the emergence and enhancement of desertification processes in Kazakhstan are mainly associated with such economic activities as: grazing, agriculture, intensive usage of mineral resources, construction and operation of industrial, military and civilian facilities, irrigation and linear structures. Desertification is also the result of illegal logging, uprooting shrubs and dwarf shrubs for fodder and fuel, forest and grassland fires, haphazard recreation organization dumps around settlements, pollution of soil and groundwater with toxic substances. In addition, in Kazakhstan, each type of forest has its own set of factors causing forest degradation. The forests of forest steppe zone such as birch stands mixed with aspen and willow suffer from reduction in area because of extensive agricultural cultivation of steppe land around woodland. Briefly, it can be said: The main threats to the forest ecosystems of Kazakhstan include conversion of tugai forest into agricultural land, increased cutting for fuel wood, illegal logging and forest fires.

**Keywords:** Central Asia, climate change, desertification, deforestation, anthropogenic factor, steppe forest.

### 1 INTRODUCTION

The Central Asian Region grow out of both vast lowland plains mainly in the north bordering Russia as well as mountain ranges of various altitudes located in the south and southeast such as the Altai, Jungarian Ala Tau and the Tian Shan mountains at the border of Western China. The largest lowland plains are located in Kazakhstan, particularly in the north and western parts of the country. The climate in Central Asia is highly continental with quite hot summers and cold winters. Usually, annual precipitation in the lowlands and foothills ranges from 80 to 500 mm while the mountainous areas receive more rainfall at a level of about 1,000 mm/year. Except for the mountains, in the lowlands the annual rainfall is several times less than what could be evaporated, resulting in a considerable moisture deficit. Dry climate ensures the conditions for the hegemony of desert and semi-desert landscapes. The countries of Central Asia are home to diverse ecological features caused by varying topographical and climatic characteristics (Kleine *et. al.*, 2009).

This study focused on forest types and climate change and its effects, forest, and land degradation in Kazakhstan; and finally, suggests some measurements to take and priorities to set for forest rehabilitation and restoration practices in Kazakhstan.

#### 1.1 Vegetation and climate characteristics

As represented by FAO's ecological zoning maps, Central Asian countries mainly belong to the moderate steppe and moderate desert zones (Kleine *et. al.*, 2009). Similarly, Kazakhstan lies down mainly in a temperate climate zone, with subtropical deserts in the south lowland plains with steppes, semi deserts, and deserts form 60 % of the surface area, while arid foothills represent 30 % and mountains 10 %. Kazakhstan includes many lakes and rivers, the largest of which are the Lake Balkhash and the Irtysh River. Its location between the Siberian taiga and Central Asian deserts and between the

Caspian Sea and the high mountains of the Tien-Shan means the country possesses a great variety of natural landscapes and ecosystems (Anonymous, 2001). Kazakhstan is a forest-poor country (Anonymous, 2007); forest cover percent in the Republic is only 4.57 % (Yesserkepova, 2010; Mambetov *et. al.*, 2013). That's why only 3.1 million ha belongs to high forests. The forest cover percent determined by European standards amount to 1.1 %, not 4.5 % as stated by Mambetov *et al.* (2013). 97 % of the forests have been classified primarily as protection forests, two-thirds of which is entirely excluded from commercial timber harvesting (Kushlin *et. al.*, 2004). Forests mainly occupy the northern part of the country and the high mountain slope valleys and riparian areas (Anonymous, 2001).

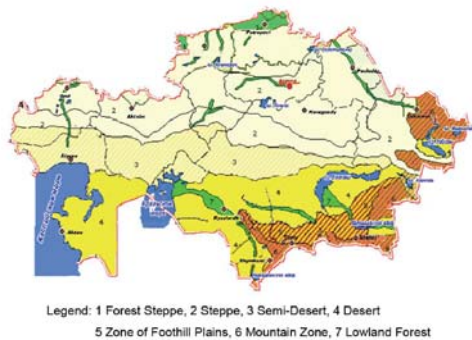
Although this region is characterized by severe winters and relatively hot summers in the north and continental climate under hot conditions in the southern parts, it has a unique vegetation character determined by various topographic and climatic features. The climatic features of these zones are shown in Table I (Anonymous, 2001).

The forests in Kazakhstan belong to different phytogeographical zones. The more humid north refers to forest steppe zone, and with an increase of dryness towards the south follow steppe, semi-desert and finally the desert zone as shown in the zoning map in Figure 1.

The coldest month is January and the warmest one is July. There is little precipitation, especially in the southern regions. Annual precipitation in the south is 100 mm in the south, while it is 300-500 mm in the north. In Kazakhstan (except for its mountainous parts) the annual rainfall is several times less than what could be evaporated, resulting in a considerable moisture deficit. The average temperature in January varies from -5 °C in the extreme south to -20 °C in the north. In the plains of Kazakhstan the average July temperature varies from +18°C in the north to +29 °C in the south (Meshkov *et. al.*, 2009).

**Table I:** Basic climatic indexes of natural zones of Kazakhstan (Arkhipov *et. al.*, 2000)

Climate Indices	Highland	Forest-Steppe	Steppe	Semi-Desert	Desert
Air temperature - annual average (°C)	+ 0.3... +1.0	+ 0.3... +1.0	+1.1...+3.1	+4.4...+6.4	+7...+12
Average temperature in July (°C)	+5... +17	+18... +19	+18... +22	+23... +25	+25... +30
Average temperature in January (°C)	-25	-19	-16... - 19	-12... -20	-5... -15
Annual precipitation (mm)	500... 1200	350... 400	200... 400	150... 280	100... 200
Summer precipitation (% of total annual precipitation)	30... 60	60	70	40	35
Duration of vegetation period (days)	0... 150	160... 170	170... 180	170... 200	200... 240
Duration of the snow period (days)	200... 365	150... 170	140... 160	120... 140	30... 120
Area (percentage of land cover)	1.0	10.3	19.7	22	47



**Figure 1:** Natural vegetation zones in Kazakhstan (Meshkov *et. al.*, 2009)

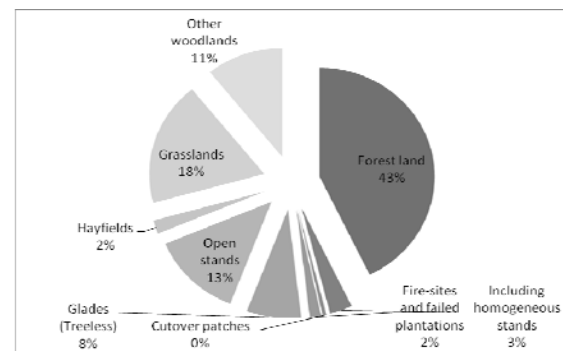
### 1.2 Status of forest and its degradation

Kazakhstan, like whole Central Asia, belongs to the least forested areas in the world. In all five states of the region - Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan – forests cover less than 10% of the territory (FAO, 2007; 2010). The more recent statistics by FAO related to forestry sector is shown in Table II and Table III for Kazakhstan and the other countries of Central Asia Region (Anonymous, 2014). In Central Asia countries, national changes in forest areas over the past 25 years (1990-2015) showed positive trend for Kazakhstan and Kyrgyzstan and negative trends for Uzbekistan. However, the average forest growing stock volume (19 m<sup>3</sup>/ha) has decreased in Kazakhstan since 1990 (Sakıcı and Ayan, 2016).

In Kazakhstan, the largest country in the Central Asia Region, forests cover about 12.3 million ha. representing 44 % of the State Forest Fund area of 27.8 million ha or 10.2 % of the total territory (Figure 2) (Kleine *et. al.*, 2009; Meshkov *et. al.*, 2009). The major ecosystems with some form of tree cover include forest steppe, steppe, semi-deserts and deserts, foothill plains, the mountain zone, and lowland forests (Kleine *et. al.*, 2009).

The area and standing wood stock of main woodland type in Kazakhstan is given in Table II (Mátyás, 2010). The main forest-forming species are conifers – *Pinus silvestris* L., *Picea schrenkiana* Fisch. & C.A. Mey., *Picea obovata* Ledeb., *Abies sibirica* Ledeb., *Larix sibirica* Ledeb., *Pinus sibirica* Du Tour; softwood broadleaved – *Betula pubescens* Ehrh. *Betula verrucosa* Ehrh., *Populus tremula* L.; hardwood broadleaved - *Quercus robur* L., *Ulmus laevis* Pall, *Ulmus pinnatoramosa* Dieck ex Koehne, *Elaeagnus angustifolia* L.; *Haloxylon aphyllum* (Minkw.) Iljin, *Haloxylon persicum* Bunge ex Boiss. & Buhse (Figure 3). In the northern part of the country which represents a continuation of the

West Siberian Lowlands, birch forests extend over a huge territory, generally scattered among croplands. To the south is the pine woods seen as the ribbon-like pine forests on the right banks of the Irtysh River. The Kazakhstan Altai covers the eastern part of the Altai range including the right sub-basins of the Irtysh River. This mountainous area is covered by forests consisting of spruce, larch, pine, birch and aspen, while *Pinus sibirica* occupies the top part of the mountain slopes (Meshkov *et. al.*, 2009).



**Figure 2:** Forestry fund lands according to current stocking conditions (Meshkov *et. al.*, 2009)

With more than 6 million ha, saxaul take up the major part of the forest area followed by coniferous forests and birch forests (Figure 3) (Kleine *et. al.*, 2009). All forests in the Republic of Kazakhstan are protective forests. This issue becomes topical in forest-poor areas, to which Republic of Kazakhstan belongs (Mambetov *et. al.*, 2013). It is seen that some parameters such as employment and gross value added, and also some indicators such as food security, energy, shelter related to Kazakhstan forest sector are comparable with other Central Asia Countries (Table III, IV) (Anonymous, 2014).

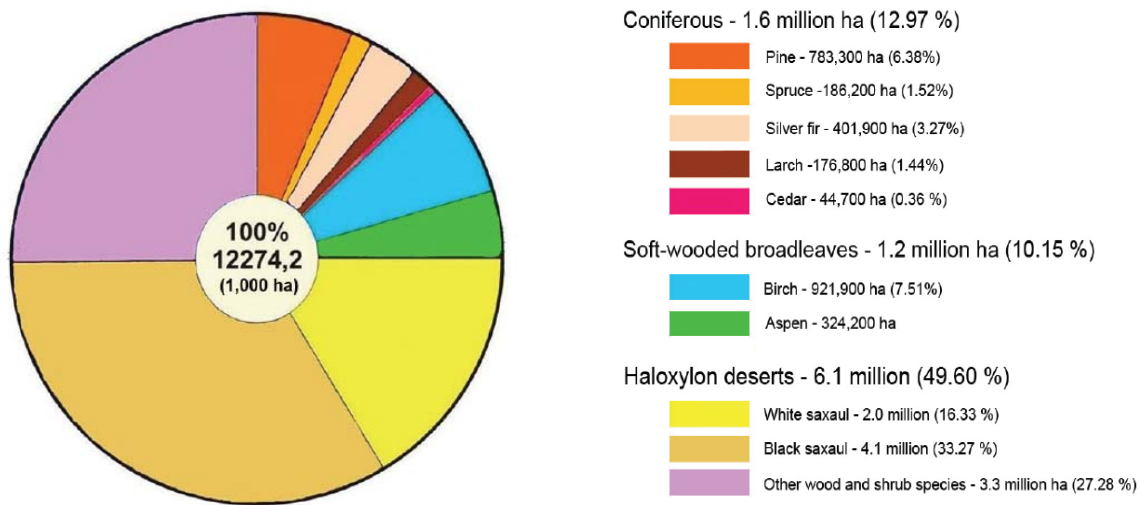
The forests in Kazakhstan are unevenly distributed, with about 80 % of the wood stock in the northern and northeastern areas. The percentage of wooded land in Kazakhstan, including *Haloxylon* spp. and bushes, is 4.5%, while forests are only 1.2 %. Nevertheless, despite their small size, the forests play an important role in soil protection, climate and water regulation, water protection and recreation (Yesserkepova, 2010).

### 1.3 Climate change vulnerability assessment for forest

Yesserkepova (2010) has stated the possible effects of the climate change on the forests of Kazakhstan. In terms of percentage of forest land, Kazakhstan stands low in the global list, although area per person in Kazakhstan,

**Table II:** The area (1000 ha) and standing wood stock (million m<sup>3</sup>) of the main woodland classes in the Republic of Kazakhstan (Mátyás, 2010, *Data source: Kazakh Forest Management Enterprise*)

Year	Woodland class											
	Coniferous		Deciduous softwood		Deciduous hardwood		Saxaul spp.		Other wood		Bushes	
	area	stock	area	stock	area	stock	area	stock	area	stock	area	stock
1988	1737.5	221.1	1303.3	115.6	86.5	2.3	481.2	9.7	43.9	1.0	1410.0	6.5
1993	1800.2	240.4	1406.1	123.3	95.3	2.8	5091.4	10.7	80.8	1.4	2068.8	7.0
1998	1719.0	236.6	1430.5	126.0	98.1	2.9	5421.4	10.2	82.5	1.5	2675.6	9.3
2003	1650.8	228.6	1415.6	131.1	100.0	3.1	6252.8	15.2	137.0	2.6	3094.5	11.0
2008	1606.0	235.4	1378.0	127.2	98.9	3.2	6088.0	14.9	140.1	2.7	2963.2	10.9



**Figure 3:** Distribution of dominant species on state forestry fund lands (Meshkov *et. al.*, 2009)

at 0.77 ha, is the same as the United States of America and Malaysia, and more than that in several East European countries. With a possible move to the south in mountain regions, the resistance of forest ecosystems implies eco-climatic zone boundary disturbances. The temperature and humidity changes may cause unsuitable conditions for pine, fir, larch and cedar, and thus leading to changes in species compositions, with an increase in less valuable deciduous trees and shrubs. In mountainous regions, the lower limit of spruce moving upward by 100–120 m will give way to deciduous softwood species and fruit trees. Fir plantings may disappear from the territory of Zhetisu Alatau, and they will remain only in a small area of East Kazakhstan.

The main species, such as pine, fir, cedar and juniper, are at the southernmost border of their area, and are very sensitive to temperature and humidity regimes, which explains how highly the forests are vulnerable to climate change (Table V) (Yesserkepova, 2010).

The observed annual temperature trends for the last 50 years in Kazakhstan have been positive, increasing by 1.5 °C. on the grounds that the greater part of the territory of Kazakhstan is occupied by deserts and semi-deserts, their ecosystems and many economic sectors, especially agriculture and water resources, are very vulnerable to climate change. According to climate change scenarios based on global climate modeling, further temperature increases with no significant gain in atmospheric precipitation may lead to a drier climate (Yesserkepova, 2010). On the possible impacts of climate change, the report by the National Human Development (2008) states

that: "Forestry's climate and weather adaptive measures need to focus on overcoming their negative effects and gaining the maximum from those changes, as well as the development of national parks and specially protected areas" (Anonymous, 2008). Goryunova (2009) has summarized the impacts of climate change in Kazakhstan (Table VI).

## 2 DESERTIFICATION AND DEGRADATION

### 2.1 Desertification as a major environmental problem

Desertification is expressed as a global environmental and socio-economic matter. With the rise in the population of the Earth, almost full development of good agricultural lands and unprecedented increase of anthropogenic impact on the environment, desertification can become a major threat to the successful socio-economic development for many countries in the XXI century (UNEP, 1994; Saigal, 2003; Glazovsky, 2015). According to the definition of the United Nations Convention to Combat Desertification, desertification is "land degradation in arid, semi-arid and dry sub-humid areas in result of various factors including climatic variations and human activities". Both natural and anthropogenic factors are the causes of desertification in Kazakhstan.

As much as two-thirds of Kazakhstan's land is predicted to be prone to desertification, particularly the central and southern parts of the Aral Sea Basin (ADB, 2004). The rank of desertification in the regions ranges from moderate to high, due mainly to unsustainable agri -



**Table III:** Contribution of the formal forest sector to employment and GDP, 2011 (Anonymous, 2014)

Country/ Area	Employment					Gross value added				
	Roundwood production	Wood processing	Pulp & paper	Total for the forest sector		Roundwood production	Wood processing	Pulp & paper	Total for the forest sector	
	(1000)			(1000)	(% of total labour force)	(US\$ million)			(US\$ million)	(% contribution to GDP)
Armenia	3	1	1	5	0.3	8	2	8	17	0.2
Azerbaijan	2	2	1	5	0.1	1	5	10	16	0.0
Georgia	8	3	1	12	0.5	49	7	6	61	0.5
Kazakhstan	7	1	3	11	0.1	86	40	48	173	0.1
Kyrgyzstan	3	1	0	4	0.2	3	2	3	9	0.2
Tajikistan	2	0	0	2	0.1	2	4	0	5	0.1
Turkmenistan	9	0	-	9	0.4	1	0	-	1	0.0
Uzbekistan	7	0	0	7	0.1	5	2	6	14	0.0
<b>Total Central Asia</b>	<b>41</b>	<b>8</b>	<b>6</b>	<b>55</b>	<b>0.1</b>	<b>155</b>	<b>62</b>	<b>81</b>	<b>297</b>	<b>0.1</b>

GDP: Gross domestic product

**Table IV:** Indicators of the socio-economic benefits from forests, 2011 (Anonymous, 2014)

Country / area	Employment		Gross value added		Food security		Energy		Shelter	
	Total for the formal and informal sector		Total for the formal and informal sector		Number of people using woodfuel to cook		Primary energy supply from wood		People in homes made partly from forest products	
	(1000)	(% of total labour force)	(US\$ million)	(% of total GDP)	(1000)	(% of total population)	(MTOE)	(% of TPES)	(1000)	(% of total population)
Armenia	84	5.8	95	1.0	1348	43,3	1	25.1	2647	85.4
Azerbaijan	4	0.1	106	0.2	799	8,6	0	0.0	8310	89.3
Georgia	17	0.7	95	0.8	1735	40.1	1	14.9	-	-
Kazakhstan	13	0.2	186	0.1	605	3.7	0	0.1	856	5.3
Kyrgyzstan	5	0.2	22	0.4	1790	33.2	0	0.3	-	-
Tajikistan	2	0.1	17	0.3	1844	26.4	0	1.0	-	-
Turkmenistan	11	0.5	23	0.1	987	19.3	0	0.0	4145	81.2
Uzbekistan	7	0.1	14	0.0	4069	14.7	0	0.0	-	-
<b>Total Central Asia</b>	<b>143</b>	<b>0.4</b>	<b>558</b>	<b>0.2</b>	<b>13177</b>	<b>16.9</b>	<b>1</b>	<b>0.8</b>	<b>15959</b>	<b>20.4</b>

GDP: Gross domestic product; TPES: Total primary energy supply; MTOE: Million tons of oil equivalent

**Table V:** Change in average annual air temperature and annual total precipitation as to different scenarios of GHG concentrations (Mátyás, 2010)

Scenario	Climate characteristics	2030	2050	2070
Medium	Change in average annual air temperature	1,4 °C	2,7 °C	4,6 °C
	Change in total annual precipitation	+2%	+4%	+5%
Extremely high	Change in average annual air temperature	1,2-1,9 °C (1,3 °C)	2,5 - 4,0 °C (3,0 °C)	5,7-8,0 °C (6,2 °C)
	Change in total annual precipitation	-2 - +8% (2,2%)	-4 - +15% (3,7%)	8- 28% (6,5%)
Extremely low	Change in average annual air temperature	1,5-2,2 °C (1,7 °C)	1,6-2,6 °C (2,0 °C)	3,1-3,4 °C (3,3 °C)
	Change in total annual precipitation	0-8% (3,0%)	-3 - +9% (1,7%)	-2 - +13% (4,1%)

**Table VI:** Impacts of climate change in Kazakhstan

Change of climate elements and sea level rise	Vulnerable area	Paramount change	Impact	
			Primary	Secondary
> 3 °C (> +20 % precipitation)	Water resources	- Flow change	- Intensification of winter floods - Decrease of summer flows	-Risk to life and property - Stress on water resources in summer time - Negative effects on riparian forest - Negative effects of poplar plantation growth

cultural and forestry applications such as poor irrigation and drainage management systems, intensive livestock grazing, excessive timber cutting, and forest fires (Anonymous, 2007).

The key natural factor contributing to desertification processes in Kazakhstan is the intra-continental state of the country, determining continental and arid climate, the scarcity and irregularity of water resources' distribution, causing wide spread sand (up to 30 million ha) and saline lands (127 million ha). There are conditions for the enhancement of land degradation processes and for the violation of the seasonal features of soil formation under the influence of drought. These natural characters of Kazakhstan conduce poor resistance of the environment to human impact. It is estimated that about 75 % of the country is expose to high environmental risks (Bekturova, 1999).

Anthropogenic factors that lead to the urgent and uptrend of desertification processes in Kazakhstan are mainly associated with such economic activities as grazing, agriculture, development of mineral resources, construction and operation of industrial, military and civilian facilities, irrigation and linear structures. Desertification is also the result of illegal logging, uprooting shrubs and dwarf shrubs for fodder and fuel, forest and grassland fires, haphazard recreation organization dumps around settlements, pollution of soil and groundwater with toxic substances as well as the impact of transport.

## 2.2 Degradation of vegetation

Degradation of vegetation, water and wind erosion, salinization and dehumidification of soils, chemical pollution of soil, groundwater and surface water, anthropogenic land disturbance and hydrological regime are the main types of desertification in Kazakhstan determined in accordance with the criteria adopted by the Convention to Combat Desertification. Degradation of vegetation is one of the most popular and visually defined desertification processes, manifested in the form of degradation of forests, rangeland sand hayfields. Though little, the forests Central Asia has are highly significant but in a state of continual decline. Forest loss and degradation is estimated to have been on the 75% of the forest area since the 1960s (Loo, 2013).

The degradation of forest is most argument in the forests of Rudnyy and Southern Altai, where over the past 40 years productivity of coniferous forests has decreased by 7 %, and the area of *Abies* spp. forests has diminished by 13 %. Forests degrade very severely in the floodplains of the desert rivers. Undesirable changes in

type take place due to a decrease in soil moisture as a result of the regulation of the river flow in these forests (Mambetov *et. al.*, 2013).

In Kyzylorda region, one of reasons of sharp worsening of plantation is the change of forest growth conditions originating from ecological disaster in Aral Sea region. In addition, it becomes unfeasible to grow for the black saxaul, the main species of saxaul forests in Kazakhstan, with drying of Aral Sea and lowering of ground waters in larger parts of Kyzyl-Kum desert. Currently, area of exposed bottom of Aral Sea is more than 5 million ha. These dead areas, covered with salty sand, have steadily been expanding. Saline and active sands soils, which are formed here, serve as arena for leaching salt, dust and sand to adjacent lands of Aral Sea region, doing harm to the economy of the entire region (Mambetov *et. al.*, 2013).

Despite works undertaken in the field of protection, maintenance, rehabilitation and rational use of forests, and preservation of the biological diversity, there is an observed tendency of degradation of forest ecosystem in the country. Destruction of forests and reduction of their areas cause considerable changes in biological diversity. According to the existing terminology, degradation of forests is a slow process of loss of productivity and dying-off of growing stock under influence of anthropogenic or natural factors resulting in the deterioration of the forest environment (Meshkov *et. al.*, 2009).

## 2.3 Causes of forest degradation

In Kazakhstan, each type of forest has its own set of factors causing forest degradation. The forests of forest steppe zone (birch stands mixed with aspen and willow) suffer from reduction in area due to extensive agricultural cultivation of steppe land around woodland. In most cases plowing was carried out up to the very forest edge, and woodlots with small areas were completely uprooted and destroyed (UNDP 2004; UNCCD 2006a; 2006b). This resulted in a change of the hydrological regime and soil formations on which these forests were formed. In addition, clear cuttings in birch forests over many decades followed by natural re-growth without systematic tending operations resulted in the formation of low-quality stands.

For the last 10 years the forested lands of *Pinus* spp. forests of the Irtysh region in the East-Kazakhstan and Pavlodar regions have been reduced to 162,400 ha with timber stocks decreasing to 16.8 million m<sup>3</sup>. Large-scale illegal cutting also became more frequent. Steppe pine forests have been over-logged suffering from large forest

fires in the past. According to up-to-date satellite image interpretation ribbon-like relict pine forests of the Irtysh region are devastated by forest fires and damaged by predators practically on half of the area, comprising over 300.000 ha. Furthermore, they were constantly affected by radio nuclides as a result of nuclear tests at the Semipalatinsk nuclear test base in earlier times. However, this influence on forests has not been well studied yet.

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

During the last 100 years the lower boundary of *Picea* spp. forests location in the Zailiysk Alatau Mountains of the Northern Tien Shan have risen by 100-150 m up the hill slopes, therefore the range of spruce forests distribution shortened. The same happened in the mountains of Jungarian Alatau, where the range of Silver fir shortened almost by three times. From 1966 to 1993, the productive capacity of conifer forests decreased by 7% (161 to 150 m<sup>3</sup>/ha), the area of Silver fir stands representing a specific worth due to its location at the edge of the natural area was reduced by 16 % (from 459 to 384 ha).

### 3 CONCLUSIONS

By taking the current situation, degradation and desertification processes into account, priority areas for forestry in Kazakhstan can be underlined as follows. The precedence should be given to strengthening forestry institutions in Kazakhstan, to enhance national and local capacity of fire prevention & control, afforestation & reforestation units and of the units combating desertification. Improving governance especially with regard to private afforestation should also be another priority for Kazakhstan, and some stimulation policies at the national level must be developed. To this end, effective forest governance monitoring practices should be adopted. It is of great significance for Kazakhstan to take necessary steps to reverse the effects of past degradation through physical investment projects addressing water use efficiency and salinity reduction by means of modernizing irrigation and drainage systems for agricultural lands and plantations, depleted and degraded agricultural lands including rangelands by revegetation. Replacement of lost forests by appropriate and reliable reforestation and afforestation practices should also have a priority on the agenda. Opportunities for carbon sequestration in agriculture, rangelands, and forests should further be assessed.

Climate data monitoring should be improved and network development should be ensured. This is to increase information reliability on climate system status and provide the user with information on climate change.

Reforestation should be one of the priorities subject for developing forestry sector. In "Kazakhstan Strategy – 2030" and in the address to the people of Kazakhstan, the President marks out this direction as being one of the priorities that stimulate ecological improvement of the

state territory. It is oriented on the use of natural and artificial methods of reforestation (Mambetov *et. al.*, 2013; Norbert, 2010).

*On Kazakhstan forestry and forests* (Kleine *et. al.*, 2009), it is briefly stated that:

- The implementation of strategies for rehabilitation of degraded forests, watershed management and conservation of forest biodiversity must be supported.
- Under the current conditions, the expansion of forest area and rehabilitation and restoration of degraded forests must be financed primarily by the State.
- Several technical matters need to be addressed for enhancing the efficiency of forest rehabilitation work, including improvement of forest seed production and seed sources as well as the expansion of production of planting stocks particularly containerized seedling through enhanced nursery techniques.
- Priority will also be given to the rehabilitation of burnt forest areas, clear-cut stands, and shelterbelts to protect agricultural lands.
- Special attention will be paid to renewed efforts in combating desertification through expansion of saxaul plantations.
- The coniferous forests of the country will be predominantly regenerated by natural means and also expanded through block-strip planting which are more resistant to fire and attacks by pests and diseases.

The new forest policy of the State is directed towards progressive development of the forest sector in all directions, particularly convenient protection of forests, expansion of the forest area, and site-specific management and operations in order to increase the overall forest productivity (Meshkov *et. al.*, 2009).

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