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Forest Landscape Restoration in the Caucasus and Central Asia

Note by the Secretariat

Summary

This study, focusing primarily on the period from the collapse of the Soviet Union until the present day, identifies the key drivers of forest degradation and the potential for forest landscape restoration in the Caucasus and Central Asia. The study was undertaken to support the preparation of restoration pledges in the eight countries of the Caucasus and Central Asia in the run up to the Ministerial Roundtable on Forest Landscape Restoration and the Bonn Challenge in the Caucasus and Central Asia that took place in June 2018 in Astana, Kazakhstan. At this Roundtable Armenia, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan committed to restore over 2.5 million ha of forest landscapes by 2030.

Executive summary

With the exception of Georgia, forest cover in the other seven countries of the Caucasus and Central Asia (CCA) is below 15 per cent. This study, focusing primarily on the period from the collapse of the Soviet Union until the present day, identifies the key drivers of forest degradation across the region. These include fuelwood removal, overgrazing and uncontrolled logging. Following independence in 1991, the supply of energy from the Russian Federation fell sharply. As a result, fuelwood, especially for the rural population, became the primary source of energy. Livestock numbers rose, leading to overgrazing, which inhibited forest regeneration. In addition, a shift from small livestock (sheep, goats) to larger domesticated animals (cattle, horses) kept closer to settlements, increased grazing pressure on pastures and partly on the surrounding forests, further degrading forests across the region. Finally, uncontrolled logging added to the ongoing exploitation of the forest. The non-wood-based energy supply has improved in Azerbaijan, Kazakhstan and Turkmenistan, halting or at least substantially slowing down forest degradation due to fuelwood removal. However, fuelwood removal continues to drive forest degradation in other CCA countries. Harvesting timber for wood products and grazing remain the other major drivers of forest degradation in the Caucasus and Central Asia.

Forests are largely state-owned and administered by governmental bodies in all CCA countries. These forestry administrations are either under the ministries in charge of agriculture or environment, or independent state agencies. Until recently, sustainable forest management principles or incentive-based forest management were not common. Rather, conservationist approaches were preferred, wherein substantial parts of the forest were designated for conservation or restoration, independent of other national or international projects. Likewise, the sustainability of forest products and the carbon-friendly nature of wood, especially wood energy, from sustainably-managed forests were neither acknowledged nor supported. The use of wood for energy was predominantly seen as environmentally unfriendly and a threat to forests. In addition, the forestry authorities did not meaningfully engage local stakeholders, the private sector or other related sectors in its management. Forestry administrators have been promoting greater multi-sectoral cooperation and stakeholder engagement since 2000. In addition, some countries, such as Georgia and Kazakhstan, have started to develop legal and institutional frameworks to support private forest ownership.

There are many landscapes in the CCA that would benefit from restoration, including reforestation and afforestation. Forests near settlements, mining sites, tugai forests (riparian forests in arid climate zones) and forests in steep terrain require the most urgent attention. Forests around settlements have suffered the most from pressure of tree felling and grazing. Tugai forest is the most degraded forest type in countries where it constitutes a substantial part of the State Forest Fund[1], namely Azerbaijan, Kazakhstan, Turkmenistan and Uzbekistan. Prior to and during the Soviet era, tugai forests were cleared for agriculture. A reduction in river runoff due to water removal for irrigation caused further degradation. The remaining tugai forests have suffered from tree felling, fuelwood collection, and grazing. As tugai forests are among the most productive ecosystems in the region and provide vital ecosystem services in these dry lands, there is an urgent need for their restoration.

In addition to forests near settlements and tugai forests, restoring former mining sites and forests on slopes could lessen disaster risks by preventing surface erosion and landslides. The restoration of forest on land cleared for opencast mining would also benefit ecosystem services for neighbouring communities. Forests on slopes, comprised mostly of spruce, juniper, walnut, wild fruit and pistachio (in Central Asia) and broadleaf forests (in the Caucasus), have suffered significant degradation due to fuelwood removal, uncontrolled logging, and grazing. By inhibiting the regrowth of young trees, grazing has led many forests on steep slopes to become over-mature. Unless the numbers of young trees are increased through planting or natural regeneration, there is a danger of the loss of these forests through mortality. Degraded or deforested areas of broadleaf, juniper and conifer forests would also benefit from restoration. This study finds that these measures would significantly restore the region's forests without significantly competing with other land uses.

This study suggests that restoration, reforestation and afforestation would be best focused on areas other than highly-valued agricultural land or pastures. In densely-populated areas in particular, restoration of forests near settlements needs to allow for the utilization of afforested plots by the local population, for instance by cultivating and harvesting

[1] State Forest Fund is a tenure category common to all former Soviet Union countries. In general, the State Forest Fund refers to all forests, forested and non-forested areas owned or administered by the State forestry authorities.

hay or berries between rows of young trees until newly planted trees yield income. Once the trees bear fruit or timber restoration can offer income opportunities to rural communities. The large number of wild and indigenous fruit species in many of the CCA countries offers several unique products and value chains. At the same time, restoration of forests near settlements should be complemented by measures to control grazing, a leading cause of degradation.

The scope to extend the forest area is limited by climatic conditions and competition from other land use. Agroforestry may well offer opportunities to expand forested areas. Windbreaks, for instance, offer opportunities to expand forest cover even in intensively-farmed regions and densely-populated landscapes. Indeed, this is already part of the forestry-related strategies of most CCA countries.

According to national data, 70 per cent of forests in Armenia are degraded or overmature. The most pressing driver of forest degradation in Armenia is fuelwood removal. The view of the Government is that an increase in the supply of alternative energy sources to rural households that rely currently on fuelwood would be necessary to halt forest degradation and to begin forest and forest landscape restoration in the country. Plantations of fast-growing trees could help to meet the demand for energy in rural areas. Meanwhile, afforestation and forest restoration on mining sites and slopes is urgently needed to prevent soil erosion. This study estimates Armenia's restoration potential as 100,000 ha, which corresponds to the forest area degraded or lost between the 1990s and 2018. Among Armenia's Intended Nationally Determined Contributions under UNFCCC is an ambitious target to increase forest cover to 20.1 per cent by 2050 (an increase of 266,500 ha), which goes well beyond addressing the losses since the 1990s.

In Azerbaijan, 80 per cent of all villages are now supplied with gas, meaning that the pressure on forests from fuelwood removal has drastically decreased. Overgrazing and illegal logging are the current drivers of forest degradation, particularly in remote regions with higher poverty rates and weaker law enforcement. According to the country's National Forest Concept 2015-2030, increasing the forest area through afforestation and plantations is a major priority. Tugai forests and forests on slopes are identified as the key forest types in need of restoration. Azerbaijan's national target is to plant or restore forests on an area of 593,000 ha, thereby increasing forest cover to 20 per cent by 2030.

This study identifies Georgia's restoration potential at 200,000 ha, which corresponds to the forest area lost in the 1990s, the result of increased logging and fuelwood removal, triggered by a lack of wood and energy exports from the Russian Federation into Georgia. Fuelwood collection and grazing continue to be major drivers of degradation. Forests throughout the country are in need of restoration, with the Borjomi Region a particular priority. Georgia's UNFCCC commitment is to reforest and afforest an area of 1,500 ha around the Borjomi National Park and assist the natural regeneration of forests on a further 7,500 ha by 2030. Subject to external financial and technical support, Georgia committed to the afforestation/reforestation of up to 35,000 ha by 2030 (dependent on external support).

According to the Ministry of Agriculture of Kazakhstan, 70 per cent of the country is considered degraded. Most degraded territories are arid zones with saxaul forests, steppes and agricultural land. In general, overgrazing and salinization are the main drivers of land degradation. The major causes of degradation of the saxaul forests were fuelwood removals and charcoal production as well as grazing. Today, fuelwood removal plays a less important role in contributing to forest degradation in Kazakhstan as a result of better access to other sources of energy. This study identifies wooded lands in the arid zones, in particular on the dry bed of the Aral Sea, and the tugai forests, as being in greatest need of restoration. Moving towards a green economy is an overarching goal of the Kazakhstan-2050 Strategy – a national programme aimed at positioning Kazakhstan among the top thirty global economies by 2050. In addition, Kazakhstan's "Concept for Conservation and Sustainable Use of Biodiversity by 2030" specifies the Aral Sea and protective tree lines along roads and railway lines as key targets for forest and wooded land restoration. The Concept sets a target to increase wooded land to 4.7 per cent of land area by 2020 and to 5 per cent by 2030. This is to be achieved through reforestation and afforestation of a total of 500,000 ha by 2030, including the establishment of fast-growing tree plantations, establishing green belts around cities, and planting 10,000 ha of shelterbelts.

In Kyrgyzstan, 36 per cent (about 160,000 ha) of juniper forests and half of the walnut and wild fruit forests have been lost since 1968. This figure corresponds to the area identified in this study as having immediate potential for restoration. Today, more than one-third of Kyrgyzstan's households rely on coal or fuelwood for heating, with the fuelwood component contributing to forest degradation. Grazing in forests inhibits regrowth, reinforcing forest degradation and making forest restoration difficult. This study found that walnut forests are in the greatest need of restoration due to the high numbers of people living near them and whose incomes are tied to walnut harvest. The Jalal-Abad (Chatkal district) and Talas provinces, characterised by widespread mining activities, offer further opportunities for restoration.

Kyrgyzstan has set a target to increase its forest area by 83,000 ha by 2025. There are numerous initiatives, including projects by GEF and GIZ, addressing forest restoration in walnut forests. There are, however, no explicit targets for spruce or riparian forests. Some projects support the establishment of fast-growing plantations and promote agroforestry, which should reduce pressure on forests by helping to meet demand for fuelwood and timber.

In Tajikistan forests covered 16-18 per cent of the land area in 1920. By 2015, forest cover was only 2.9 per cent. Most forests were cleared for agriculture and mining during the Soviet period, greatly increasing pressure on remaining forest. After 2000, the pace of forest degradation accelerated due to uncontrolled tree cutting and increased livestock numbers. Overgrazing is a particular issue for the woodlands of the Pamir mountains, as they regrow slowly due to the harsh climate. This study identifies juniper, pistachio and riparian forests in the mountains and saxaul forests in the arid zones as in need of the most urgent attention. The restoration of abandoned mining sites and saxaul forests offers the greatest potential due to limited competition with other land uses. Restoring the pistachio forests would be especially beneficial because of the potential to generate income from pistachio harvest. Tajikistan's "Forest Sector Development Strategy" aims, by 2030, to plant new forests on 15,000 ha, rehabilitate 30,000 ha of existing forests and carry out measures that support natural forest regeneration on 120,000 ha.

In Turkmenistan, all forest types and forest landscapes show signs of degradation and most forest types are limited to small remnants (a 2001 biodiversity assessment funded by USAID, reveals that only 7,000 ha of tugai forests and 42,020 ha of juniper forest remain). A 2013 study found that more than two-thirds of Turkmenistan's saxaul forest and woodland area has degraded since the 1950s (State Committee of Turkmenistan for Environmental Protection and Land Resources, 2018). That study identified saxaul wooded lands and tugai forests as in greatest need of restoration. Turkmenistan's National Forest Program 2013-2020 gives priority to restoration and afforestation of saxaul forests to combat the erosion of deserts and protect settlements from wind-blown sand. The programme also contains plans to afforest the area around Lake Altyn Asyr, and to plant 4 million trees as shelterbelts by 2020.

Since the first half of the 20th century, Uzbekistan has lost 90 per cent of former tugai forests, as a result of conversion to agriculture, uncontrolled fuelwood removal, and reductions of seasonal flooding as a result of water abstraction. The result is that saxaul forest area has dropped by 82 per cent. More recently, windbreaks, mostly of poplars on irrigated agricultural land, have decreased from 40,000 ha to less than 20,000 ha since the late 1990s. According to Uzbekistan's National Biodiversity Strategy and Action Plan, the tugai and saxaul forests are in greatest need of restoration. In addition, the establishment of large-scale nut and fruit plantations could help to compensate for degradation of the country's mountain forests and creating job opportunities. Finally, this study suggests that the creation of woodlots or plantations around rural communities could address the population's demand for timber and fuelwood. Uzbekistan's recently-adopted forestry programme for 2017-2021, includes annual targets to plant 42,000 ha of forests, including 18,000 ha of saxaul forest, as well as measures to enhance 10,000 ha of natural regeneration of saxaul.

1. Introduction

The Bonn Challenge was launched in 2011 by the Government of Germany and IUCN, and extended by the 2014 New York Declaration on Forests. It is a global effort to bring 150 million ha of deforested and degraded land into restoration by 2020, and 350 million ha by 2030. Today, the Bonn Challenge serves as an open, voluntary and flexible discussion and exchange platform for concrete action and cooperation to facilitate the implementation of forest landscape restoration worldwide. Achieving the Bonn Challenge's goal of restoring 350 million ha by 2030 would result in the sequestration of at least 12 Gt of carbon dioxide over the period 2011-2030 (Dave et al., 2017). However, the benefits of implementing Bonn Challenge pledges go beyond carbon sequestration. As well as reversing degradation, forest landscape restoration (FLR) should also help to improve productivity and the resilience of landscapes, enabling them to provide environmental services that will benefit people and biodiversity.

Since 2011, the international Bonn Challenge process has grown to include five regional processes in Latin America, Africa, Asia, the Mediterranean and, the Caucasus and Central Asia. By 2018, a combination of national and regional governments, private bodies and many others (47 actors) had pledged to restore 160.2 million ha of deforested and degraded land[2] by 2030. This study was undertaken to support the preparation of restoration pledges in the eight countries of the CCA in the run up to the Ministerial Roundtable[3] on Forest Landscape Restoration and the Bonn Challenge in the Caucasus and Central Asia that took place in June 2018 in Astana, Kazakhstan. The Roundtable provided the first opportunity to align national and regional efforts in the Caucasus and Central Asia with the international Bonn Challenge.

The most appropriate restoration objectives and strategies will depend on local social, economic and ecological contexts and needs, as well as on national and global goals. CCA countries face challenges with degradation and overutilization of forest areas. Forest policy and decision makers are not always aware of international initiatives and the opportunities they bear for their own countries. The FLR approach under the Bonn Challenge provides an overall framework to enhance national restoration efforts and regain forest services to benefit people and nature.

Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan – referred to in this study as countries of the Caucasus and Central Asia (CCA) – gained independence in 1991 following the dissolution of the Soviet Union. The first three are located in the Caucasus, between the Russian Federation, Turkey and Iran and between the Black Sea and the Caspian Sea. The other five countries lie between the Caspian Sea in the west and the mountain ranges of the Pamirs, Tian Shan and Altay in the east or between the Russian Federation, China, Afghanistan and Iran (figure 1).

[2] www.bonnchallenge.org, as of June 2018
[3] www.unece.org/index.php?id=47712

FIGURE 1: Map of the Caucasus and Central Asia

After a deep economic crisis during the 1990s, the fortunes of the CCA countries varied. By 2017, Armenia, Georgia, Kyrgyzstan, Tajikistan and Uzbekistan developed into low middle-income countries, while Azerbaijan, Kazakhstan and Turkmenistan developed into upper middle-income countries. By 2018, Armenia had developed into an upper middle-income country, while Tajikistan has been reclassified as low-income country (World Bank, 2018). Azerbaijan, Kazakhstan and Turkmenistan possess rich stocks of fossil energy reserves and are among the most important exporters of oil and gas worldwide (ADB, 2010). Kyrgyzstan, Tajikistan and Uzbekistan have the lowest GDP per capita among the CCA countries and are heavily-dependent on remittances from migrant workers (table 1).

Agriculture, including forestry, is of great importance in all CCA countries and is a major employer. With the exception of Kazakhstan and Turkmenistan, agriculture accounts for at least 25 per cent of employment in all CCA countries. The role of rural communities is underlined by the share of the rural population, which is more than 40 per cent for all CCA countries, except for Armenia.

TABLE 1: Population, GDP and employment of the CCA countries

Country	Population in 2017[4]			GDP[5]		Employment in agriculture in 2016 [%][4]	
	Total [Million]	Rural in [%]	Urban in [%]	per capita [USD]	Contribution of agriculture [%]	Male	Female
Armenia	2.99	37.5	62.5	3 615	17.7	31	40
Azerbaijan	9.43	44.8	55.2	3 879	6.0	31	43
Georgia	4.26	46	54	3 866	9.0	44	46
Kazakhstan	17.09	46.8	53.2	7 715	4.8	19	17
Kyrgyzstan	5.89	64	36	1 078	14.9	28	32
Tajikistan	9.0	73	27	796		45	73

[4] Source: FAOSTAT (http://www.fao.org/faostat/en/#home)
[5] Source: World Bank – Data – Indicators (https://data.worldbank.org/indicator)

Turkmenistan	5.5	49.2	50.8	6 389		19	17
Uzbekistan	30.45	63.4	36.6	2 111	17.6	30	27

2. Forests and forest landscapes in countries of the Caucasus and Central Asia

Armenia, Azerbaijan and Georgia are three countries of the Caucasus located between the Black Sea and the Caspian Sea. The Greater Caucasus range runs along the northern border of Georgia and Azerbaijan, while the Lesser Caucasus lie at the southern border of the three countries. Between the Greater and Lesser Caucasus, the Transcaucasian depression stretches from west to east. Within this depression, low ridges separate the Kolkheti lowland in the west, which borders the Black Sea, from the Kura river basin, which drains into the Caspian Sea in the east.

Moist air masses from the Black Sea create a humid climate with annual precipitation of 1,200 mm to 2,000 mm in the Kolkheti lowland. Further east, in the Kura river basin in southeastern Georgia and central Azerbaijan, the climate turns arid with annual precipitation of 200 mm. In the mountains, climate becomes more and more humid with increasing elevation, which results in annual precipitation of 2,500 mm to 4,000 mm in the western parts of the Greater and Lesser Caucasus (Krever et al., 2001). Also along the Caucasus mountain ranges, precipitation decreases from west to east. Though, in the east in Azerbaijan moist air masses from the Caspian Sea result in a humid climate at higher elevation.

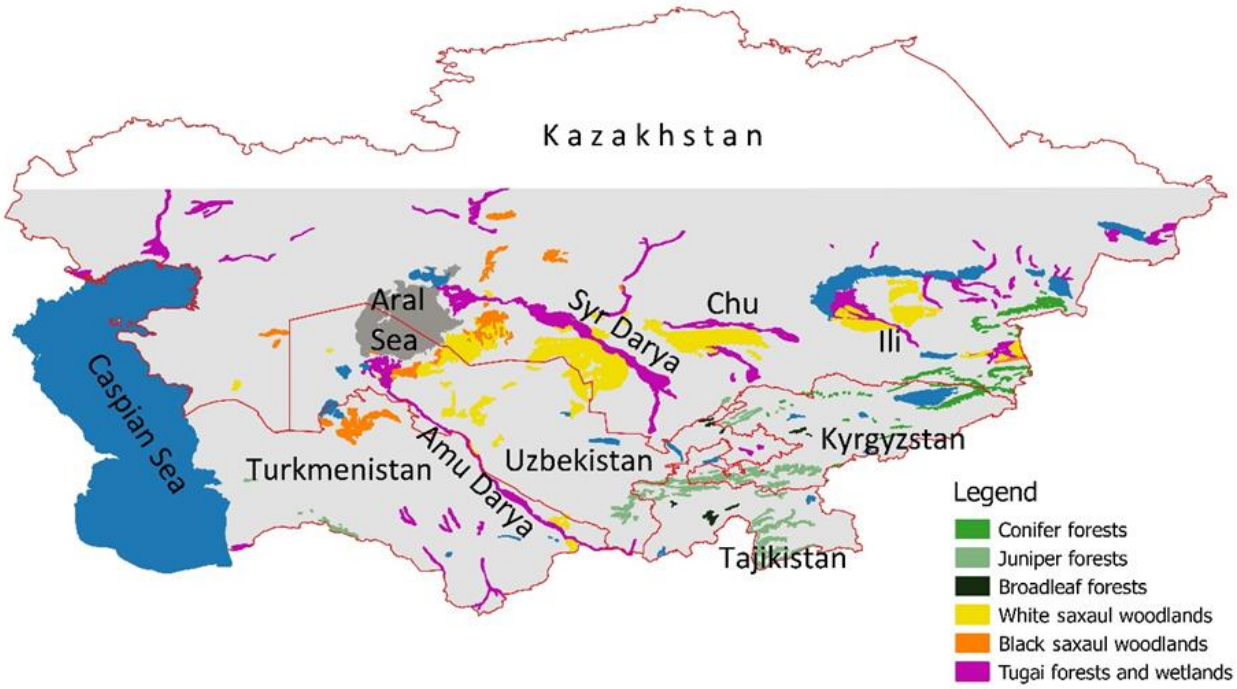
This climatic pattern would allow forests in large parts of Georgia but restricts forests to the mountains in large parts of Armenia and Azerbaijan. In Georgia, large parts of the low-lying areas in the Kolkheti lowland, which would naturally be covered by forests, are used for agriculture. Most forests in the countries of the Caucasus are broadleaf forests, mainly of beech (Fagus orientalis) or oak (Quercus spp.) and hornbeam (Carpinus spp.). These forests lie roughly between 600 m and 1,000 m but can occur up to 2,000 m. Conifer forests cover parts of the mountains at elevations between 2,000 m and 2,500 m. In lower elevations, broadleaf forests are mixed with wild fruit species, like Caucasian pear (Pyrus caucasicum) and oriental apple (Malus orientalis). On more arid sites, there are pistachio forests at low elevation and juniper forests at high elevations in the mountains (Krever et al., 2001).

Central Asia is largely dominated by plains. Thus, most areas of Kazakhstan, Turkmenistan, and Uzbekistan are steppe. Kyrgyzstan and Tajikistan are largely mountainous, with the Tian Shan mountains in Kyrgyzstan and Pamir mountains in Tajikistan rising to altitudes above 6,000 m. The border between Kazakhstan and Kyrgyzstan, as well as the northeastern part of Tashkent province in Uzbekistan belongs to the Tian Shan mountain range. Kazakhstan shares borders with China, Mongolia and the Russian Federation in the Altay mountains. The border between Turkmenistan and Iran runs along the Kopetdag mountains.

The climate throughout most of Central Asia is arid and continental (typical annual precipitation of 150 mm to 250 mm), with the result that steppes and arid zones are the dominant land type. As in the Caucasus, humidity and precipitation increase with elevation, e.g. the mountains in Jalalabad province in southern Kyrgyzstan receive up to 1,200 mm of annual precipitation (ADB, 2010). This largely restricts broadleaf and conifer forests to the mountains (figure 2). Conifer forests in Central Asia are largely dominated by Schrenk's spruce (Picea schrenkiana), which forms monospecies forests mostly on north slopes between 1,800 m and 2,800 m in the Tian Shan mountains. Juniper forests are found on more arid sites than Picea schrenkiana and grow at higher elevations, up to 3,200 m. Broadleaved forests in Central Asia are walnut and wild fruit forests, or pistachio forests. The former contains walnut (Juglans regia), mixed with several other wild fruit tree species (see sections on Kyrgyzstan, and Uzbekistan). The main extent of these forests is found on the slopes of the Tian Shan north of the Ferghana Valley in Kyrgyzstan and Uzbekistan (figure 2) where high annual precipitation occurs (up to 1,200 mm). In contrast, pistachio is distributed at lower elevations and on more arid sites (Rachkovskaya et al., 2003).

Central Asia's deserts are winter-cold deserts, typically with natural psammophytic vegetation, of which white saxaul (Haloxylon persicum) and Artemisia are the main species (Rachkovskaya et al., 2003). White saxaul occurs in stands that meet the criteria to be classified as forest by FAO. Black saxaul (Haloxylon aphyllum) forms stands on alluvial plains in the desert regions, which partly qualify as forest. The northern part of Kazakhstan borders Siberia and is located in the forest steppe zone with a mosaic of steppes and cropland with patches of aspen and aspen-birch forests (USAID, 2001a).

FIGURE 2: Distribution of major forest types in the desert zones and mountains of Central Asia (in grey)



Source: Rachkovskaya et al., 2003.

In the arid parts of the Caucasus and in the desert and steppe regions of Central Asia, tugai forest is distributed along the rivers (Krever et al., 2001, Rachkovskaya et al., 2003). Tugai is the term used to describe the riparian forests of Central Asia. The species in tugai forests have adapted to the arid climate by extending their root systems into the groundwater, enabling them to exploit the groundwater (phreatophytic trees). Tugai in the mountains is mainly composed of elm, poplar and willow species and is restricted to narrow margins along rivers where groundwater levels are high. Tugai forests along the rivers in the dry regions consist mainly of willow species, Populus pruinosa, Populus euphratica and Russian olive (Elaeagnus angustifolia). Willows are distributed along the riverbanks, Populus pruinosa and Russian olive are restricted to sites with groundwater levels not deeper than 4 m, but Populus euphratica grows on sites with groundwater levels as deep as 12 m. Even so, tugai forests in the arid regions need river flow, including regular flooding, to replenish the groundwater, which allows generative recruitment, i.e. recruitment through seed germination (Thevs et al., 2008a, Thevs et al., 2008b).

It is a common feature across the CCA countries that forests in the mountains are mainly restricted to northern exposed slopes. Thus, in the elevation zone, which is suitable for forests, there tends to be a mosaic of forest and grassland, with grassland occupying the south exposed slopes and forest the north exposed slopes. Forest or grassland cover on east and west exposed slopes is dependent on elevation and local climate (Rachkovskaya et al., 2003).

The Tian Shan and Pamir mountains, as well as the Caucasus, are globally significant centres of biodiversity (Krever et al., 2001: Republic of Armenia SAEPF 2017: USAID 2000a, b, c and 2001b, c). Many of today's most important fruit species originated in the Caucasus, Tian Shan and Pamir mountains (USAID, 2001b).

With the sole exception of Georgia, forest cover in the other CCA countries is low, typically much less than 15 per cent. Between the 2010 and 2015 Global Forest Resources Assessments, the area of forest and other wooded land remained stable or increased in all countries, except Uzbekistan, which recorded a small decrease (FAO, 2010, 2015a).

TABLE 2: Forest areas and forest cover by country as at 2015

Country	Area ['000 ha]						
	Country area	Arable land	Forest	Primary forest	Other naturally regenerated forest	Planted forest	Forest cover [%]
Armenia	2 974	447	332	17	293	22	11.2
Azerbaijan	8 660	1 938	1 139	0	1 139	0	13.2
Georgia	6 970	448	2 822	500	2 250	72	40.5
Kazakhstan	272 490	29 395	3 309	0	2 408	901	1.2
Kyrgyzstan	19 995	1 281	637	590	0	47	3.2
Tajikistan	14 138	730	412	297	12	103	2.9
Turkmenistan	48 810	1 940	4 127	104	4 023	0	8.5
Uzbekistan	44 740	4 400	3 220	73	2 345	802	7.2

Sources: FAOSTAT(www.fao.org/faostat/en), FAO, 2015a.

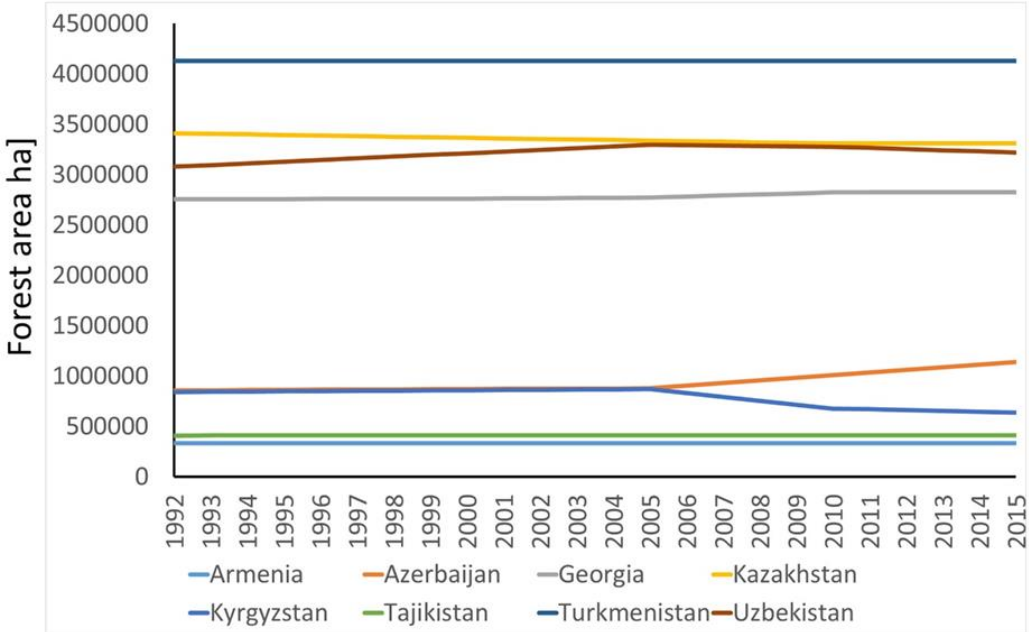
TABLE 3: Forests and other wooded land by country in 2010 and 2015 after Global Forest Resource Assessment

Country	FRA 2010				FRA 2015			
	Forest		Other wooded land		Forest		Other wooded land	
	1000 ha	% of land area	1000 ha	% of land area	1000 ha	% of land area	1000 ha	% of land area
Armenia	262	9	45	2	332	11.2	63	2.2
Azerbaijan	936	11	54	1	1 139	13.2	0	0
Georgia	2 742	39	51	1	2 822	40.5	7	0.1
Kazakhstan	3 309	1.2	16 479	6.1	3 309	1.2	16 479	6.1
Kyrgyzstan	954	5	390	2	637	3.2	704	3.7
Tajikistan	410	2.9	142	1	412	2.9	142	1
Turkmenistan	4 127	8.5	0	0	4 127	8.5	0	0
Uzbekistan	3 276	8	874	2	3 220	7.2	115	0.3

Notes: Forests are defined as land spanning more than 0.5 ha with trees higher than 5 m and a canopy cover of more than 10 per cent, or trees able to reach these thresholds in situ. Other wooded land is defined as land not classified as "forest", spanning more than 0.5 ha; with trees higher than 5 m and a canopy cover of 5 per cent to 10 per cent, or trees able to reach these thresholds in situ; or with a combined cover of shrubs, bushes and trees above 10 per cent. Neither includes land that is predominantly under agricultural or urban land use.

Sources: FAO, 2010, 2015a

GRAPH 1: Forest area of the CCA countries 1992-2015 after FAOSTAT



Source: www.fao.org/faostat/en

3. The status of forests in the Caucasus and Central Asia

After the collapse of the Soviet Union and the independence of countries in the Caucasus and Central Asia, forests and forest landscapes have been degrading throughout the region. Unauthorized fuelwood removal and logging for commercial purposes, as well as overgrazing in the forest and woodlands, became significant threats to forests, the result of economic decline and lack of affordable energy availability (UNECE, 2013).

As energy supply from the Russian Federation dropped sharply after independence, there was a switch to fuelwood as a primary energy source, in particular for rural populations. The shift to fuelwood was so fast and sudden that forests were degraded through uncontrolled tree cutting and fuelwood removal from the start of the 1990s until the present day. The situation was so severe that people even cut trees in parks, avenues and gardens. Some cities lost most of the trees within their boundaries.

Gas, coal and electricity were the main energy sources for household heating and cooking. Consumption of all three fell, often sharply, in almost all CCA countries in the 1990s. Between 2000 and 2015, gas consumption doubled in Azerbaijan and Turkmenistan, quadrupling in Kazakhstan. Over the same period, gas exports rose steeply (table 4). In Uzbekistan, a steep increase in gas exports resulted in a fall in domestic consumption. Coal consumption in Georgia, Kyrgyzstan and Tajikistan, countries that lack fossil energy reserves, has been increasing since 2000 (table 5) (ADB, 2010). This is in line with a household survey by the World Agroforestry Centre in Kyrgyzstan in 2017 (unpublished data). The survey suggests a preference for fuelwood for cooking, while coal is preferred for heating. Consequently, it seems likely that demand for fuelwood will remain unless alternative gas or electricity supplies become available. Consumption of electricity per capita increased between 2000 and 2015 in all CCA countries, except Tajikistan and Uzbekistan (table 6).

The fall in consumption of gas, coal and electricity in the CCA during the 1990s followed the collapse of the Soviet Union. In addition, there was a sharp reduction in energy trade between the newly independent countries and in some cases, trade halted completely, which exacerbated the situation (Krever et al., 2001). Fuelwood was used to make up for the shortfalls in gas, coal, and electricity supply. Fuelwood remains a significant source of household energy in many countries, particularly in Armenia, Georgia, Kyrgyzstan, Tajikistan and Uzbekistan (UNECE, 2017).

The energy supply in Azerbaijan, Kazakhstan and Turkmenistan has improved to the point that forest degradation due to fuelwood removal has slowed substantially or halted. Fuelwood removal remains an issue for remote rural settlements, which are too far from the energy supply infrastructure.

TABLE 4: Imports, exports and consumption of natural gas in the CCA countries in 1991, 2000 and 2015

Country	Net imports/exports			Consumption		
	1991	2000	2015	1991	2000	2015
Armenia	3.59	1.12	1.79	3.57	1.12	1.76
Azerbaijan	7.95	0.24	-6.84	14.47	4.83	9.54
Georgia	3.93	0.9	2.01	3.98	0.95	2.02
Kazakhstan	3.78	-0.83	-5.77	10.17	6.57	27.2
Kyrgyzstan	1.46	0.55	0.2	1.53	0.57	0.23
Tajikistan	1.31	0.6	0.11 (in 2012)	1.39	0.63	0.12 (in 2012)
Turkmenistan	-57.16	-27.3	-46.81	11.02	10.9	21.34
Uzbekistan	-0.53	-4.26	-13.1	33.36	41.66	37.55

Notes: Gas net imports/exports: positive figure shows net import; negative figure is net export. The unit Mtoe is million tonnes oil equivalent.

Source: International Energy Agency (http://energyatlas.iea.org/#!/tellmap/1378539487).

TABLE 5: Coal consumption (excluding electricity generation and other transformations) of CCA countries in 1991, 2000 and 2015

Country	Coal consumption [Mtoe]		
	1991	2000	2015
Armenia	0.13	0.02	
Azerbaijan	0.07	0.01	
Georgia	0.35	0.01	0.27
Kazakhstan	15.49	0.85	10.58
Kyrgyzstan	1.86	0.2	0.48
Tajikistan	0.42	0.01	0.39
Turkmenistan	0.3	0.04	
Uzbekistan	1.46	0.39	0.37

Source: International Energy Agency (http://energyatlas.iea.org/#!/tellmap/1378539487)

TABLE 6: Electricity consumption per capita in 1991, 2000 and 2015

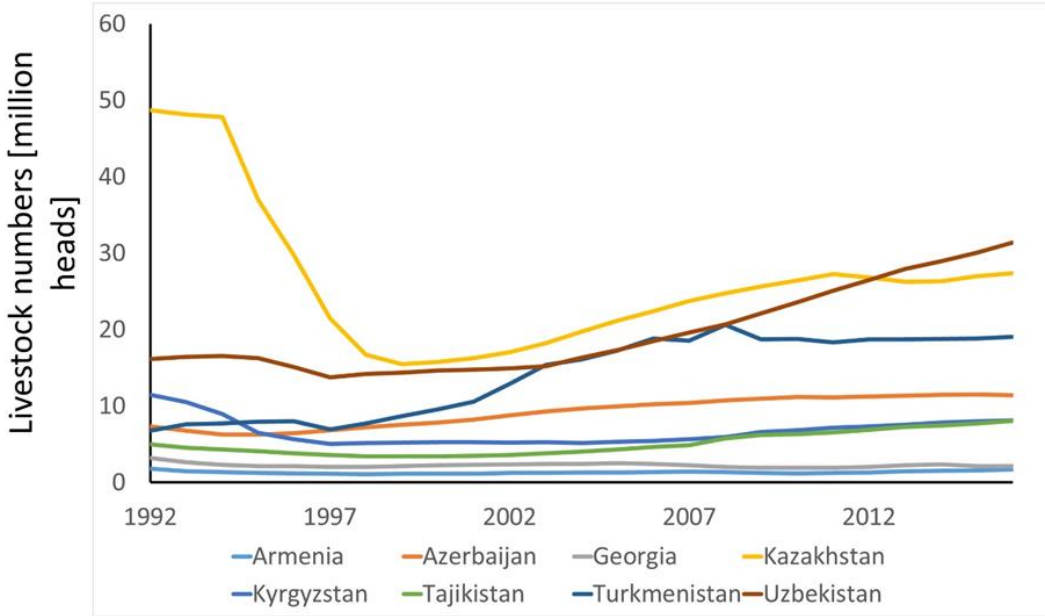
Country	Electricity consumption per capita in MWh		
	1991	2000	2015
Armenia	2.68	1.29	1.9
Azerbaijan	2.63	2.04	2.24
Georgia	2.7	1.45	2.73
Kazakhstan	5.64	3.17	5.77
Kyrgyzstan	2.32	1.7	1.83
Tajikistan	3.19	2.17	1.55

Turkmenistan	2.21	1.7	3.06
Uzbekistan	2.32	1.78	1.64

Source: International Energy Agency (http://energyatlas.iea.org/#!/tellmap/1378539487)

After fuelwood collection, uncontrolled/overgrazing by livestock is a key driver of forest degradation. After independence, until the middle or end of the 1990s, livestock numbers tended to fall, notably in Kazakhstan and Kyrgyzstan (graph 2). From 2000, livestock numbers rose in all countries except Armenia and Georgia. Livestock numbers in Azerbaijan, Tajikistan, Turkmenistan and Uzbekistan are currently higher than before independence. Uzbekistan has shown the steepest increase with an almost doubling of livestock numbers since 2000.

GRAPH 2: Livestock numbers 1992-2016



Source: FAOSTAT (http://www.fao.org/faostat/en/#home).

Apart from Azerbaijan, countries have seen a shift from small livestock, such as sheep and goats, to large livestock like cattle and horses (table 7). Cattle tend to be kept closer to settlements and taken to summer pastures in high mountains less often than small livestock and horses. The resultant increased grazing pressure on areas around settlements, including forests, prevents forest regeneration so that degraded forests remain degraded and could be lost completely.

TABLE 7: Livestock composition (% of total numbers of heads) for years 1992, 2005 and 2016

Year	**Camels**	**Cattle, including buffalos**	**Horses, including mules and donkeys**	**Pigs**	**Goats**	**Sheep**
Armenia						
1992	0.0	31.1	0.5	12.3	1.3	54.8
2005	0.0	44.6	1.5	6.9	3.6	43.3
2016	0.0	42.1	0.9	10.5	1.8	44.8
Azerbaijan						
1992	0.0	25.0	0.9	1.9	2.6	69.7

2005	0.0	23.3	1.1	0.2	6.0	69.3
2016	0.0	23.6	0.9	0.0	5.7	69.7
Georgia						
1992	0.0	31.1	0.6	22.7	1.8	43.7
2005	0.0	47.0	2.2	19.1	4.6	27.2
2016	0.0	47.8	2.4	7.6	2.4	39.8
Kazakhstan						
1992	0.3	19.7	3.5	6.1	1.4	68.9
2005	0.6	24.6	5.4	6.1	10.0	53.3
2016	0.6	22.6	7.7	3.2	8.5	57.3
Kyrgyzstan						
1992	0.0	10.4	3.4	3.1	2.6	80.5
2005	0.0	19.5	7.8	1.6	15.2	55.9
2016	0.0	18.8	6.3	0.6	10.6	63.7
Tajikistan						
1992	0.0	28.1	2.3	2.6	17.4	49.6
2005	0.0	30.6	5.3	0.0	22.6	41.4
2016	0.0	28.8	2.9	0.0	24.7	43.6
Turkmenistan						
1992	1.5	11.5	0.8	3.5	3.3	79.5
2005	0.6	11.7	0.3	0.2	11.6	75.7
2016	0.7	12.7	0.3	0.0	12.5	73.8
Uzbekistan						
1992	0.1	31.6	1.6	4.0	5.7	56.9
2005	0.1	36.0	2.4	0.5	9.7	51.3
2016	0.1	37.0	1.7	0.3	11.0	49.9

Source: FAOSTAT (http://www.fao.org/faostat/en/#home).

Summer grazing of high-mountain pastures impacts the forests at the upper timberline. During the 1990s and early 2000s, summer pasture at higher altitudes was grazed less intensively than during the Soviet period due to a breakdown of infrastructure. Since 2010, work to restore infrastructure, such as repairing or renewing bridges, and the availability of better vehicles for equipment transport, have led to a sharp rise in grazing pressure. Climate change may be expected to result in lower timberlines moving up mountain slopes. At the higher altitudes, regular grazing prevents forest species recruitment and means that the upper timberline cannot move higher. Climate change will most likely result in a reduction in forest area e.g. in Azerbaijan (UNDP, 2011).

In addition to fuelwood removal, the largely-uncontrolled timber harvest has been and continues to be a driver of forest degradation. With the exception of Georgia, the CCA countries are net importers of forest products. Consumption of wood and wood products, especially sawnwood and wood-based panels, has been recovering since the mid-1990s. Consumption of paper and paperboard has increased steadily since the mid-1990s (UNECE, 2013).

Non-wood forest products (NWFPs) are an important source of livelihoods in the region. Major NWFPs include nuts, fruits, berries, mushrooms, medicinal plants, wild game, beekeeping and fodder. Previously, Leshozes (forest administrations) systematically managed the collection of NWFPs. After independence, such management systems became less common, to be replaced by increased and uncontrolled collection (for subsistence purposes), which has increased, leading to degradation of this resource (UNECE, 2013).

Forest fires, pathogens and insufficient control of both, play a role in all countries to a varying extent. In the low-lying plains, in particular Kazakhstan, Turkmenistan and Uzbekistan, soil salinization and a reduction in river runoff are

major additional drivers of degradation of tugai and black saxaul forests. Tugai forest had suffered severe degradation long before the collapse of the Soviet Union as a result of large-scale clearance and reclamation for irrigated agricultural land (Krever et al., 2001, ADB, 2010).

Commercial logging is currently prohibited in most forests within the CCA. Protected areas had been established prior to independence and these have been extended with strengthened protection through both national and international projects (UNECE, 2013).

In general, fuelwood removal was the major driver of forest degradation after independence in the Caucasus and Central Asia. Later, during the 1990s, overgrazing and timber harvest reinforced forest degradation. Currently, there is not much pressure from fuelwood harvest on forests in Azerbaijan, Kazakhstan and Turkmenistan, where gas supply has substantially improved; and in Kyrgyzstan, rural communities use more coal and electricity so that the share of fuelwood as a source of energy has decreased. Timber harvest in the other CCA countries and grazing in all CCA countries continues to drive forest degradation. Next to fuelwood removal and grazing, low river flows are a major degrader of tugai forests.

4. Forest administration

Forests are mostly state owned in all eight CCA countries. Most forests are under the State Forest Fund (so-called Leshoz land)[6]. Some forests are partially located in protected areas and small portions of the forest are located on community land. Recently, countries such as Kazakhstan have started to develop a legal framework for private forest ownership to encourage private investment in forests and especially in afforestation (FAO, 2010, UNDP, 2015a).

In the former Soviet Union, land was entirely state-owned. Cropland and pastures were administered and cultivated by state or collective farms, the Sovhozes and Kolhozes. When these collective farms were dissolved, the land (cropland and pasture land) was either privatized or restructured. Today, the respective ministries of agriculture are responsible for cropland and pasture land. Forests in the USSR were administered and managed by forest district administrations called Leshozes. After independence, Leshozes remained state owned and under the countries' forestry administrations. These forestry administrations are now either part of ministries of agriculture or belong to independent governmental bodies, like the State Agency for Environmental Protection and Forestry in Kyrgyzstan. Leshozes also include pasture and cropland. These are held under different tenure than the cropland and pasture land from the former state or collective farms. The departments in charge of cropland and pasture land within ministries of agriculture generally claim less prerogative over cropland and pasture land within the Leshozes. The land held by Leshozes is referred to, in the various country sections of this report, as the State Forest Fund. As Leshozes comprise more than forests, the State Forest Fund also includes other land categories and is larger than the forest area under the Leshozes.

After the collapse of the Soviet Union and during the 1990s economic crisis in the CCA countries, public expenditure in the forestry sector plummeted. Since 2000, forestry sector spending has increased substantially (table 8). All countries have drafted new forest codes and laws and have undergone several reforms in the forestry sector, which are described in the country sections.

TABLE 8: Public expenditure on forests [1,000 USD] in 2000, 2005 and 2010

Country	Year		
	2000	**2005**	**2010**
Armenia	1 182	2 447	3 024
Azerbaijan		32 684	
Georgia			6 590
Kyrgyzstan	284	649	2 405

[6] State Forest Fund is a tenure category common to all former Soviet Union countries. In general, the State Forest Fund refers to all forests, forested and non-forested areas owned or administered by the state forestry authorities.

Uzbekistan	7 139	4 890	7 318

Source: FAO, 2015a.

Large portions of the forest in most CCA countries are designated for biodiversity conservation (table 9) or form part of other protected areas (table 10). These forests must be protected or restored independent of any projects.

TABLE 9: Forests designated for conservation of biodiversity [1,000 ha] from 1990 to 2015

Country	Year					Percentage of total forest area in 2015
	1990	**2000**	**2005**	**2010**	**2015**	
Georgia	0	0	0	0	0	0
Kazakhstan	31	33	530	530	530	16
Kyrgyzstan	799	826	837	677	637	100
Tajikistan	110	110	110	110	110	26.7
Turkmenistan	104	104	104	104	104	2.5
Uzbekistan	83	211	275	210	210	6.5

Source: (FAO, 2015a).

TABLE 10: Forests in protected areas [1,000 ha] from 1990 to 2015

Country	Year				
	1990	**2000**	**2005**	**2010**	**2015**
Georgia		274	274	274	274
Kazakhstan					
Kyrgyzstan	2	51	56	78	78
Tajikistan	54	44	44	44	44
Turkmenistan					
Uzbekistan	83	211	275	210	210

Source: (FAO, 2015a)

Preservationist approaches to forestry were much more widely known and supported than sustainable forest management principles or incentive-based forest management approaches. Likewise, the sustainability of forest products and the carbon-friendly nature of wood, and especially wood energy, from sustainably managed forests was not widely recognized or promoted. Wood energy was a particularly sensitive subject as its use was predominantly seen as a threat to forests and as very environmentally unfriendly (UNECE, 2013).

Forestry administrators did not meaningfully or often engage local stakeholders, the private sector and other related sectors, and had not fully embraced sustainable forest management principles and the idea of wood as an ideal renewable material and fuel (World Bank, 2015b). Forestry administrators are now trying to promote the forest industry more and to seek greater multi-sectoral cooperation and stakeholder engagement (UNECE, 2015). In some countries, legal and institutional frameworks are being developed to support private forest ownership, e.g. in Georgia (National Forest Agency Georgia, 2018) and Kazakhstan (UNDP, 2015a).

5. Restoration needs and potential

The restoration[7], including reforestation and afforestation, of large areas of the CCA which have been degraded would provide environmental and social benefits. Forests close to settlements, mining sites, tugai forest (riparian forests) and forests in steep terrain are in the most urgent need of attention. Forests near settlements have suffered the heaviest pressure from wood harvest and grazing in spite of their importance for the livelihood of local people. A vivid example is the walnut wild fruit forests of southern Kyrgyzstan, notably around the Arslanbop village. Such walnut wild fruit forests are a key gene reservoir for further breeding of many globally-important fruit species and a source of high-value non-wood forest products for local communities (GIZ, 2015, World Bank, 2015b). Many conifer, juniper and broadleaf forests show a poor distribution of age classes, with too high a proportion of overmature trees and too few younger trees. To prevent the loss of these forests, there is an urgent need to reduce grazing pressure to allow a succession of young trees.

Tugai forests are among the most degraded forest type in countries where they make up a substantial part of the State Forest Fund, namely Azerbaijan, Kazakhstan, Turkmenistan and Uzbekistan. During the Soviet era, tugai forests were cleared for agriculture. A consequent increase in water abstraction from rivers for irrigation has reduced river runoff and seasonal flooding, intensifying degradation. Those tugai forests that remain have been subject to increased pressure from tree cutting, fuelwood collection and grazing. Tugai forests are among the most important ecosystems of the region and provide vital ecosystem services in arid regions, significantly strengthening the case for their urgent restoration.

Saxaul forests have suffered degradation largely from fuelwood removal and grazing. Black saxaul forests have also suffered from reduced river flows, due to increased water abstraction, in the same way as tugai forests (Thevs et al., 2013). Saxaul degradation has resulted in widespread wind erosion in the deserts of Kazakhstan, Turkmenistan and Uzbekistan and this argues for widespread habitat restoration.

As with Armenia, opencast mining has severely impacted the region's forests, as forests were cleared for mining sites. Restoring former mining sites is necessary to prevent further erosion and to restore essential ecosystem services to neighbouring communities. Forests in steep terrain are also in need of restoration. By helping to prevent erosion and landslides, restoration would lessen the risk of disasters. Finally, a powerful argument for restoring forests throughout the CCA region is their role in biodiversity as vital habitat for protected species e.g. the snow leopard in Central Asia, and as key sites for migrating birds.

Many forests, particularly broadleaf forests, including walnut, wild fruit forests, conifer forests and tugai forests are located in areas with favourable climate and good water supply. As a result, these forests often form a mosaic with pasture and other agricultural land. Trying to expand forests in such locations may be challenging because of the potential for conflict with other land uses and rural communities.

One way of avoiding such conflict, would be to target forest expansion on sites that are no longer suitable for other land uses because of excessive levels of salinity. Both tugai and black saxaul forest offer an opportunity for afforestation on saline land because of their salt tolerance. Species that could be planted include Elaeagnus angustifolia, Ulmus pumila, Populus euphratica, or Haloxylon aphyllum (Qadir et al., 2018). Over time, these new forests could offer income opportunities for rural communities from fuelwood and, possibly, timber. One particular opportunity for afforestation with saxaul exists on the dry bed of the Aral Sea, which would bring forests to areas otherwise devoid of vegetation and, in the process, would help to reduce wind erosion of salt-laden soils. The same approach to restoration could be adopted with afforestation in desert regions with white saxaul.

Increasing the numbers of young trees in degraded or deforested patches within existing broadleaf, juniper and conifer forests through planting/natural regeneration would significantly restore the region's forests, without entering into competition with other land uses. To secure forest restoration and expansion, reforestation and afforestation would ideally be focused on areas away from highly-valued agricultural land or pastures. In more populous areas, restoring forests near settlements will need to allow local residents to make use of afforested plots through hay making or planting berry-bearing plants between rows of young trees until the planted trees begin to yield income (Hardy, 2016).

[7] Considering the particularities of the CCA region restoration includes reforestation, afforestation and agro-forestry practices.

Once the trees bear fruit or timber, restoration can offer income opportunities to rural communities. Restoring forests close to settlements will only be successful, it these measures are matched by efforts to control grazing.

The potential for forest restoration and afforestation is limited by the region's testing climatic conditions and competing land uses. Agroforestry may offer opportunities to expand forest landscapes outside traditional forest areas. Windbreaks, for instance, could add to wood resources even where land is farmed intensively or is densely populated (Worbes et al., 2006). Windbreaks may also help to increase crop yields and reduce agricultural water consumption (Thevs et al., 2017).

Fast growing trees, especially poplars, as well as elm and mulberry are the main components of windbreaks. Once established, windbreaks improve the conditions for plantations of fast growing trees, which over time could potentially help to meet demand for fuelwood and timber. The introduction of windbreaks and fast-growing plantations already features in the forestry strategies in most of the CCA countries. In Kyrgyzstan, plantations have been on the government's agenda since the late 1990s.

Furthermore, windbreaks and plantations are often planted on private land or land under communal regime, which have less bureaucratic procedures for planting and for the use of wood than sites on forest land.

6. Country situations

The forest area and forest cover statistics contained in the boxes are based on FAO data using the international FAO definition of "forest" (FAO, 2015b). These data are displayed in table 2. Differences between FAO data and national data may arise from the use of different definitions of the term "forest"; where these occur, explanations appear in the country sections.

The estimated potential for forest restoration in this study is fundamentally the area of forest that has been lost during the past century, in particular since the 1990s, or is related to what the natural distribution of the forest might have been. Where data exists for the area of forest lost since the end of the Soviet Union, these are taken as the restoration potential for that country. For saxaul forest, restoration potential has been calculated on the assumption that saxaul would be restored to all sites where it would have been found naturally. Further information appears in each country section.

6.1 Armenia

Forest cover: 11.2%

Forest area: 332,000 ha (GIZ,2014)

Restoration needs: mining sites, forests in steep terrain

Restoration potential (preliminary estimate): 100,000 ha

Country target for afforestation/forest restoration: 266,500 ha by 2050

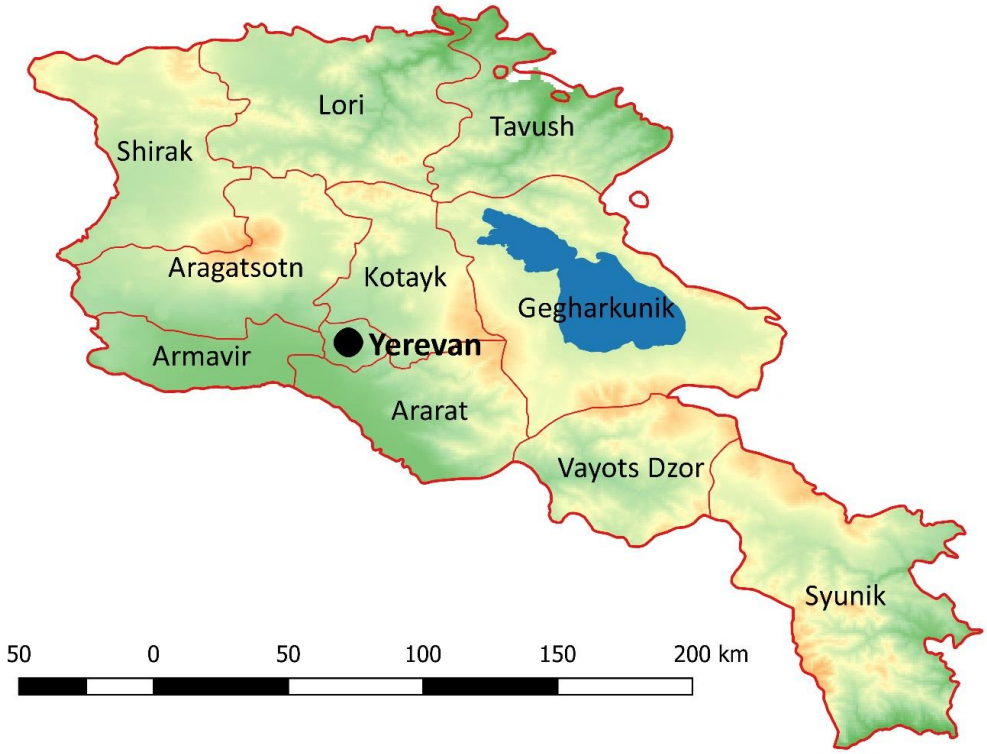


FIGURE 3: Map of Armenia

In Armenia, 75 per cent of all forests are managed under the State Forest Fund with the other 25 per cent administered by the Ministry of Nature Protection. Forests are concentrated in the northeast of the country at elevations lying between 600-2,500 m. (Republic of Armenia, 2015a). About 64 per cent of the country's forests are located in the Tavush and Lori provinces (figure 3, UNDP, 2015c).

Almost all of Armenia's forests (97 per cent) are deciduous. There are four major forest types: beech, oak, hornbeam and pistachio/wild fruit forest. Beech (Fagus orientalis) accounts for between one-third and half of all forest, with oak making up one-third and hornbeam (Carpinus) roughly 14 per cent (Junge and Fripp, 2011). Beech tends to be found mainly on north-facing slopes, at elevations between 1,000 m and 2,100 m. Hornbeam occurs at elevations between 800 m and 1800 m and may also be mixed with oak and wild fruit tree species. The fourth major forest type, pistachio forests, occur in combination with other fruit species, like almond (Amygdalus fenzlianum) and wild cherry (Prunus spp.) at elevations between 900 m and 1,000 m. in the north, and at higher elevations (1,800 m to 2,000 m) in the south of the country.

Armenia's forests have experienced significant degradation since independence, mainly due to fuelwood collection, but also grazing and forest fires. In prehistoric times, about 40 per cent of Armenia's territory would have been forested. From the 1930s to the 1950s, an annual harvest of 450,000 m³ of wood was removed for industrial purposes, a figure that has been estimated as twelve times more than the allowable cut, based on natural forest productivity (USAID, 2000a). Overcutting, primarily for fuelwood, took place after independence during the 1990s. Between 1992 and 1995 alone, 27,000 ha of forests were damaged, including 7,000 ha, which were cut and simply not regenerated. From 1990 to 2010, the forest area was reduced by about 100,000 ha (24.5% of the forest area at independence), with most of this loss taking place in the 1990s. In the north east of the country, the tree line that had risen to about 2,500 m has since retreated to roughly 1,800 m, the result of fuel wood removal, logging, and grazing pressure. If no protective measures are taken, it is estimated that another 14,000 ha to 17,000 ha of forest could be lost by 2030 (UNDP,2015c).

The most recent estimates suggest that 70 per cent of Armenia's forests are degraded or overmature (Hayantar[8], 2005). Official data suggest that wood removals ran at roughly 37,000 m³ per year between 2009 and 2013; significantly lower than the figures of 70,000 m³ to 100,000 m³ before 2003. Those figures fall well short of current wood consumption, which was estimated in 2010 as 457,000 m³. By 2012, fuelwood collection was estimated as 709,851 m³ (Republic of Armenia, 2014, 2015). This suggests that up to 630,000 m³ of wood may be cut illegally every year (UNDP, 2015c). This suggests that up to 630,000 m³ of wood may be cut illegally every year (UNDP, 2015c). These volumes are higher than the capacity of Armenia's forests to produce a sustainable yield, based on natural productivity, by a factor of at least 20. However, fuelwood, especially for household use, can also for instance be dead branches that are gathered, post-consumer wood (old pallets and sawnwood) and these would not be accounted in the illegal removals statistics.

It is hard to see how this situation can be changed, given that most households in rural areas depend on fuelwood for energy, as other energy sources are unavailable or too expensive: one-third of the rural population is estimated to be living in poverty (UNDP,2015c).

An improvement in the gas supply after 2010 led to a reduction in illegal cutting for fuelwood (Republic of Armenia, 2014). However, electricity almost doubled in price between 1999 and 2014, and prices for gas increased by 250 per cent between 2007 and 2014. As a consequence, wood removals have remained at unsustainable levels and fuelwood consumption is likely to continue to be the main cause of forest degradation in the country.

There has been an expansion of mining across the country, affecting 34,900 ha in 2013, primarily in the Lori and Syunik provinces, where most of the country's forests are located. Between 1990 and 2000, 30 per cent of forests in Lori province were destroyed due to mining (Republic of Armenia, 2014).

Wood harvest and forest degradation have resulted in erosion, landslides and disturbance to the hydrological cycle. A third of the country's area is considered eroded, part of which should be reforested (Hayantar, 2005).

Armenia's forest area has increased by 70,000 ha since FRA2010. This increase disguises changes in species composition and forest structure due to fuelwood removal and logging, changing formerly primary forest to shrub-dominated secondary forest. In beech and oak primary forest, logging and the lack of successful natural regeneration, have allowed steppe vegetation to encroach into the forest, reducing still further the chances of securing natural regeneration.

Forests are administered by the State Forest Administration's State Non-Commercial Organization, which was transferred from the Ministry of Agriculture to the Ministry of Environment and Nature Protection in 2018 (http://hayantar.am/en/about-us/).

The National Forest Program of the Republic of Armenia 2005-20159 takes the view that the country's optimal forest cover would be 20.1 per cent, which compares with the FRA2015 figure of 11.2 per cent. This would require an increase in the forest area of 266,500 ha (Hayantar, 2005). The goal is to reach this target figure by 2050, as stated in the country's INDC 10(Republic of Armenia, 2015b). Afforestation and forest restoration to prevent erosion were mentioned as national priorities in the Strategy of the Republic of Armenia on Conservation, Protection, Reproduction and Use of Biological Diversity from 2015 (Republic of Armenia, 2015a).

From 2000 to 2009 a reforestation and afforestation programme was implemented on 33,540 ha. Of these plans, 3,854 ha were newly planted, and 5,944 ha were managed through coppicing, while the rest was naturally regenerated with the help of fencing and fertilizers. From 2000 to 2014, the number and total size of protected areas substantially increased. A special government programme focused on the Lori and Tavush Provinces, to increase the number of natural

[8] Hayantar – State Non-Commercial Organization (SNCO) under the Ministry of Nature Protection of the Republic of Armenia.

[9] https://www.unece.org/fileadmin/DAM/timber/meetings/20170913/National_Forest_Program_Armenia.pdf

[10] Intended Nationally Determined Contributions (INDCs) is a term used under the United Nations Framework Convention on Climate Change (UNFCCC) for reductions in greenhouse gas emissions that all countries that signed the UNFCCC were asked to publish in the lead-up to the 2015 United Nations Climate Change Conference held in Paris, France, in December 2015.

monuments11 and the Forest State Reserve Khosrov (Ararat province) was awarded the European Diploma on Protected Areas in 2013. From 2009 to 2013, 1,756.5 ha were afforested and reforested, in large parts with the help of international projects (Republic of Armenia, 2014).

Hayantar states that issues of fuel supply to rural communities must be addressed, as this is the main driver of illegal cutting. By 2010, 566 communities out of a total 915 communities in the country were supplied with gas (Junge and Fripp, 2011).

Halting forest degradation and securing forest landscape restoration will only succeed if combined with measures to address fuelwood shortages. One approach will be to supply alternative energy sources and to increase energy efficiency, but it will also require action to establish plantations of fast-growing trees to meet the demand for fuelwood in rural areas where providing alternative fuel sources may not be practicable (Republic of Armenia, 2014).

This study estimates Armenia's restoration potential at 100,000 ha, which corresponds to the forest area degraded and partly lost in the period from 1990 to 2010 (USAID, 2000a). Investment in agriculture was limited following independence, meaning that the forest area lost has not been designated for high value agriculture. As a result, competition for land in these areas is less pressing than in areas with a tradition of agriculture dating from before 1990. Former mining sites are also in great need of restoration.

6.1.1 Ongoing projects

The following forest landscape restoration projects are ongoing:

Title	**Type, timescale, implementing agency**	**Targets**	**Source**
The establishment of a new forest belt nearby Lake Suvan	National project 2014-2023	Plant new forests on 1113.2 ha in Suvan National Park and adjacent community areas.	Decision #1441-N by the Government of RA from 15-Nov-2015
Mainstreaming Sustainable Land and Forest Management in Dry Mountain Landscapes of Northeastern Armenia	GEF 2016-2020 implemented by UNDP, executed by Ministry of Nature Protection and Ministry of Agriculture	Restore degraded forests on 4,932 ha through assisted natural forest regeneration incentives for communities to refrain from unsustainable forest use.	https://www.thegef.org/project/mainstreaming-sustainable-land-and-forest-management-dry-mountain-landscapes
Promotion of Eco-Corridors in the Southern Caucasus	WWF 2014-2019 Funded by BMZ through KfW	To link protected areas and create income opportunities for communities around protected areas.	http://wwf.panda.org/who_we_are/wwf_offices/armenia/projects/ongoing/eco_corridors/

[11] https://www.iucn.org/theme/protected-areas/about/protected-areas-categories/category-iii-natural-monument-or-feature

6.2 Azerbaijan

Forest cover: 13.2%
Forest area: 1.14 million ha
Restoration needs: tugai forests and forests on slopes
Restoration potential (preliminary estimate): within the limit of 593,000 ha
Country target for afforestation/forest restoration: 593,000 ha

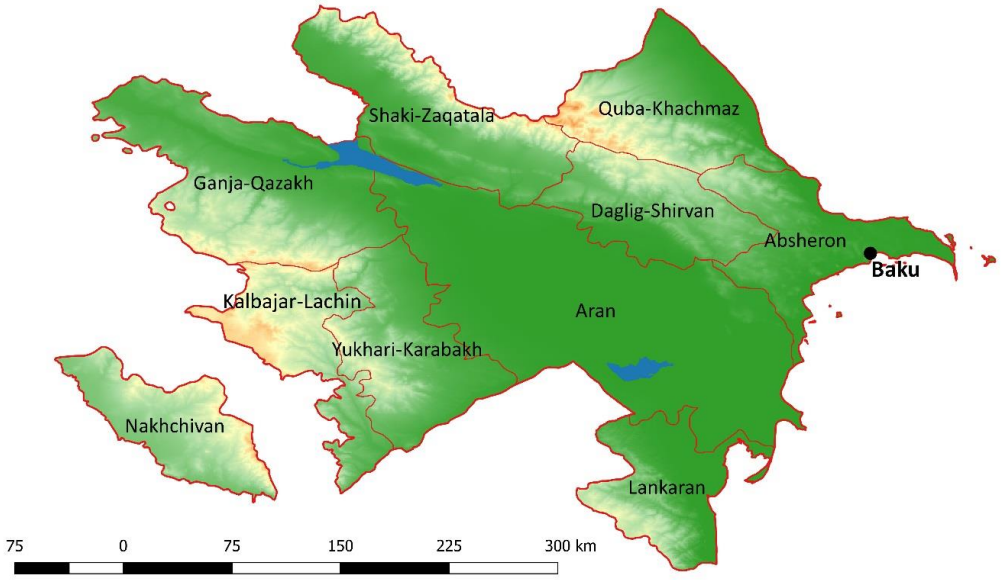


FIGURE 4: Map of Azerbaijan

Forests in Azerbaijan are managed by the Department of Forest Development of the Ministry of Ecology and Natural Resources. The State Forest Fund covers 1,213,700 ha (FAO and Forestry Department of the Ministry of Ecology and Natural Resources of Azerbaijan, 2017).

Despite its small size, Azerbaijan encompasses a considerable range of climatic zones and landscapes (figure 4). The southeast and southwest have a humid subtropical climate with annual precipitations of 1,200 mm to 1,600 mm, while the central part of Azerbaijan is arid with only 150 mm precipitation annually (USAID, 2010).

The vast majority, 97 per cent, of forests are broadleaved. About 48 per cent of Azerbaijan's forests are mountain forests in the Greater Caucasus. The Lesser Caucasus contains 34.2 per cent of the country's forests. The mountain forests are distributed between 500 m and 2,100 m in the north and up to 2,500 m in the south. The lower areas (500 to 1,000 m) are dominated by oak (Quercus iberico) with a minor percentage of hornbeam (Carpinus orientalis) and lime (Tilia caucasica) trees. Beech (Fagus orientalis) forms forests on the northern slopes between 600 m and 1,800 m. Maple is often found at lower elevations in beech forests, while, at higher elevations, birch and rhododendron species may be found in beech-dominated forests. There are smaller areas of hornbeam forests (800 m - 1,800 m), which contain wild fruit species, like Caucasian pear (Pyrus caucasicum) and oriental apple (Malus orientalis). Above 1,800 m, spruce, pine, fir and beech form shrub-like forests. On dry sites in the mountains, juniper and pistachio grows in shrub-like forests. Tugai forests form strips and belts along most rivers in the country. The major tugai species are white poplar (Populus alba), oak (Quercus longipes) and Caucasian wingnut (Pterocarya pterocarpa).

In the Lankaran and the Talysh mountains by the coast of the Caspian Sea, there are relict[12] broadleaf forests with Alnus barbata and Acer velutinum along rivers, Ruscus hyrcana, Buxus hyrcana, Ilex hyrcana (Hyrcanian winterberry) in the foothills and several oak species above 600 m. These relict broadleaf and tugai forests were degraded, largely due to conversion to other landuse (USAID, 2000b).

Only 15 per cent of the country's forests have a canopy cover of 40 per cent or more, while the remaining 85 are open or fragmented forests with a canopy cover of less than 40 per cent (UNDP, 2011).

Azerbaijan experienced two periods of deforestation that reduced the forest area from 2.6 million ha, or 30 per cent of the land area, to 1.14 million ha by 2015. The first period was from 1861 to 1921, when wood was needed for construction for oil exploitation. The second, was after independence from the Soviet Union (FAO and Forestry Department of the Ministry of Ecology and Natural Resources of Azerbaijan, 2017). During the Soviet era, forests were protected and used for recreation, with timber and energy imported from the Russian Federation. After the collapse of the Soviet Union, those imports stopped and most people in rural areas relied on forests to meet their energy needs (UNDP, 2011). From the 1990s until 2000, illegal commercial logging for furniture manufacture, construction and fuelwood led to forest degradation, a situation that persisted until 2009 (USAID, 2010). Nowadays, 80 per cent of villages are supplied with gas, which has reduced the pressure on forests from fuelwood removal (FAO and Forestry Department of the Ministry of Ecology and Natural Resources of Azerbaijan, 2017).

During the 1990s, livestock tended to be kept close to villages as remote summer pastures were not accessible. In mountain regions, this resulted in higher grazing pressure on mid-elevation pastures and adjacent forests (USAID, 2000b). Currently, forests are all protected by law and only sanitary cuts are permitted. This practice does not specifically address active forest management, logging, and fuelwood removal. Despite protective measures, forest degradation continues, caused primarily by overgrazing and illegal cutting for timber and fuelwood, especially in remote regions with higher poverty rates and where enforcement of rules and laws is weak.

During the 1990s, between 4,000 ha and 5,000 ha of forests, mostly poplar, were planted annually (USAID, 2000b). From 2000 to 2010, forest cover increased, partly due to improved forest management and law enforcement (ADB 2014). From 2011 to 2015 the area of forest which was rehabilitated or restored was between 7,355 ha and 7,505 ha annually. At the same time, the area of afforestation dropped from 3,149 ha in 2011 to 2,636 ha in 2015 annually (FAO and Forestry Department of the Ministry of Ecology and Natural Resources of Azerbaijan, 2017).

Azerbaijan's National Forestry Programme identifies increasing the forest area through afforestation and plantations as a major priority, with the aim of increasing forest cover to 20 per cent, primarily on land that is not part of the State Forest Fund. This would require establishing 593,000 ha of newly planted forests or plantations. For these plans to succeed, forests must be protected from illegal logging and overgrazing (Republic of Azerbaijan, 2013). Most of the new forests would be designed to protect soils and watersheds. A smaller portion could be used for timber and non-timber forest products. Meeting the demand for fuelwood would be achieved by careful sanitary cuttings and from new plantations of fast-growing trees. There is a desire to promote fast-growing trees as a source of raw material for furniture manufacture and construction. Planting windbreaks and using afforestation to control soil erosion will also be supported.

Restoration needs are particularly high for tugai forests and forests in steep terrain. It is improbable that restoration could increase the forest area to the 2.6 million ha that existed until the middle of the 19th century, since much of those former forests are now devoted to agriculture or occupied by settlements.

6.2.1 Ongoing projects

These forest landscape restoration projects are ongoing:

Title	Type, timescale, implementing agency	Targets	Source
Forest Resources Assessment and	GEF Approved July 2017	Build a forest information system as a solid database for	https://www.thegef.org/project/forest-resources-

[12] A relict species is a population that presently occurs in a restricted area, but whose original range was far wider during a previous geologic epoch.

Monitoring to Strengthen Forest Knowledge Framework in Azerbaijan	2017-2019 implemented by FAO, executed by Forestry Department of the Ministry of Ecology and Natural Resources	forest policy and management. Improve forest management to enhance carbon sequestration and other benefits for rural communities. Bring 22,100 ha under integrated forest management plans.	assessment-and-monitoring-strengthen-forest-knowledge-framework-azerbaijan
Sustainable Land and Forest Management in the Greater Caucasus Landscape	GEF Approved 2012 2013-2017 implemented by UNDP, executed by Ministry of Ecology and Natural Resources	Amend policies to support sustainable land and forest management. Restore 5000 ha of degraded community forests.	https://www.thegef.org/project/sustainable-land-and-forest-management-greater-caucasus-landscape http://www.az.undp.org/content/azerbaijan/en/home/operations/projects/sustain_development/_sustainable-land-and-forest-management-in-the-greater-caucasus-.html
Promotion of Eco-Corridors in the Southern Caucasus	WWF 2015-2019 Funded by BMZ through KfW	To link protected areas and create income opportunities for communities around protected areas.	http://wwf.panda.org/who_we_are/wwf_offices/armenia/projects/ongoing/eco_corridors/

6.3 Georgia

Forest cover: 40.5%
Forest area: 2.8 million ha
Restoration needs: Forests throughout the country, priority on the region around the city Borjomi (Samtskhe-Javakheti)
Restoration potential (preliminary estimate): at least 200,000 ha
Country target for afforestation/forest restoration: 9,000 ha (unconditional) and an additional 35,000 ha if funding is available. SFM practices on 45,000 ha (unconditional) and up to 250,000 ha conditional. Put 1 million ha of forests under protection by expanding the protected area from 0.52 million ha to 1.3 million ha[13].

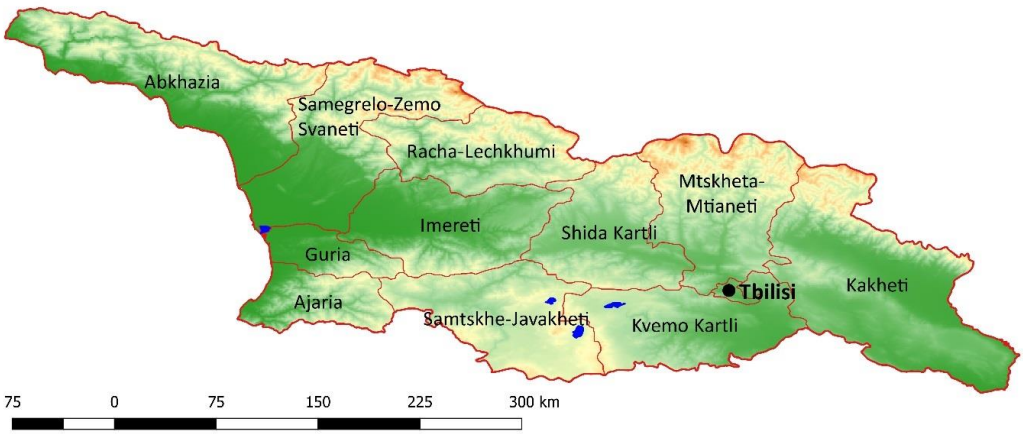


FIGURE 5: Map of Georgia

Georgia has the highest forest cover in the CCA region, at 40.5 per cent. This figure cannot be confirmed because there has been no full forest inventory since independence but these data match recent, preliminary national data (Tskhovrebadze, 2018). Georgia is conducting its first country-wide national forest inventory with the intention of making results available for FRA2025. Core indicators of sustainable forest management and assessment methods have been developed and are ready for application in Georgia's new national forest inventory (Giorgadye, 2017).

Depending on the source, the State Forest Fund covers an area of 2.9 million ha (Tskhovrebadze, 2018) or 3 million ha (Amirgulashvili, 2018). Almost all forests are natural or near-natural (98 per cent), with only 2 per cent planted. Forests are mainly distributed in the mountains with higher diversity in the west than in the east of the country. Evergreen species like rhododendron (Rhododendron ponticum) and holly (Ilex colchica) dominate the forests of the Kolkhiz lowlands along the coast of the Black Sea, rising to 500 m - 600 m under a subtropical humid climate. At higher elevations and further inland, forests are dominated by oak and beech (Fagus orientalis) rising to 2,000 m. Between 1,400 m and 2,000 m Caucasian fir (Abies nordmanniana) and oriental spruce (Picea orientalis) occur in mixture with beech or form conifer forests rising to 2,150 m. Pine and birch species dominate at altitudes between 1,800 and 2,000 m to 2,500 m. The climate becomes progressively more arid moving from west to east, particularly in Kakheti province (figure 5) (Krever et al., 2001).

More than 80 per cent of forests are located on steep slopes (FAO 2016). Beech (Fagus orientalis) is the dominant species in half of the forests, followed by oaks as the second most important species in the country. Other important tree species are fir, hornbeam, spruce, pine and alder.

In 1950, forests in Georgia became protected, reducing the annual wood harvest from 1.5 million m³ to 432,000 m³. The gap between demand and supply was filled by imports from the Russian Federation. Imports from the Russian

[13] The 1.3 million ha cover all different ecosystems that are included in protected areas.

Federation stopped after independence, causing intense pressure on Georgia's forests and resulted in the wood harvest in 2013 increasing to 702,137 m³ (Torchinava, 2016).

Forests play an important role as a source of fuel and timber for communities living nearby and this has led to overexploitation in past decades, mainly due to fuelwood cutting and collection. In 1998, so-called "social cuts" were introduced, entitling every rural household to cut 7 m³ – 15 m³ wood annually for fuel. The actual amount depended on the region, e.g. 7 m³ in lowland regions but up to 15 m³ in mountain regions. According to the rules, these social cuts take place under the supervision of foresters. However, more wood is removed than is re-growing and often high-value wood is cut for fuel instead of using it for timber (Amirgulashvili, 2018).

The Global Forest Resources Assessment 2015 records that fuelwood removal increased throughout the 1990s and peaked in 2008, with an average annual removal of 750,000 m³ (FAO, 2015a). Another study reports that annual fuelwood removals exceed 2 million m³, well in excess of any sustainable allowable cut (CENN, 2016). In addition, it is estimated that 40 per cent of the potential heating value of the fuelwood is wasted because wood is burned while it is still fresh with too high a moisture content (Amirgulashvili, 2018).

Due to excessive wood harvest, triggered by short term permits during the 1990s, about 200,000 ha of forests were almost destroyed (FAO and UNECE 2015). Grazing is an issue, too, but less pronounced than fuelwood collection.

In Kakheti province, forests are in a poorer condition than in other parts of the country, as the climate is arid, growth rates are lower and grazing pressure higher. In the 1990s, most of the windbreaks were cut down for fuelwood (MS Consulting, 2016).

Between 1990 and 2014, 806.7 ha were afforested/reforested (FAO, 2016). There is still significant potential for other forestlands to be restored. The ongoing forest inventory will provide a good basis for well-targeted restoration. Kakheti province has both the greatest need and the greatest potential for forest restoration, both by increasing numbers of trees in degraded/sparse forest areas or by planting windbreaks in agricultural areas. There is less scope for restoration in other parts of Georgia where areas suitable for afforestation are rare, but existing forest landscapes could be restored. Forest restoration is needed in the Borjomi National Park, where the forests suffered considerable damage from fires in 2008 and 2016.

The National Forest Agency (part of the Ministry of Environmental Protection and Agriculture of Georgia) administers 1.8 million ha of forests. The rangers and foresters report to the National Forest Agency and are jointly appointed with the local authorities. The Forest Policy Service in the Ministry of Environment and Natural Resources Protection is an advisory body[14]. The Agency for Protected Areas also reports to the Ministry of Environment Protection and Agriculture and administers 500,000 ha forests within protected areas of the country. The remaining forests are under the Autonomous Region Adjara and under some municipalities, e.g. Tbilisi.

The National Forestry Concept from 2013[15] provides guidance on forest policies in Georgia and includes the restoration of degraded forests and reforestation as a priority. Other actions under this concept include drawing up a forest landscape restoration strategy. The potential of using the services of carbon cycling to yield additional income through carbon credits, etc. will be investigated in a study which is currently in the planning stages. The concept promotes short-rotation plantations and suggests that fuelwood from sustainably-managed forests could be cut and collected by foresters, instead of the local population. It addresses energy efficiency and the provision of other sources of energy (coal, gas), which are planned to be made available for rural households. This goes along with the Environmental Action Program 2012-2016, which aims to improve forests in the next 20 years. To achieve this, a new Forest Code was developed (Ministry of Environment Protection of Georgia, 2012). The draft of the new Forest Code is expected to be adopted by the Parliament in 2018 (National Forest Agency Georgia, 2018).

In Georgia's Intended Nationally Determined Contributions (INDCs) under UNFCCC[16], the 45,000 ha Borjomi National Park is a key area for the introduction of SFM practices. There, an area of 1,500 ha is proposed for reforestation/afforestation and natural regeneration of forests will be supported on 7,500 ha, both by 2030

[14] http://forestry.gov.ge/en/about-us/vision-and-goals
[15] http://environment.cenn.org/app/uploads/2016/09/CENN-BROCHURE-reduced-ENG.pdf
[16] http://www4.unfccc.int/ndcregistry/PublishedDocuments/Georgia%20First/INDC_of_Georgia.pdf

(unconditional commitment). With external financial and technical support (i.e. conditional commitment), the country commits itself to afforest/reforest up to 35,000 ha, in parallel with supporting relevant activities to assist natural regeneration until 2030 and introducing SFM practices on up to 250,000 ha. Establishing adequate infrastructure and assuring effective management plans for protected areas is planned with international financial support. In addition, Georgia committed to expand the protected area from 0.52 million ha to 1.3 million ha (about 20% of Georgia's territory), including at least 1 million ha of forest (Ministry of Environment Protection of Georgia, 2015).

The restoration potential for Georgian forests have been estimated to be at least 200,000 ha, amounting to the area of forest that was severely exploited during the 1990s due to the practice of handing out short-term cutting-permits (FAO and UNECE, 2015). Before 1990, cleared forest land was often converted to agriculture. The areas cleared during the 1990s were not used for agriculture, so it should be possible to restore most of these areas.

6.3.1 Ongoing projects

These forest landscape restoration projects are ongoing:

Title	Type, timescale, implementing agency	Targets	Source
Generating Economic and Environmental Benefits from Sustainable Land Management for Vulnerable Rural Communities of Georgia	GEF implemented by UNEP, executed by the Regional Environment Centre for the Caucasus (REC Caucasus)	Improve land productivity on 590,000 ha (all types of land use). Restoration of 10,000 ha of degraded land through planting of trees as windbreaks.	https://www.thegef.org/project/generating-economic-and-environmental-benefits-sustainable-land-management-vulnerable-rural
Applying Landscape and Sustainable Land Management (L-SLM) for Mitigating Land Degradation and Contributing to Poverty Reduction in Rural Areas	GEF implemented by UNEP, executed by Ministry of Environment Protection of Georgia through Regional Environment Centre (REC) for the Caucasus	Implement integrated landscape management plans.	https://www.thegef.org/project/applying-landscape-and-sustainable-land-management-l-slm-mitigating-land-degradation-and
Global Forest Watch 2.0 FW 2.0	GEF approved in August 2015, due for completion September 2018; implemented by UN Environment, executed by the Ministry of Environment Protection of Georgia. This project takes place in Georgia and Madagascar.	Use of the ecosystem approach in countries to maintain ecosystem services and sustainable productivity of terrestrial and aquatic systems is increased. Transformative REDD+ strategies and finance approaches are developed and implemented by developing countries that aim at reducing emissions from deforestation and forest degradation and bringing multiple benefits for biodiversity and livelihoods.	https://www.thegef.org/project/global-forest-watch-20-fw-20
Promotion of Eco-Corridors in the	WWF 2015-2019	To link protected areas and create income opportunities	http://wwf.panda.org/who_we_are/wwf_offices/armenia/p

Southern Caucasus	Funded by BMZ through KfW.	for communities around protected areas.	rojects/ongoing/eco_corridors/
Sustainable Forest Governance in Georgia Phase II	Austrian Development Agency implemented by Caucasus Environment Network (CENN) Began July 2015, due for completion 31 August 2018.	Pilot, promote and lobby modern forest management practices.	http://www.entwicklung.at/projekte/detail/project/show/sustainable-forest-governance-in-georgia-phase-ii/
Protected areas in the Caucasus, Georgia	KfW 2014-2019 implemented by GFA Consulting.	Funds to support establishment of eco-corridors in Ajara.	https://www.gfa-group.de/projects/Protected_areas_in_the_Caucasus_3876698.html
Sustainable biodiversity management in the South Caucasus	GIZ Coordination in Georgia	Focus on improving forest management in Georgia. Only in the arid eastern part of Georgia, in Kakheti, this programme worked on windbreaks in the agrarian landscape. But this component has ceased already.	http://biodivers-southcaucasus.org/georgia

In the Tusheti region, there are ongoing discussions to develop a biosphere reserve area. Negotiations are ongoing for a GCF project for the Kakheti region, which might have a forest landscape restoration component.

6.4 Kazakhstan

Forest cover: 1.2%

Forest area: 3.3 million ha

Restoration needs: saxaul wooded land and forests[17], in particular on the dry bed of the Aral Sea and in tugai forests

Restoration potential (preliminary estimate): saxaul wooded lands (up to 8.9 million ha, if the entire former natural range were restored) and tugai forests

Country target for afforestation/forest restoration: 200,000 ha of wooded land and forests until 2020; and 300,000 ha of wooded lands and forests by 2030. In addition, it is planned to establish plantations of fast-growing trees, create green belts around cities, plant 10,000 ha of shelterbelts and set up protected areas for saxaul woodlands on 962,021 ha by 2030.

FIGURE 6: Map of Kazakhstan

According to FAOSTAT, forests cover 3,309,000 ha corresponding to 1.2 per cent of the land area. The Committee of Forestry and Wildlife, however, reported an area of forests of 12.9 million ha as of 2018, corresponding to 4.7 per cent of the country (Committee of Forestry and Wildlife of Kazakhstan, 2018). The different numbers can be explained by the different definitions of forest used by the national and international data provider. Saxaul woodland is classed as forest under the national standard of Kazakhstan, but only part of the area meets the criteria to qualify as forest under the FAO definition, with the remainder counted as "other wooded land" (FAO, 2015b). The State Forest Fund's area is 29.8 million ha (Committee of Forestry and Wildlife of Kazakhstan 2018). The Committee of Forestry and Wildlife under the Ministry of Agriculture is responsible for forestry.

According to Kazakhstan's national data, black saxaul (Haloxylon aphyllum) makes up 32.3 per cent of wooded land and forest, followed by 16.7 per cent white saxaul (H. persicum) and other shrub vegetation at 23.6 per cent (Committee of Forestry and Wildlife of Kazakhstan 2018). Half of all wooded land and forest is located in the provinces Kyzylorda, Zhambyl and Turkistan (figure 6). Coniferous forest accounts for 13.4 per cent of the wooded lands and forests; broadleaf forests for 14.2 per cent, concentrated in the provinces of Almaty and East Kazakhstan. Half the conifer forests consist of pine species. Other species include fir and spruce. The spruce forests are dominated by Picea schrenkiana, in the Tian Shan mountain range (1,700-2,800 m). Birch makes up more than half of the broadleaf forests, about one-third is aspen, forming a patchwork of forest in the Forest Steppe Zone along Kazakhstan's northern border, with the remainder consisting of small stands of walnut and wild fruit forests and forests of oak, maple, elm, ash, willow and poplar (USAID, 2001a).

About 70 per cent of Kazakhstan is classed as degraded to varying degrees, mostly desert with saxaul vegetation, steppe and agricultural land, which is affected by overgrazing and salinization (UNDP, 2015a). Saxaul forest in arid zones, fall under the category "degraded desert areas". Considering the former natural distribution of saxaul, the country could

[17] Some areas with saxaul are classifies as *saxaul forests*, others with a lower density of trees as *saxaul wooded lands*.

have potential for another 8.9 million ha of saxaul vegetation (Thevs et al., 2013)18. Fuelwood removal and charcoal production with grazing are the major causes for saxaul degradation. The dry bed of the Aral Sea, together with smaller areas around the Ural Delta at the Caspian Sea and the steppes around Karaganda are earmarked as the most severely degraded landscapes in Kazakhstan. The deserts in the south of the country are also classified as degraded. Tugai forests had been cleared over decades for conversion to irrigated agricultural land and those that survived were further degraded in the 1990s by fuelwood removal and grazing (USAID, 2001a).

Fuelwood collection continues to be an issue for remoter areas without regular gas or coal supply. It plays a less important role in Kazakhstan than in neighbouring countries because of the better availability of other sources of energy. Recently, more areas of forest have been degraded, in particular in the Tian Shan and Altay mountains, as land has been developed to cater for an expanding tourism sector (UNDP, 2016a). Uncontrolled logging affects all conifer and broadleaved forests, while fuelwood removal affects every type of woodland. In particular, saxaul areas have suffered severe degradation from fuelwood removal. Saxaul is the single largest vegetation type in Kazakhstan and most rural communities depend on saxaul forest for energy in the absence of other sources of energy.

The strategy Kazakhstan-2050 (adopted in 2013) is that the whole country moves towards a green economy and promotes the conservation and effective management of forest ecosystems.

Before this strategy was adopted, forest landscape restoration activities were carried out under the GEF project Forest Protection and Reforestation19 and from 2010 to 2013 under the national Natural Resource Program (Zhasyi Damu Program). Formerly, 46,000 ha of Pine forests along the Irtysh River were restored, 61,400 ha of saxaul forests and woodlands on the dry Aral Sea bed were planted, and 107,000 ha of other degraded lands were restored. In addition, 168,000 ha of saxaul forests and woodlands were brought under sustainable grazing management (World Bank 2013). Moreover, afforestation of saxaul on the dry bed of the Aral Sea (56,500 ha), pine forests along the Irtysh River around Semey City (22,800 ha) and the Green Belt around the capital, Astana, was carried out (Ministry of Agriculture of Kazakhstan, 2015). Both the GEF Project and the national Natural Resource Program addressed the most urgent restoration needs and gained experience of forest landscape restoration under arid climate conditions. This knowledge will be beneficial to further restoration activity.

In 2015, Kazakhstan presented its “National Biodiversity Strategy and Action Plan by 2030”, which is in line with the concept of transition to a green economy. This strategy includes the conservation of biodiversity and the sustainable use of forests, wild animals and pasture.

Areas identified for afforestation and reforestation include the dry bed of the Aral Sea and protective tree lines along roads and railway lines. It assumes that the area of forest and wooded land will increase to 4.7 per cent by 2020 and to 5 per cent by 2030. This will be achieved through reforestation and afforestation (200,000 ha by 2020 and 300,000 ha by 2030), the establishment of plantations of fast-growing trees, the creation of green belts around cities, and by planting 10,000 ha of shelterbelts by 2030. Forests and protective tree belts that do not belong to the State Forest Fund will be transferred to the State Forest Fund (UNDP, 2015a). Restoration will also focus on wooded land in the deserts i.e. saxaul, especially on the dry bed of the Aral Sea, and tugai forests. Saxaul forest and wooded land offers the highest potential for restoration, as there is negligible competition from other land uses.

There are recommendations to encourage the private sector to establish plantations of fast-growing trees, which might help to attract investment in wood processing industries such as cellulose, paper and engineered wood products. Furthermore, agroforestry systems, in particular windbreaks should be further supported (UNDP, 2015a).

6.4.1 Ongoing projects

The following forest landscape restoration projects are ongoing:

Title	Type, timescale, implementing agency	Targets	Source
Conservation and Sustainable	Approved in March 2018	The project focuses on critical forest and woodland	https://www.thegef.org/project/conservation-and-

[18] The term saxaul vegetation used here comprises more than saxaul forests by the national definition.

[19] https://www.thegef.org/project/forest-protection-and-reforestation

Management of Key Globally Important Ecosystems for Multiple Benefits	implemented by UNDP, executed by the Forestry and Wildlife Committee.	ecosystems of Kazakhstan. Set up protected areas for mountain forests and grassland (882,028 ha), saxaul woodland (962,021 ha), and tugai forest (46,700 ha). Increase forests in Protected Area from 5.75% to 7%.	sustainable-management-key-globally-important-ecosystems-multiple-benefits
Improving Sustainability of PA System in Desert Ecosystems through Promotion of Biodiversity-compatible Livelihoods in and around PAs	Approved in July 2013 implemented by UNDP, executed by the Forestry and Wildlife Committee.	To establish new and strengthen existing protected areas in the desert regions of Kazakhstan. 1,000 ha tugai forests shall be restored and 20,000 ha and tugai forest shall come under sustainable management. Restore 85,000 ha degraded rangelands in the Ili-Balkhash and Ustyurt regions. These rangelands are partly interspersed with saxaul vegetation.	https://www.thegef.org/project/improving-sustainability-pa-system-desert-ecosystems-through-promotion-biodiversity
Sustainable and climate sensitive land use for economic development in Central Asia	GIZ runs from 2016-2019.	The Committee of Forestry and Fauna in the Ministry of Agriculture of Kazakhstan is supporting pilot plots with fast-growing trees that are under private ownership.	https://www.giz.de/en/worldwide/14210.html
Central Asian Desert Initiative (CADI)	ICI Project 2016-2019 Committee on Forestry and Wildlife of the Ministry of Agriculture, Association for the Conservation of Biodiversity in Kazakhstan	To preserve biological diversity and the conservation and sustainable use of cold winter deserts in Central Asia. Saxaul woodland will be protected along with other desert ecosystems.	http://cadi.uni-greifswald.de/en/home/

6.5 Kyrgyzstan

Forest cover: 3.2%
Forest area: 637,000 ha
Restoration needs: walnut and wild fruit forests, forests in the Jalal-Abad (Chatkal district) and Talas provinces due to widespread mining activities.
Restoration potential (preliminary estimate): 160,000 ha of spruce and juniper forests
Country target for afforestation/forest restoration: 83,000 ha by 2025

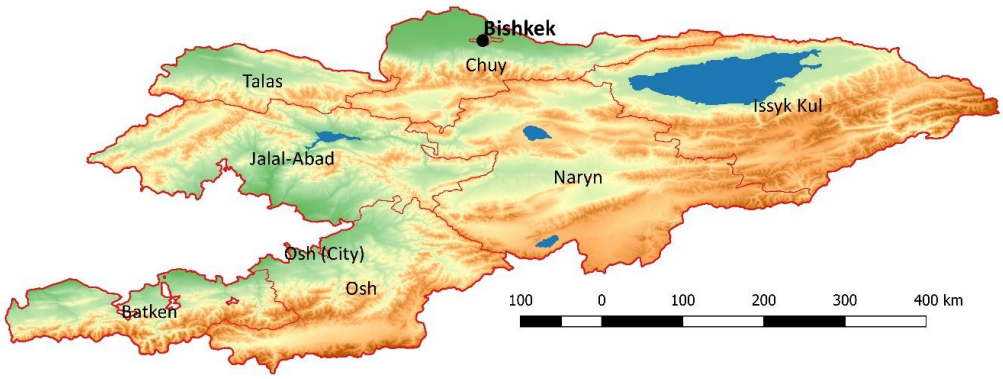


FIGURE 7: Map of Kyrgyzstan

Kyrgyzstan, with a forest area of 637,000 ha (3.2 per cent of the land area) has the second lowest forest cover among the CCA countries. However, it has the highest area of primary forest (590,000 ha) in the region. According to official data from the State Agency of Environmental Protection and Forestry of Kyrgyzstan, the forest area is 1,164,065 ha (5.6 per cent of the land area), with 839,560 ha managed by the State Forest fund and 277,000 ha of forest on community land (World Bank, 2015b). These differences arise because the two sources use different definitions for "forest" and "other wooded land". Thus, some of the forest reported by the national data would have been classified as "other wooded land" by FAO. In 2010, Kyrgyzstan reported 954,000 ha of forests and 390,000 ha of other wooded land (FAO, 2010). In 2015, the reported forest area was 637,000 ha, while the area of other wooded land increased to 704,000 ha. This shift can be explained through the reclassification of forests for international reporting.

The State Agency of Environmental Protection and Forestry is responsible for all forest-related issues in Kyrgyzstan. The total area under the State Forestry Fund is 3.3 million ha, which includes forest but also cropland and pasture (SAEPF, 2017).

The major forest types in Kyrgyzstan are juniper, conifer, walnut and wild fruit, and riparian (tugai) forests. The State Agency of Environmental Protection and Forestry reports that juniper forests cover 202,500 ha or 18 per cent of the forest area. These forests play an important role in protecting against erosion in steep terrain and are found mainly in southern Kyrgyzstan, in the provinces of Osh and Batken (figure 7). The upper elevation limit of juniper forests is at about 3,200 m. The major species of juniper are: Juniperus turkestanica, J. semiglobosa and J. seravshanica.

Spruce forests of Picea schrenkiana cover 120,400 ha (14 per cent of the forest area). Spruce forests dominate in the north of Kyrgyzstan and occur at about 2,800 m - 3,000 m. Walnut and wild fruit forests cover 631,000 ha and are distributed mainly in southern Kyrgyzstan with the largest contiguous areas on the slopes of the provinces Jalal-Abad (Chatkal district) and Ferghana ranges between 1,000 m and 2,200 m. (USAID, 2001b). These forests are a mixture of walnut (Juglans regia) and a number of wild and ancient species of apple, pear, cherry, plum, almond and other fruits mainly belonging to the family Rosaceae. At lower elevations, pistachio dominates parts of these forests. Riparian forests form narrow strips along most of the rivers, with willow (Salix alba), birch (Betula), Euphrates poplar (Populus euphratica) and sea buckthorn (Hippophae rhamnoides) as the main species (SAEPF, 2015). While these former three

forest types are held under the State Forest Fund, many riparian forests and plantations (mainly poplar), are held as community land (World Bank 2015b). Most forests form a mosaic with pastureland, as the best pastures are located in the same elevation range as most of the forests (USAID, 2001b).

During the Soviet era, between 400,000 m³ and 500,000 m³ of roundwood and 2 million m³ of fuelwood were imported annually from the Russian Federation. In the early 1990s, imports fell sharply and with no alternative source of energy and raw material. The result was that people exploited timber and fuelwood from Kyrgyzstan's forests. A ban on domestic logging, introduced in 2007 resulted in an increase in timber imports from the Russian Federation. About 2.4 million people live in proximity to forests with about 1.8 million, or 31 per cent of the country's population reliant, to some extent, on forest resources: for example, the walnut and wild fruit forests in Jalal-Abad province and the surrounding area are home to 1.2 million people (World Bank, 2015b).

At the end of the 1990s, fuelwood provided heating for 60 per cent of the population (USAID, 2001b). While dependence on fuelwood has decreased, as coal has partly replaced wood, there are still a sizeable percentage of households in Kyrgyzstan that rely on wood for heating. The share of fuelwood rises with distance from roads and markets (World Bank, 2015a). After fuelwood removal and logging, grazing in forest areas is the next major cause of forest degradation. Leasing pasture to herders is the largest source of income for the State Forestry Enterprises, accounting for 34 per cent of gross income in 2013, followed closely by collection of nuts and fruits. Both of these activities have come at the expense of future care and tree regrowth and both impede forest regeneration. At the institutional level, there is a need for forestry enterprises and communities to work together more effectively (World Bank, 2015b).

Since 1968, 36 per cent of juniper forest and half of all walnut and wild fruit forests have disappeared. Since the 1930s, two-thirds of the country's spruce forests have been lost (USAID, 2001b).

Considering the high numbers of people who rely on the income from walnut harvests, the most pressing need for forest landscape restoration is in the walnut and wild fruit forests (in several regions of the country). Widespread mining activity has led to the need for forest restoration in the Jalal-Abad (Chatkal district) and Talas provinces (figure 7). Further, restoration is needed around Issyk Kul, in particular around the city Karakol, as forests suffer from increasing tourism activities.

Measures to combat further degradation and support forest restoration could include, establishing plantations of fast-growing trees that would supply fuel and timber, together with controlling grazing pressure in forested areas (SAEPF, 2015, World Bank, 2015b). The main potential to restores forest lost over the last 100 years is in the juniper forests (100,000 ha) and the spruce forests (60,000 ha). Both forest types occur at elevations that are unsuitable for crop cultivation but damage and competition from summer grazing is important for livestock herders and would represent a challenge to forest restoration.

Kyrgyzstan has set a national target to increase forest cover by 2025, from 5.6 per cent to 6 per cent, equivalent to 83,000 ha. Currently, Kyrgyzstan is in the process of adopting a national development strategy until 2040. For the five years from 2018-2023, a comprehensive governmental programme was adopted, the "40 Steps to a New Era[20]". Step 40 of this programme states the following actions: "Establish plantations and increase forest cover with tax reduction and other incentives for enterprises that establish plantations of fruit trees, walnut trees, or fast-growing trees". The programme is under revision in the context of the formation of a new government, which plans to develop a new medium-term strategy that will replace the 40 Steps Program.

6.5.1 Ongoing projects

The following forest landscape restoration projects are ongoing or, where complete and closed, they remain relevant:

Title	Type, timescale, implementing agency	Targets	Source
Sustainable Management of	GEF project 2015-2018	Bring 20,000 ha forest land under improved multifunctional forest	https://www.thegef.org/project/sustainable-

[20] The "40 steps" program was abolished in spring 2018, but not replaced with something new yet. The objectives still remain. http://regulatortek.gov.kg/ru/content/40-shagov-v-budushchee

Mountainous Forest and Land Resources under Climate Change Conditions	implemented by FAO and executed by the State Agency for Environmental Protection and Forestry and Ministry of Agriculture.	management. Rehabilitate 8,000 ha degraded forest land through agroforestry and controlled grazing. Establish 2,000 ha plantation of fast growing trees, which results in avoiding degradation of 8,000 ha forest. 5,000 ha agricultural land come under agroforestry (windbreaks) as SLM practice.	management-mountainous-forest-and-land-resources-under-climate-change-conditions
Integrated Forest Ecosystem Management	GEF project approved in 2015 implemented by World Bank, executed by State Agency for Environmental Protection and Forestry.	Component 1: Support for institutional reforms and capacity-building. Create an environment for making integrated natural resource management plans. Component 2: Implementation of integrated natural resource management plans in 12 Leshozes. Planned interventions include establishment of short rotation plantations and silvo-pastoral systems. Component 3: Elaborate forest information and update the forest inventory.	https://www.thegef.org/project/sustainable-forest-and-land-management
Conservation of Globally Important Biodiversity and Associated Land and Forest Resources of Western Tian Shan Forest Mountain Ecosystems to Support Sustainable Livelihoods	GEF project Approved in 2015 Implemented by UNDP, executed by the State Agency for Environmental Protection and Forestry.	Restore 5,000 ha of juniper forests. Protect 25,000 ha of genetically important walnut and wild fruit forests, replace logging by conservation forestry.	https://www.thegef.org/project/conservation-globally-important-biodiversity-and-associated-land-and-forest-resources
Community-based management of walnut forests and pasture in Southern Kyrgyzstan	GIZ 2014-2018 Extension after 2018.	Project area contains 13,000 ha walnut forests and 36,700 ha pasture, which partly form a mosaic with the walnut forests. Develop joint management model of natural resources. Plant forests with walnut and other fruit trees.	https://www.giz.de/en/worldwide/29911.html
Sustainable and climate sensitive land use for economic development in Central Asia	GIZ	In the field of forests, the project supports joint management approach to design integrative management plans. In Kyrgyzstan, 6 Leshozes test innovative and adapted mechanisms for decentralised, participatory	https://www.giz.de/en/worldwide/14210.html

		management.	
The Forest and Environment Sector Programme. Involving of private sector in management of natural resources	Norwegian Forestry Group 2011-2014	This project mainly focused on capacity and institutional development with the Kyrgyz Forest and Land Users Association.	http://www.nfg.no/article.cfm?ID_art=42&ID_kanal=1
Project for Development of Rural Business with Forest Products in the Kyrgyz Republic	JICA Ongoing	Establish systems for marketing of forest products through Joint Forest Management. Products were apple and apricot.	https://www.jica.go.jp/english/our_work/thematic_issues/environment/c8h0vm0000bq16uo-att/projects_15.pdf

All the listed projects include a component addressing institutional reforms, capacity building, participatory planning, as well as to improve livelihoods in and around project areas. In the project "Integrated Forest Ecosystem Management", agroforestry is not specifically addressed. The project "Conservation of Globally Important Biodiversity and Associated Land and Forest Resources of Western Tian Shan Forest Mountain Ecosystems to Support Sustainable Livelihoods" largely focuses on the protection of the snow leopard. Restoring juniper forests will create migration routes and improved habitat. A large part of the funding for this project is directed to strengthen protected areas and to establish two new national parks, which are primarily located above the treeline. Many of the projects address forest landscape restoration needs in the walnut and wild fruit forest areas, but none explicitly targets spruce or riparian forests. Plantations of fast-growing trees and agroforestry systems would both contribute to meeting fuelwood and timber demand, thus reducing the pressure on native forests.

The State Agency for Environmental Protection and Forestry and FAO began drafting a proposal for a Green Climate Fund project with an inaugural meeting having taken place in Bishkek in March, 201721.

[21] http://www.fao.org/europe/news/detail-news/en/c/854275/

6.6 Tajikistan

Forest cover: 2.9%
Forest area: 412,000 ha
Restoration needs: Juniper forests, pistachio forests, riparian forests in the mountains and saxaul
Restoration potential (preliminary estimate): Mining sites, saxaul and pistachio forests
Country target for afforestation/forest restoration: plant new forests on 15,000 ha by 2030 and rehabilitate 30,000 ha of forests by 2030. Support natural forest regeneration on 120,000 ha by 2030.

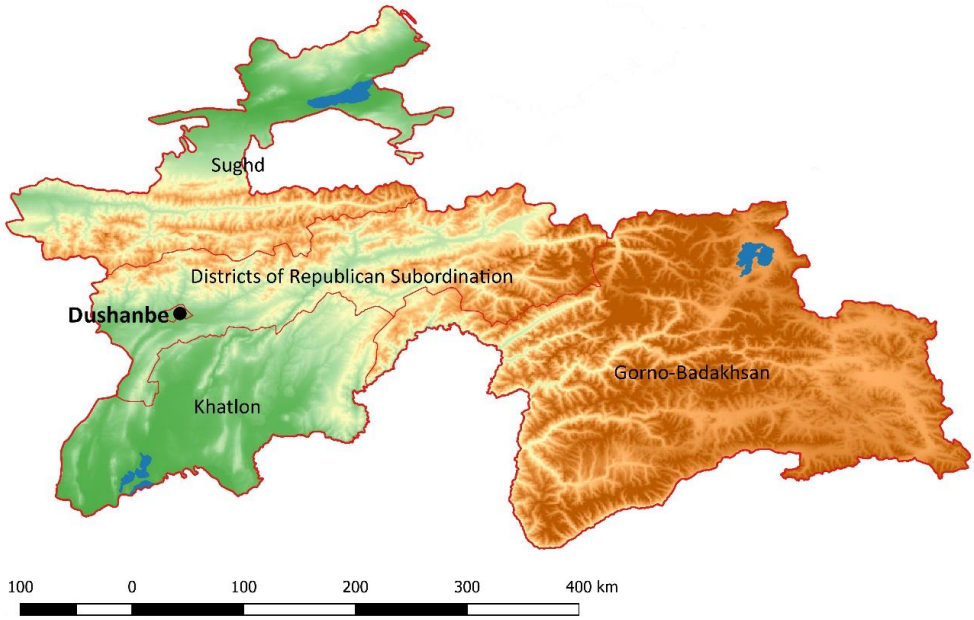


FIGURE 8: Map of Tajikistan

Tajikistan has little forest cover, with forests occupying 412,000 ha (2.9 per cent of the land area). This figure is significantly higher than a turn-of-the-century USAID report that recorded forest cover at 215,000 ha (USAID, 2001c). Most of Tajikistan's forests are situated in the northern mountainous regions, between 800 m - 2,500 m but there are also tugai forests in the Amu Darya watershed in Khatlon province (figure 8).

The six major forest types are: conifer, juniper, walnut, wild fruit forests, pistachio, tugai forests and saxaul. Forests of Picea schrenkiana occur at 1,700 m - 3,200 m. In addition, there are 90,000 ha of juniper forests in this elevation zone. As in Kyrgyzstan, small relict areas of wild walnut and fruit forests can be found in Tajikistan. Wild fruit, nut trees (including pistachio, almonds) and maples are the second largest forest type and cover 42,000 ha in the dry foothills of the mountains (USAID, 2001c). Most tugai forests are concentrated in the Tigrovaia Balka Nature Reserve at the lower reaches of the rivers Vaksh and Pianj and are a mixture of Populus euphratica, Tamarix and Russian olive (Elaeagnus angustifolia). Other riparian forests occur in narrow strips along rivers in the mountains and consist of poplar, birch, elm, and sea buckthorn. In the south, saxaul woodland is the dominant forest type (about 8,000 ha).

Forest cover in Tajikistan was 16 - 18 per cent about 100 years ago but most of this was cleared for agriculture and mining (USAID, 2001c). The pressure on remaining forests increased during the Soviet period. During the 1970s and 1980s, about 400,000 m³ of wood (350,000 m³ timber and 50,000 m³ fuelwood) were imported annually from the Soviet Union (UNECE, 2015). After the collapse of the Soviet Union, imports fell drastically.

Following the severe economic crisis and civil strife in the 1990s, most of Tajikistan's population lived in poverty with most people spending more than half their income on food (TAJSTAT, 2016). With coal and other non-wood fuel

difficult to obtain, 60 per cent of the rural population relied on wood for heating. Imports alone could not meet the demand, so people resorted to collecting fuelwood from domestic forests and woodlands. This unregulated cutting led to widespread forest degradation (USAID, 2001c). In spite of increasing coal production (from 178,300 t in 2009 to 878,100 t in 2014), the demand for energy still outstrips supply (TAJSTAT, 2015). The pace of forest degradation increased after 2000, due to further uncontrolled tree cutting (UNDP, 2014). Increasing livestock numbers have led to overgrazing, preventing forest regeneration, which continues to be a major cause of forest landscape degradation. This is a particularly critical in the woodlands of the Pamir mountains because of the harsh growing conditions.

Tugai forests, which had once made up 4.9 per cent of the country's forests, had shrunk to only 0.6 per cent by end of the 1990s. Tugai forests were cleared for agriculture, which in turn resulted in reduced river runoff inhibiting regeneration and causing further degradation (USAID, 2001c).

Juniper, pistachio, riparian forests in the mountains and saxaul forests all need intensive forest landscape restoration. Juniper forests require less active restoration, with protection from firewood gathering and heavy grazing pressure sufficing to allow recovery. Planting saxaul will help prevent erosion and desertification. The establishment of a nursery for pistachio in the Dangara Leshoz would provide opportunities to generate income. There is considerable potential for forest restoration on abandoned mining sites and saxaul areas, where limited competition from other land use would create a good environment for forest landscape restoration.

The State Forestry Agency (the country's forest authority) developed the State Forestry Program (2006-2015), to promote forest restoration and increased carbon sequestration. This initiative was complemented by GIZ with the project "Restoration and Sustainable Management of Alluvial Forests in Gorno-Badakhshan Region", which was implemented between 2009 and 2011, and focused on implementing a joint forest management approach (BMUB, 2018).

The National Strategy and Action Plan on Conservation of Biodiversity 2020, aims to expand the area of high-value forests by 1,000 ha by 2020 with the engagement of households and to restore 5 per cent of degraded lands by 2017 (Republic of Tajikistan, 2014). There were no data at time of publication about the area of land that had been successfully restored.

The State Forestry Agency has developed a strategy for forests, for implementation over the period 2015-2030, which has been adopted by all relevant ministries and state agencies, except the Ministry of Finance, meaning that the funding is not yet in place. The National Development Strategy 2030 addresses energy issues and aims to provide a reliable energy supply. Planting 1,000 ha, rehabilitating 2,000 ha and supporting natural forest regeneration on 8,000 ha of forests annually is envisaged.

6.6.1 Ongoing projects

The following forest landscape restoration projects are ongoing:

Title	Type, timescale, implementing agency	Targets	Source
Conservation and Sustainable Use of Pamir Alay and Tian Shan Ecosystems for Snow Leopard Protection and Sustainable Community Livelihoods	GEF approved in 2015 implemented by UNDP, executed by National Biodiversity and Biosafety Centre.	Restoration of 6,000 ha of forests in the Zaravshan, Ramm and Turkestan mountain ridges as corridors for snow leopard migration. Avoid loss of 15,000 ha of juniper forests, which are important as snow leopard habitat, through designation as high conservation value. Revise nut and wild fruit collection schemes in 10,000 ha of forests.	https://www.thegef.org/project/conservation-and-sustainable-use-pamir-alay-and-tian-shan-ecosystems-snow-leopard-protection
Environmental Land Management and	Approved in 2013 implemented by the	Capacities will be built to reduce desertification, soil erosion and	https://www.thegef.org/project/environmental-land-

Rural Livelihoods	World Bank, executed by the Committee on Environmental Protection	deforestation in the important Tien Shan and Pamir mountain ecosystems. Provide grants to support sustainable rangeland management and slopes cultivation through orchards, woodlots, and shelterbelts).	management-and-rural-livelihoods
Adaptation to climate change through sustainable forest management	GIZ 2013-2018	Implement Joint Forest Management in 6 pilot provinces (i.e. leasing forest land to local people over long-time periods coupled with development of management plans for those forest tenants). By 2015, more than 900 contracts were signed.	https://www.giz.de/en/worldwide/29916.html
Adaptation to climate change of sustainable forestry in major watersheds	KfW approved in 2014 implemented by theState Forestry Agency.	Rehabilitate and plant forests on 6,400 ha in the provinces Khatlon and Gorno-Badakhshan, in order to provide additional income opportunities, fuelwood, timber and non-timber forest products to rural communities. Support infrastructure of the forestry administrations. Support local nurseries.	https://www.kfw-entwicklungsbank.de/ipfz/Projektdatenbank%20/Klimaanp-d-nachhalt-Waldbau-in-wichtigen-Einzugsgeb-in-T-zur-Sicherung-der-WV-u-Schutz-dlok-Bev-vor-Katastropen-29594.htm#
Sustainable forest management	Caritas Switzerland 2015-2018 Implemented by State Forestry Agency	Afforestation of 4,000 ha forest in Khatlon province, to improve livelihoods and biodiversity.	https://www.caritas.ch/de/was-wir-tun/engagement-weltweit/klimaschutz-und-katastrophenpraevention/tadschikistan-durch-nachhaltige-landnutzung-naturkatastrophen-vorbeugen.html

Other projects that can have influence on forest restoration in Tajikistan include a project by the Norwegian Forestry Group via the project "Rural Development by Means of Vocational Training within the Forestry and Environmental Sector in Tajikistan" - Phase 2 from 2011 to 201422 . In addition, Tajikistan joined the group of countries under the Pilot Program for Climate Resilience (PPCR) in 2009 (PPCR, 2011).

[22] http://www.nfg.no/article.cfm?ID_art=128&ID_kanal=1

6.7 Turkmenistan

Forest cover: 8.5%
Forest area: 4.1 million ha
Restoration needs: saxaul wood land and forests
Restoration potential (preliminary estimate): saxaul wooded lands (potentially 18.3 million ha if all areas where saxaul occurred naturally were restored)
Country target for afforestation/forest restoration: plant 4 million trees as shelterbelts around cities and field plots by 2020

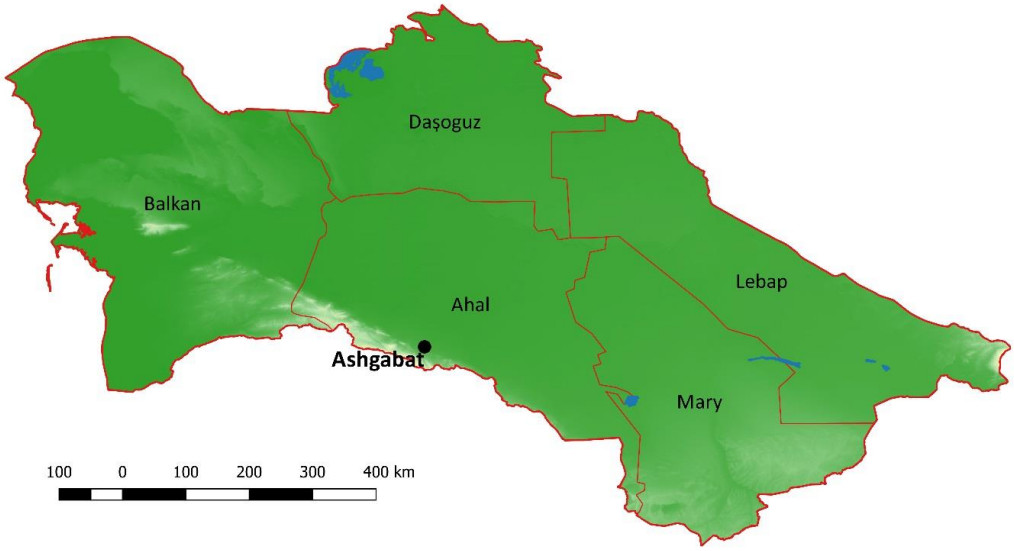


FIGURE 9: Map of Turkmenistan

Turkmenistan is largely desert, accounting for about 80 per cent of its land area (USAID, 2001d). The deserts are mainly sandy with psammophytic vegetation. White saxaul (Haloxylon persicum) is the most important woody species, forming woodlands and accounting for the majority of the Country's forests in the desert areas. In the mountains along the Iranian border are broadleaf forests dominated by Turkmen maple (Acer tucomanicum) lying at altitudes between 800 m and 2,500 m. Juniper forests (Juniperus turkomanica) occur from 1,300 m - 2,000 m on steep slopes. Mountain riparian forests form narrow strips along rivers at elevations between 1,000 m and 1,500 m. The dominant tree species are walnut (Juglans regia), ash (Fraxinus syriaca) and elm (Ulmus carpinifolia). Tugai forests with Populus euphratica, P. pruinosa and Tamarix are found along the Amu Darya River in Daşoguz and Lebap (figure 9). Almost all of Turkmenistan's forested landscapes, regardless of type, show visible signs of degradation (USAID, 2001 d).

Most forests exist today as small remnants areas of what were more extensive forested landscapes. There are now only 7,000 ha of tugai forest and 42,020 ha of juniper forest remaining. Of the former saxaul forest and woodland, less than one-third remains today. Since the start of the 20th century, Turkmenistan has lost about 18.3 million ha of saxaul forests, representing 82 per cent of the former natural distribution of saxaul vegetation[23] (Thevs et al., 2013). There is an overwhelming case for restoration of the remaining saxaul forest reserve to combat further degradation and desertification and to protect the biodiversity of these cold winter deserts (FINC, 2017).

The principal causes of forest degradation remain the same as in other countries: uncontrolled logging, fuelwood removal and the conversion of forest to agricultural land.

[23] The term saxaul vegetation used here comprises more than saxaul forests by the national definition.

The GEF project, "Strengthening the management effectiveness of the protected areas system of Turkmenistan", 2009-2014, was intended to strengthen the whole system of protected areas and to establish new protected areas in mountainous regions. Improved data collection and capacities were realized, however, much of the work started under this project still remains (Williams, 2014).

The National Forest Program 2013-2020 (State Committee of Turkmenistan for Environmental Protection and Land Resources, 2018), prioritises restoration and afforestation of saxaul forests to halt erosion of deserts and to protect settlements. This includes the afforestation of the area around Lake Altyn Asyr (Balkan province) and the planting of 4 million trees within new shelterbelts, by 2020.

6.7.1 Ongoing projects

The following forest landscape restoration are ongoing:

Title	Type, timescale, implementing agency	Targets	Source
Central Asian Desert Initiative (CADI)	IKI (International Climate Initiative of Ministry of Environment of Germany) 2016-2019 State Committee of Turkmenistan for Environmental Protection and Land Resources, National Institute of Deserts, Flora and Fauna.	To strengthen and expand protected areas in the winter cold deserts of Central Asia, protecting saxaul woodland among other desert ecosystems. Specifically, for Turkmenistan, it suggests expanding the Repetek Biosphere Reserve.	http://cadi.uni-greifswald.de/en/home/
Ecosystem-based land use and preservation of ecosystems in the lower section of the Amu Darya	GIZ, funded by ICI (International Climate Initiative) 2018-2020 National Institute of Deserts, Flora and Fauna.	To strengthen capacities to develop and implement ecosystem-based adaption strategies for riparian ecosystems and adjacent land use systems along the Amu Darya.	https://www.international-climate-initiative.com/en/nc/details/project/ecosystembased-land-use-and-preservation-of-ecosystems-in-the-lower-section-of-the-amu-darya-17_II_106-3001/?cookieName=search_results&source=single

6.8 Uzbekistan

Forest cover: 7.2%
Forest area: 3.2 million ha
Restoration needs: Tugai forests, followed by saxaul woodland and forest, particularly on the dry bed of the Aral Sea
Restoration potential (preliminary estimate): Saxaul woodland and forest (up to 9.7 million ha, if all of the land where saxaul once occurred naturally were restored) and mountain forests, in particular pistachio
Country target for afforestation/forest restoration: 42,000 ha annually until 2021

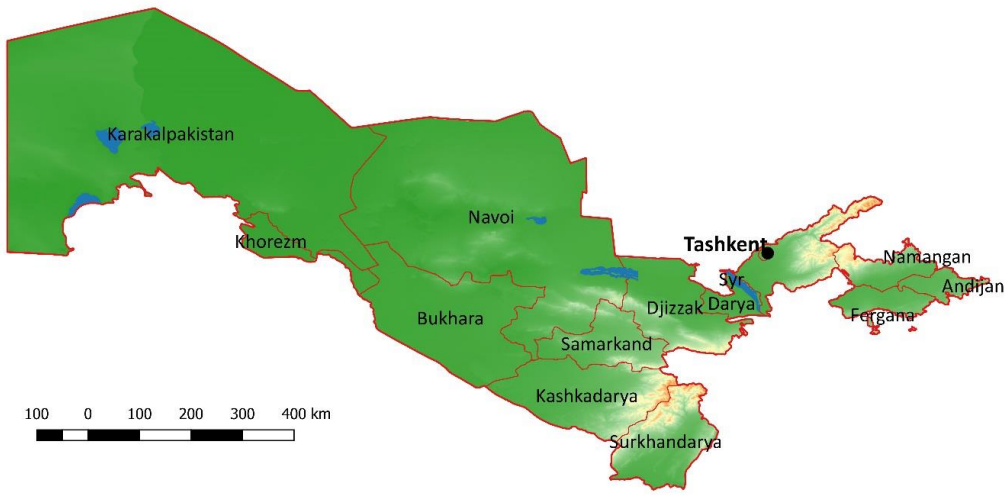


FIGURE 10: Map of Uzbekistan

Like Turkmenistan, Uzbekistan (figure 10) is largely desert, accounting for 85 per cent of the land area (USAID, 2001e). Of the desert area, 27 per cent are sandy and have psammophytic vegetation some of which meet the FAO criteria as forest, with white saxaul (Haloxylon persicum) the most important woody species. A paper presented at a UNECE/FAO workshop in Tashkent in August 2017 reported a forest area of more than 3.5 million ha, comprising 12 per cent juniper-dominated mountain forests, 7 per cent valley/plains forests (mainly broadleaf) with the remaining 81 per cent of forests located in deserts (Zakhadullaev, 2017).

The State Forest Fund manages 11.4 million ha of land (Zakhadullaev, 2017), of which 3.9 million ha are classified as forest land, though only 2.8 million ha of this land meets the criteria to be classed as forest (FAO, 2015c). In addition to the area under the State Forest Fund, there are, considerable areas of forest that they do not manage, located either on agricultural land or in protected areas. The data for those forests are estimates and this may explain the difference between the FRA2015 data and other data sources for forest cover (Zakhadullaev, 2017).

The Committee for Forests within the Ministry of Agriculture and Water Resources is in charge of forests in Uzbekistan24. Forests in protected areas are administered by the State Committee on Nature Protection.

There are four forest types in Uzbekistan:

1. Forests of the desert zone, dominated by white saxaul, with some Tamarix;
2. Broadleaf forests in the mountains which are distributed in a mosaic pattern with grassland and at altitudes between 800 m - 2,800 m. These contain mainly walnut, pistachio and other wild fruit tree species. The largest area of broadleaf forests is located in the western Tian Shan mountains;

[24] http://agro.uz/ru

3. Juniper forests are the main forest type in the mountains with Juniperus turkestanica, J. semiglobosa and J. seravshanica. Their main distribution is in the Pamir-Alai-Mountains at altitudes between 2,000 m - 3,000 m, intersected by dry grasslands (Festuca steppes) (USAID, 2001e);
4. Tugai forests are distributed as azonal vegetation in patches along the major rivers. They consist of poplars (Populus euphratica, P. pruinosa), willow species, Tamarix species and black saxaul (Haloxylon aphyllum).

The forest area of Uzbekistan is made up of 2,533,200 ha of forests in deserts (mainly saxaul), 298,400 ha of mountain forests (all types), and 93,600 ha of tugai forests (FAO, 2015c).

During Soviet times and after independence, the major threats facing woodland and forests were clearance and conversion to agriculture, and grazing pressure from increasing numbers of livestock (Botman, 2009). Conversion to agriculture mainly affected tugai forests, as the most attractive areas for agriculture are next to rivers. Increasing livestock numbers affected all forest types, but especially desert and mountain forests. Conversion to agriculture is no longer a major issue for forests but grazing and demand for timber and fuelwood are still increasing, causing forest degradation.

More than 90 per cent of the tugai forests that were present in the first half of the 20th century have been lost because of land clearance for agriculture, uncontrolled fuelwood removal and logging and reduced river flows (USAID, 2001e).

Of the former saxaul vegetation, 9.7 million ha (81%) have been lost (Thevs et al., 2013)25. Windbreaks in irrigated agricultural areas, mainly consisting of poplars, have decreased from 40,000 ha to less than 20,000 ha since the late 1990s (FAO, 2015c).

Uzbekistan's demand for timber, building material and fuelwood, is currently estimated at 10 million m³ annually. Sanitary cuttings of roughly 25,000 m³ per year meet only 0.1 per cent of the annual fuelwood demand. As rural communities lack access to alternative fuels like natural gas, and energy-efficient stoves, forests are under increasing pressure to supply fuelwood. The demand for timber for construction is only partly met by imports, adding further pressure on forest resources. The rate of degradation has increased during the past ten years, particularly in broadleaf and juniper forests in the mountains, which are not actively protected and managed, the result of grazing pressure (UNDP 2016b).

The National Biodiversity Strategy and Action Plan from 2012 set a target to reduce the rate of degradation and fragmentation of the most vulnerable natural ecosystems, i.e. tugai and saxaul forests, by 2025 (UNDP, 2015b). There is also a need to halt degradation of mountain forests, and to establish large-scale nut and fruit plantations which would enlarge the area of forest and create job opportunities. Woodlots and plantations need to be established around rural communities to meet the demand for fuelwood. Pistachio forests offer good restoration potential due to their income opportunities and perhaps help to stabilise dry sloping land (Michael Succow Foundation, 2014). Saxaul offers good restoration potential as there is little competition with other land uses.

In May 2017, a forestry programme was adopted for 2017-2021 (Presidential Decree, 2966). The programme foresees planting 42,000 ha of forests annually including 18,000 ha of saxaul. In addition, the programme contains measures to encourage natural regeneration of 10,000 ha of saxaul.

A National Biodiversity Strategy and Action Plan 2018-2027 has been drawn up and is awaiting formal adoption. In 2018, the Uzbek Government and the World Bank agreed on a loan of up to $150 million, dedicated to programmes in the forestry sector.

6.8.1 Ongoing projects

The following forest landscape restoration projects are ongoing:

Title	Type, timescale, implementing agency	Targets	Source
Sustainable Natural	GEF	Strengthen protected areas in mountains	https://www.thegef.org/

[25] The term saxaul vegetation used here comprises more the saxaul forests by the national definition.

Resource Use and Forest Management in Key Mountainous Areas Important for Globally Significant Biodiversity	2016-2021 implemented by UNDP, executed by State Committee on Nature Protection.	through improved zoning, equipment, and capacity development. Improve mountain forests that are important as snow leopard habitat. Implement community-based forest management on 16,000 ha forest, accompanied by: establishing nurseries for commercial nut, fruit, and fast growing trees, create woodlots and plantations for fuelwood, support shifting to other energy sources (e.g. gas, coal, and connection to the electricity grid), and increase energy efficiency.	project/sustainable-natural-resource-use-and-forest-management-key-mountainous-areas-important
Sustainable Management of Forests in Mountain and Valley Areas	GEF approved in 2016, proposed start in 2018 implemented by FAO, executed by the State Forest Committee.	Improve data situation and information management. Protect forests from illegal cutting and uncontrolled grazing, support natural regrowth and plant forests in Ugam Chatkal National Park. Convert low productive farmland into pistachio forest. Improve management of tugai forests and windbreaks in Ferghana valley. Develop a NAMA for the forestry sector. Amend legislation and develop a forestry program. Bring 121,750 ha of forest under improved forest management.	https://www.thegef.org/project/sustainable-management-forests-mountain-and-valley-areas,
Central Asian Desert Initiative (CADI)	IKI (International Climate Initiative of Ministry of Environment of Germany) 2016-2019 FAO office Uzbekistan, State Committee on Forestry.	To strengthen and expand protected areas in winter cold deserts of Central Asia and thereby protect saxaul woodlands with other desert ecosystems. To expand protected areas of the Ustyurt Plateau.	http://cadi.uni-greifswald.de/en/home/
Ecosystem-based land use and preservation of ecosystems in the lower section of the Amu Darya	GIZ ICI (International Climat Initiative) January 2018-June 2020 Ministry of Nature Protection	To strengthen capacities for developing and implement ecosystem-based adaption strategies for riparian ecosystems and adjacent land along the Amu Darya.	https://www.international-climate-initiative.com/en/nc/details/project/ecosystembased-land-use-and-preservation-of-ecosystems-in-the-lower-section-of-the-amu-darya-17_II_106-3001/?cookieName=sea

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