

# Environmental Impact of Deforestation and Land Degradation in Tajikistan

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## ABSTRACT

The deforestation and land degradation have huge impact on the environment of Tajikistan. The impact of land degradation on the rural environment especially the poor section of the population of Tajikistan has been very high. In the environmental aspect it has found out that, there is huge impact of deforestation and land degradation in the environment of Tajikistan. Due to this the landslides are increasing, glaciers are melting with the fast pace and fertility of soil is decreasing in the country. Sown area has been decreased by 13 percent from 1990 to 2015. The arable land has decreased by 0.88 percent (of the total land area). Fallow land in the country has increased by 10700 hectares in the last 25 years. Other impact of deforestation and land degradation is the increase in the desertification in the country and the loss of biodiversity. The number of different species has decreased due to deforestation and habitat loss. Bukhara deer, Markhor, Pigeon and other birds and animals are facing the challenge to survive in the country.

## 1. Introduction

The mountainous territory of Tajikistan is a highly disaster-prone and environmentally fragile country of Central Asia. The threat of earthquakes, floods, landslides, droughts, soil erosion, and desertification, loss of biodiversity and climate change are the main environmental problems of the country. The main disaster threats that occur naturally or have an anthropogenic character, to which Tajikistan is prone, include: mudslides, floods, rock falls, avalanches, earthquakes, droughts, outbreak of disease, industrial disasters and the subsequent pollution of environment. The damage in Tajikistan is mainly caused by mudslides. The country has about 102 mudslide-prone rivers. The regions with the highest mudslide activity include the Zarafshon river basin where about 150 mudslides a year occurs, as well as the Vakhsh and Panj river basins with about 70 mudslides on the average. The highest mudslide activity occurs in the month of April (35% of all mudslides) and in May (28% of all mudslides). Manmade mudslides occur due to outbursts and heavy runoffs of water from canals, reservoirs and water-storage basins. The accidental break of the Sargazon water-storage basin with a capacity of 2.5 million cubic meters in 1987 is considered as good example. Lake Sarez with the capacity of 17 cubic kilometers and 3,260 meters above sea level is also a potential threat, affecting an area of 55,000 square kilometers in Tajikistan, Afghanistan, Turkmenistan and Uzbekistan. Tajikistan is one of the highly land-deprived countries in Central Asia. Only about 32.2 percent territory of Tajikistan consists of agricultural lands, out of which 80.8 percent are seasonal pastures and just 16 percent is cropland. The land which is suitable for farming practices comprises 8 percent of the country's territory. The farming land area in the country has increased by 1,697 hectares between the year of 1990 and 2002, but the cropland area has decreased by 9 percent during the same period. Due to the expansion of infrastructure and construction activities in rural and urban areas both between 1991 and 2002, the built-up area has increased by 38 percent in cities and 124 percent in rural areas in Tajikistan.

Land degradation may cause several off-site impacts such as flood damage due to increasing surface runoff, increase in health bill because of the worsening quality of water and decrease in electricity production due to the sedimentation in hydropower dams. It is very gigantic and difficult work to estimate the off-site cost of land degradation, however some qualitative, quantitative and monetary value information related to natural disasters in Tajikistan is available. Tajikistan faces more than 3,000 disasters every year. Landslides of 4 to 6 class affect about 36 percent of Tajikistan's total land area and about 11 percent of population gets affected. Landslides made more 2,000 fatalities in 1980s and 1990s in Tajikistan<sup>i</sup>. The regional drought of 2000-2001 was estimate to have cost Tajikistan about 5 percent of the GDP<sup>ii</sup>. The potential economic loss in expected future natural disasters is estimated at more than 70 percent of GDP for Tajikistan<sup>iii</sup>. This estimate includes catastrophic events that are expected to occur on average once in every century. Much of this potential economic loss of GDP is due to landslides, mudslides, floods and the rest is from earthquakes. Tajikistan is very much prone to landslides, according to one estimated there were 153 landslides from 1997 to 2005. The soft loess soil that coger most of the hill slope zones are exposed to gully erosion and mud slides after the heavy rains, as experienced in Khuroson district in May 2009 resulting in the heavy loss of over 300 homes. Degraded pasturelands contribute to landslides, flooding and other natural disasters but there are no studies attributing the pasture degradation plays direct role in these events. It is not possible to quantify the damage therefore the contribution of pasture degradation is considered off-site costs. It is very much clear that on-going rampant land degradation will serve to intensify the magnitude of near future natural and man-made disasters<sup>iv</sup>.

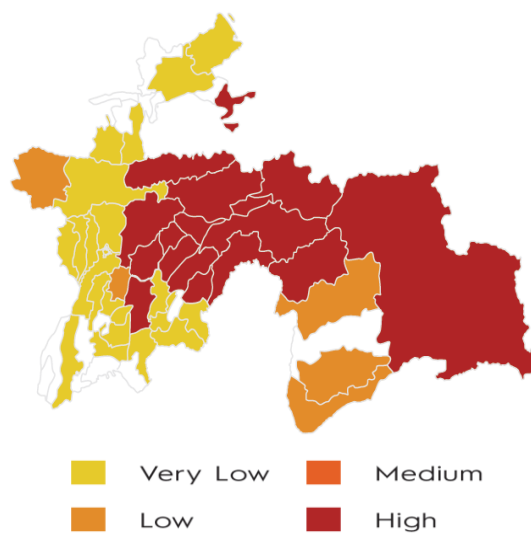
## 2. Landslides

Landslides are one of the most important consequences of deforestation and land degradation in Tajikistan. Landslides are common in the hilly and mountainous areas, triggered by increasing steepness of slopes due to seismic events, geological processes, meteorological and hydrological

anomalies, land degradation as well as a variety of anthropogenic processes like overgrazing, land deforestation, construction work, mining etc. Most of the landslides occur in the foothills and mountainous areas around 1000 to 2400 meters above mean sea level on slopes 19 degrees or steeper which is depending upon soil type and texture. Landslide can be hundreds of meters in width and about 20 meters thick. Debris of slides often remains compact after falling from the mountain, with an area about four and four hundred hectares. The number of landslides in Tajikistan has grown in the past few decades, owing to ongoing geodynamic movements, deforestation, increase in torrential rainfall, rising water table, mining and excavation. Increasing groundwater table infiltration from irrigation also contributes to landslide formation. All these circumstances break the slope stability in mountain and foothill zones<sup>v</sup>. Unplanned and haphazard settlement in hill slopes has increased exposure to them. Hydro-meteorological anomalies and weathering play an important role in the beginning of landslide formation. According to the available projections of climate change in Tajikistan, landslides will become more widespread and frequent owing to the increasing prevalence of extreme rainfall events and more rapid melting of glaciers<sup>vi</sup>.

Landslides are the major natural hazards that pose serious threat to Tajikistan. To date more than 50,000 landslide sites have been mapped in the country of which about 1,200 threaten human settlements, roads, irrigation and other infrastructure facilities<sup>vii</sup>. About 36 percent of total area of the country is exposed to landslides, with about 11 percent of the total population living in these hazardous areas<sup>viii</sup>. Landslides are usually caused by heavy rains and floods, and sometimes by earthquakes. Landslides take place in the mountainous and hilly areas of the country, and everywhere where there is a slope with more than 10 degree and deforested and degraded land. Landslides often occur during farming season on mountainous and hilly slopes, when river banks and water storage basins are washed off due to the inappropriate construction of hydro-technical facilities and roads, as well as due to gullying. Landslides damages fertile mountainous slopes and turn them into waste areas where nothing can grow for long.

Mudflows are one of the major consequences of land degradation and heavy rainfall. Mudflows are one of the results of land degradation being observed frequently in the foothills and mountainous areas of Tajikistan. About 85 percent of Tajikistan's area is threatened due to mudflow and about 32 percent of the area is situated in the high mudflow risk zones in the country. Some of the major mudflows that occurred in Tajikistan were: Garm district, village Yaldamich in 1969 and 1998, Pendzhikent, Tavidara, Nurek in 1998. A cursory look at Figure 4.1 reveals that roughly two-third are of Tajikistan in northern and eastern regions is prone to high intensity of mudflows whereas the western Tajikistan experiences very low intensity mudflows.



Source: Thinkhazard.org  
**Fig: 1.** Landslides in Tajikistan

### 3. Decline in Soil Fertility

Decline in soil fertility is one of the main effects of deforestation and land degradation in Tajikistan. Tajikistan has arid and semi-arid natural environmental conditions. Out of a total of total 4 million hectares of agricultural land, about 27 percent is arid and 32 percent is semi-arid. In these regions, the ratio of evaporation to precipitation varies in between 8 to 24 percent. Due to this, irrigation of agricultural lands is very crucial for economically beneficial crop yield. Low amount of water consumption for irrigation is one of the big problems. Lack of physical and technical resources, destruction of the distribution systems and destruction of the irrigation systems and infrastructure has resulted in soil degradation due to salinization and water-logging. Another consequence of declining soil fertility is a decreasing production and productivity of crop per unit area that has reached to 50 to 60 percent poor crop quality. The energy needed for pumping water has increased compared with previous decades in Tajikistan. Nowadays Tajikistan has more than 116,000 hectares of saline soil and above 30,000 hectares of waterlogged land area. The irrigation water and drainage waters in higher elevation areas of valleys have raised the groundwater level in the low-lying areas of valley, reaching very close 1-2 meter to soil surface.<sup>ix</sup> It is estimated that about 97 percent of agricultural land in Tajikistan faces some degree of soil erosion. Land degradation caused from soil erosion due to overgrazing of pasturelands is estimated to affect about 3 million hectares, or 85 percent of pasturelands in the country<sup>x</sup>.

Only about 5 percent land area of Tajikistan is classified as arable land. Bad economic consequences of transition from command economy to market economy after the independence are clear in irrigated and dry farming areas which involve directly about 70 percent of the country's population. The serious problem related to the economic activity has arisen in the fall of soil fertility and ecological problems. After the independence of Tajikistan in 1991 about 6.14 percent of land area was arable land but due to indiscriminate use of forest and land resource it continuously decreased to 5.26 percent in 2015 (see Table 4.1).

The percentage of sown area to the total land area of Tajikistan is showing a declining trend since independence of the country in 1991 (see Table 4.1.). Due to soil salinization and water logging in the agricultural fields, the soil has become infertile, so farmers do not use it for the farming purposes. In 1990 as much as 28 percent of the total arable land was classified as area sown in the country but it has decreased to 12 percent in the year 2000 and slightly increased in 2005 and 2010. Since 2010 to 2015 sown area has remained constant at 15 percent in Tajikistan. Land degradation has increased during the 1990 to 2015 and sown area has decreased, so there is negative relation between sown area and land degradation in Tajikistan. Fallow land in Tajikistan has increased after the independence of the country in 1991. Due

to overutilization of land resource and overuse of chemical fertilizers to increase the agricultural productivity, the soils of Tajikistan are increasingly becoming infertile, as a result which the farmers must leave the land fallow for some years without cultivation to restore its fertility. In 1990s as high as 19,300 hectares of agricultural land was left fallow by the farmers. The fallow land after independence is constantly increasing and has reached 30,000 hectares in 2010. In 2015 about 30,000 hectares of the arable land was left fallow to improve its fertility. There is a positive correlation between land degradation and fallow land in Tajikistan. Arable land in Tajikistan has constantly decreased after the independence of the country in 1991. In the last 25 years 0.88 percent of the arable land of the country due to abandonment as fallow land.

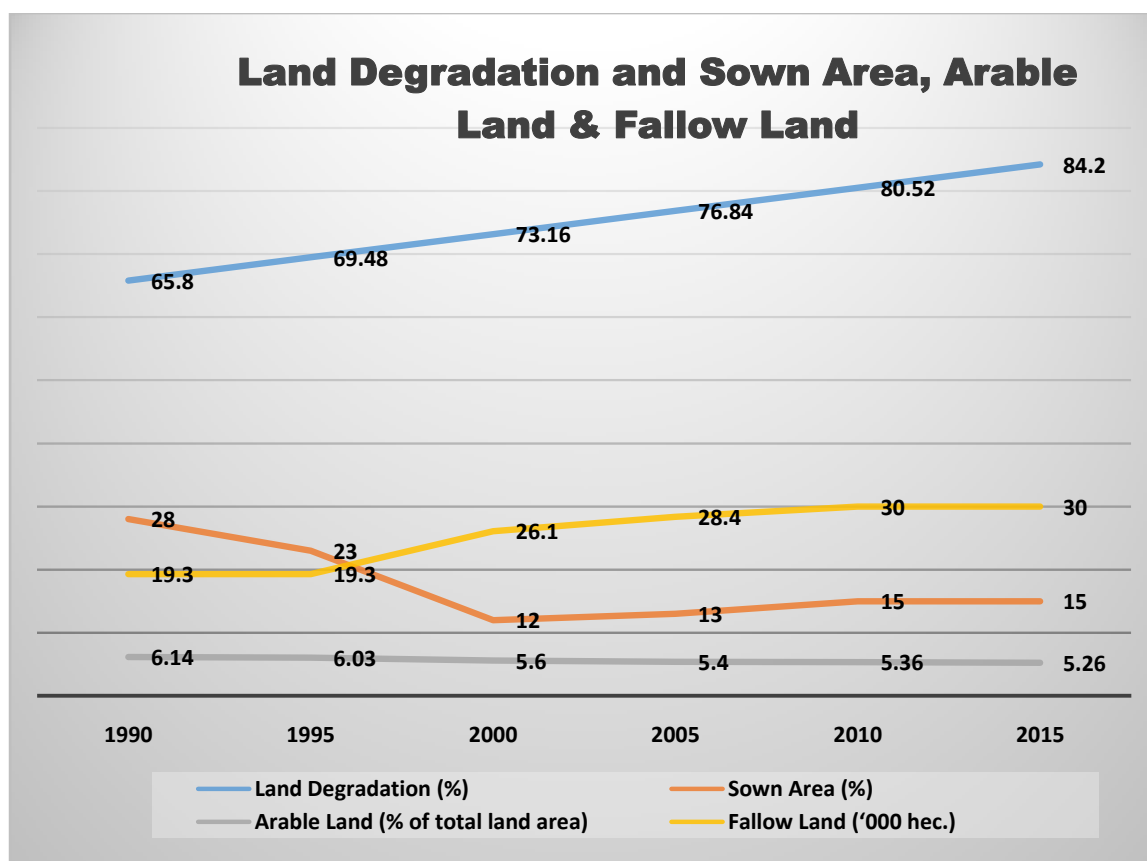
**Table: 1.** Land Degradation and Sown Area, Arable Land and Fallow Land (1990-2015)

Year	Land Degradation (%)	Sown Area (%)	Arable Land (% of total land area)	Fallow Land ('000 hectares)
1990	65.80	28	6.14	19.3
1995	69.48	23	6.03	19.3
2000	73.16	12	5.60	26.1*
2005	76.84	13	5.40	28.4**
2010	80.52	15	5.36	30.0
2015	84.20	15	5.26	30.0

Source: FAO, 2013, WB & World Data Atlas, 2016

\*data of 1998

\*\*calculated based on 1998



Source: FAO, 2013, WB & World Data Atlas, 2016

**Fig. 2.**

#### 4. Desertification

Desertification is one of the major impacts of deforestation and land degradation in Tajikistan. Desertification is defined as land degradation in arid, semi-arid and sub-humid areas due to various factors, like climatic variations and human activities.

If land degradation occurs in the world's dry-lands, it often creates desert-like situation. Land degradation occurs in most of the regions but it is defined as desertification when it occurs in the dry lands<sup>xi</sup>.

About 32 percent of the total land area of Tajikistan is being used for agriculture now. Valleys of Tajikistan are located in the arid areas, where annual precipitation does not exceed more than 250 millimeters per year and evaporation reaches about 1,500 millimeters per year. In absence of rainfall irrigation in such areas plays a leading role. The total land area suitable for agriculture in Tajikistan is about 5.21 million hectares, which is about 36 percent of the total land area of the country. Mountains, cliffs and slide-rocks occupy about half of the territory, the rest is glaciers, riverbeds, pebbles, gravels and low productive pastures. Most of the area of Tajikistan is prone to the impact of climatic effect, which is the important contributor to the land degradation. Such processes like, wind erosion, water erosion, freezing and thawing, diurnal temperature variation, intensive rainfall etc promote land degradation and desertification in the country. Human interventions such as tree and shrub cutting, uncontrolled cattle grazing in addition to climate change has negative effects on the natural resources of Tajikistan as these interventions encourage the land degradation and desertification. Gully erosion and landslides are increasing due to reclamation of slopes in the mountainous regions. Washout of fertile topsoil due to heavy rainfall has taken place in about 100,000 hectares of land in the country. About 90 percent agricultural land is prone to various type of erosion in Tajikistan. Wind and water erosion is widespread in the mountainous regions which covers about 41 percent of the territory. In desert areas deflation is observed and it covers about 24 percent of the territory, gully erosion covers 1.5 percent of the territory and it takes place mostly in irrigated and agricultural lands. Due to erosion the fertile topsoil get destructed and biological productivity of soil falls. On the areas where soil erosion is light the productivity falls by 10 to 20 percent, where wash off is average the productivity falls by 30 to 40 percent and in the areas where soil erosion is very high the productivity fall by half or more. In the dry regions the productivity of cereals in the eroded lands falls to one third. The loss of productivity affect the economy of the country while cumulative damage of soil erosion significantly exceeds the harvest loss. About 70,000 hectares of land are annually reseeded due to unfavorable weather conditions. The intensive desertification is observed in newly irrigated lands of the country. The example of this may be Yavan valley, where 42,000 hectares are eroded out of 48,000 hectares; the gully area makes up 4,500 hectares<sup>xii</sup>. In 2010 about, 17 percent of land area in Tajikistan had become desert out of which 3.44 percent is sandy desert<sup>xiii</sup>. Increasing deforestation and land degradation is due to over exploitation of agricultural fields and pasturelands, converting them into deserts.

Thus, it can be concluded that Tajikistan faces severe problem of land degradation such as erosion, salinization, swamping, and deforestation. These problems are from both due to climate change and anthropogenic factors. Desertification has become one of the serious problems of the country. Long dry periods and less rainfall together with high temperatures in spring and summer seasons, lead to the intensification of desertification processes in Southern and Central Tajikistan. Due to climate change caused by increase in temperature and evaporation, water demand in agriculture sector for irrigation of essential agricultural crops are likely to

increase by 20 to 30 percent compared to present climate conditions.

## 5. Loss of Biodiversity

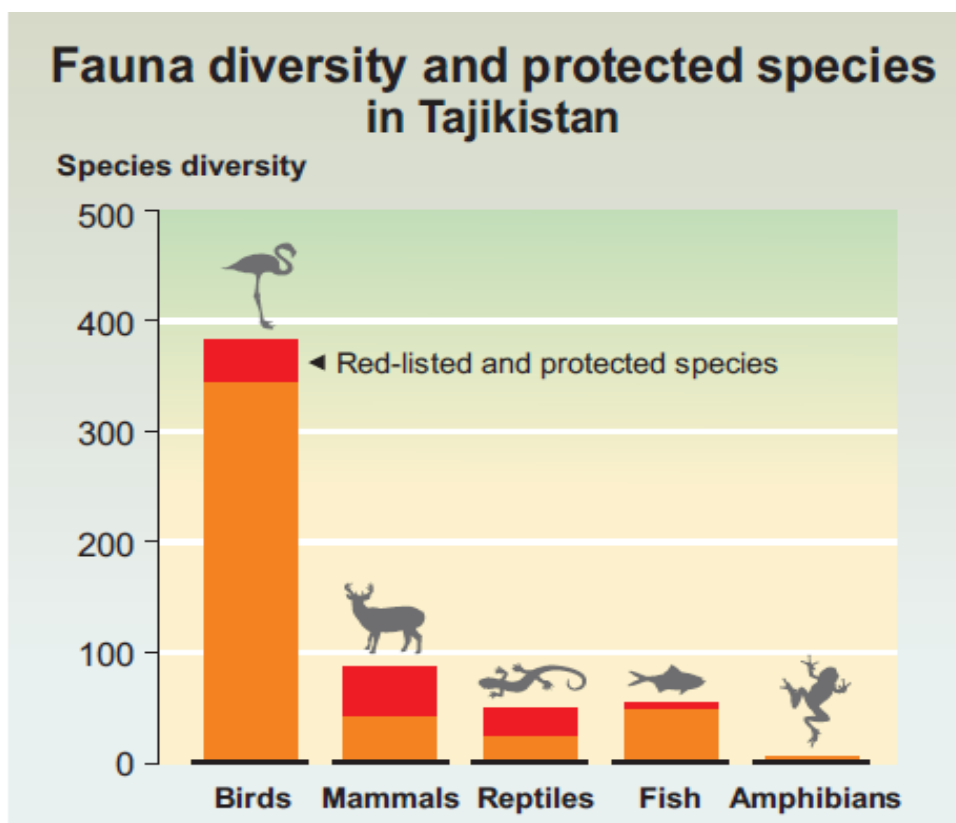
Loss of Biodiversity is one of the consequences of deforestation and land degradation in Tajikistan. The cutting of shrubs, trees and brushwood constitute a leading threat to biodiversity. Overgrazing, poaching and human intrusion into wildlife is a severe attack on Tajikistan's natural resources. Tajikistan has unique natural and recreational resource, beautiful virgin ecosystem and rich biodiversity. However, lack of environmental protection, poverty and exploitation of natural resources has negative impact in the environment. Habitation of wildlife are being damaged and reduced to patches across the country because of human intrusion, which was common in the pre independence period. The problem of extraction of medicinal plants and shrubs, hunting, illegal fishing and berry picking are all over the place. The rampant exploitation of natural resources are not only threatening the ecosystem of Tajikistan but also endangers the potential of ecotourism, which brings revenue and employment to the large number of people.

Tajikistan published its Red Data Book in 1988 listing 226 flora and 162 fauna species (see Figure: 4.3). The most vulnerable fauna of in the country are mammals- 50% and reptiles- 44.7%. In Tajikistan out of the total 84 species of mammals, 2 are extinct, 12 are endangered and 28 are considered as rare, declining or undetermined. Among the mammals listed in the Red Data Book are the Bukhara red deer, the markhor, the Persian gazelle, the Siberian mountain goat. The Turan tiger is extinct from the wild. Several birds are also in the endangered category and are listed in the Red Data Book, for example several species of plovers, waders, birds of prey, pheasants, cranes, pigeons and swifts. Sixteen different types of plants are extinct. The number of total species in the Red Data Book is 388, seems very moderate, seeing that nearly half of the species of the mid-mountain forest ecosystems are considered to be endangered because of its reduced habitat. More than 60 species of wild medicinal plants which grows in forests are used in Tajikistan. In Tajikistan government and non-government agencies are trying to raise awareness to protect the threatened flora and fauna in the country and to use the biological resources sustainably<sup>xiv</sup>.

Illegal cutting of trees, harvesting of fuel wood and the trade of timber threaten biodiversity in the region and lead to habitat degradation. Harvesting of fuel wood and extraction of shrubs has increased nearly three times in some areas compared to even a few years ago as a result of energy shortages and the economic crisis in the country. Fuel wood cutting and consumption lead to forest degradation and the disappearance of certain species living in the forest and this contribute to global warming. Rural populations which have lack of fossil fuel are largely dependent on fuel wood for heating and cooking especially in winter. Overgrazing and uncontrolled livestock grazing threaten the subalpine, alpine and steppe ecosystems. A large portion of the pasturelands in Tajikistan are subject to soil erosion. The number of sheep grazing on the winter and summer ranges and steppes and semi-deserts has tripled over the past two decades.<sup>xv</sup> Intensive

grazing, deforestation and land degradation has resulted in reduced species diversity and habitat degradation. Many animals and plants are losing the number of species for example; Bukhara Deer had total 335 species in 1991 and reduced to only 44 in 2012. A look at Table 4.2 will reveals that many other animals and plants are losing their diversity in Tajikistan. Dappler Deer, Markhor, Chukar, Badger and Pigeon are the other examples which are losing the number of species in Tajikistan. The reducing number is directly related to reducing forest and degradation of land. Figure 4.4 reveals that as the land is degrading in Tajikistan the number of species is

reducing. Secondary plant community occupies about 80 percent of rangeland in sub-alpine belt. The alpine belt in Tajikistan is slightly better preserved. Grazing of cattle in forest disturbs the growth plants and trees and creates competition for wild ungulates. The consequence of overgrazing is the environmental damage over large parts of Tajikistan. Erosion from pastures, farmlands and forest are increasing turbidity in rivers and wetlands which impact breeding in birds and fish population. Pesticides and fertilizers are killing large number of animals and birds and it make their way up to the food chain to humans<sup>xvi</sup>.



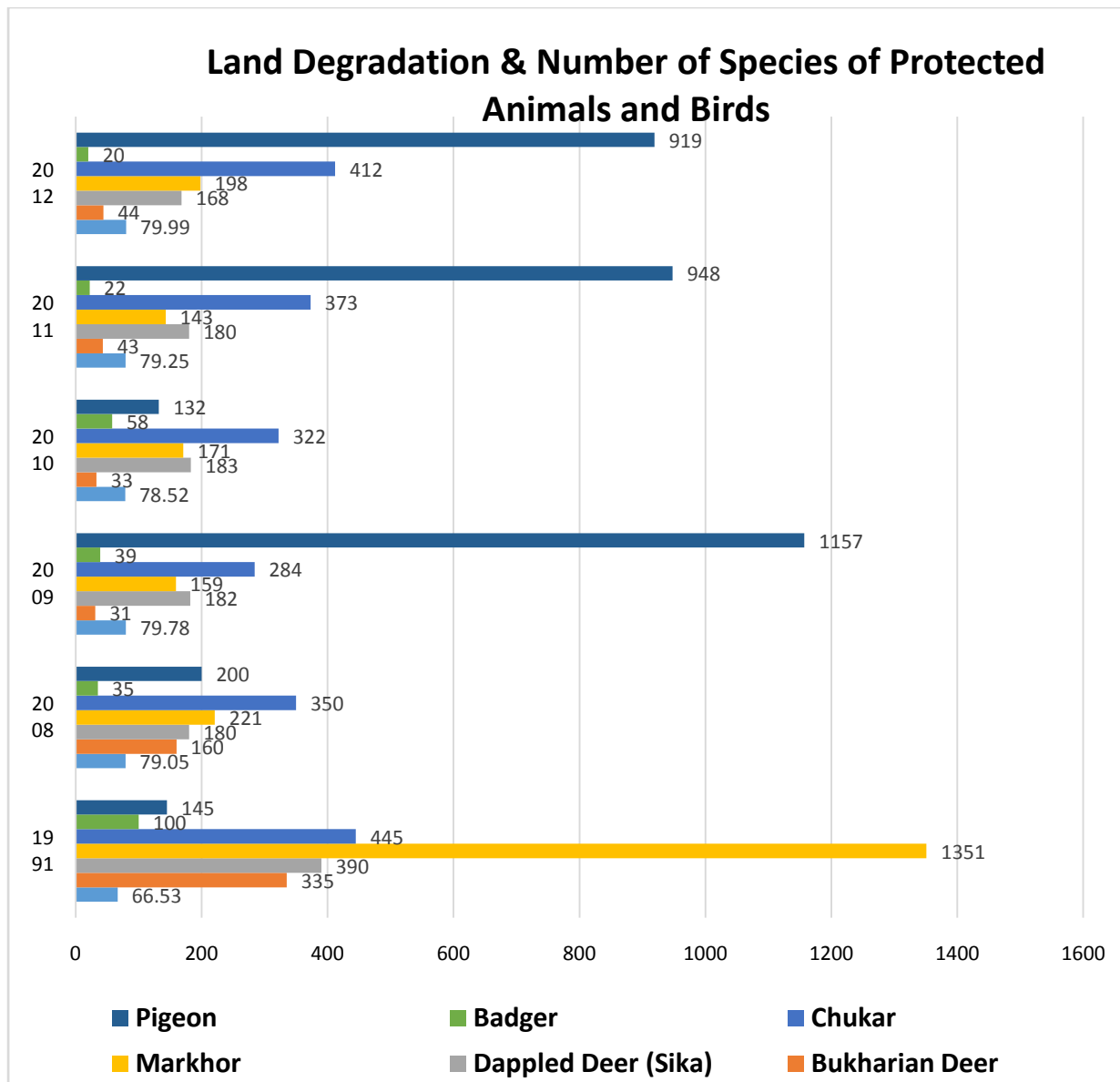
Sources: Tajikistan Fifth National Report for the Convention on Biodiversity (2015),

Fig-3

Table 2. Land Degradation and Number of Species of Protected Animals and Birds in Tajikistan (1991-2012)

Year	Land Degradation (%)	Bukharian Deer	Dappled Deer (Sika)	Markhor	Chukar	Badger	Pigeon
1991	66.53	335	390	1351	445	100	1450
2008	79.05	160	180	221	350	35	2000
2009	79.78	31	182	159	284	39	1157
2010	78.52	33	183	171	322	58	1320
2011	79.25	43	180	143	373	22	948
2012	79.99	44	168	198	412	20	919

Source: Fifth National Report on Biological Diversity, 2015



Source: Fifth National Report on Biological Diversity, 2015

Fig. 4.

## 6. Conclusion

In this paper the environmental impact of deforestation and land degradation has been analyzed. The deforestation and land degradation have huge impact on the environment, economy and society of the country. The impact of land degradation on the rural environment, society and economy especially the poor section of the population of Tajikistan has been very high. In the environmental aspect it has found out that, there is huge impact of deforestation and land degradation in the environment of Tajikistan. Due to this the landslides are increasing, glaciers are melting with the fast pace and fertility

of soil is decreasing in the country. Sown area has been decreased by 13 percent from 1990 to 2015. The arable land has decreased by 0.88 percent (of the total land area). Fallow land in the country has increased by 10700 hectares in the last 25 years. Other impact of deforestation and land degradation is the increase in the desertification in the country and the loss of biodiversity. The number of different species has decreased due to deforestation and habitat loss. Bukhara deer, Markhor, Pigeon and other birds and animals are facing the challenge to survive in the country.

## References

1. Shigaeva, J., Wolfgramm, B., and Dear, C. (2013); *Sustainable Land Management in Kyrgyzstan and Tajikistan: A Research Review*.
2. World Bank (2006); *Equity and Development: World Development Report*, New York
3. Shigaeva, J., Wolfgramm, B., & Dear, C. (2013), *Sustainable Land Management in Kyrgyzstan and Tajikistan: A Research Review*.
4. UNDP-UNEP Poverty Environment Initiative (2012); *The Economics of Land Degradation for the Agriculture Sector in Tajikistan*.

5. Thurman, M. (2011); *Natural Disaster Risks in Central Asia: A Synthesis*, Bureau for Crisis Prevention and Recovery–UNDP (BCPR-UNDP), p.47.
  6. R.A. Niyazov (2002); *Climate Influence on the Initial Formation of Landslide Processes in Uzbekistan*
  7. *Millennium Development Goals: Tajikistan Progress Report*, (2010)
  8. UNDP(2011); *Guidelines on Regional Disaster Risk Assessment for the Territory of Tajikistan*
  9. Khaidar Djumankulov et. al. (2001); “Soil and Water Resources in the Agricultural Sector of TajTajik TaTajikistan”.
  10. Asian Development Bank Annual Report, (2004); Singapore
  11. [http://www.droughtmanagement.info/literature/UNCCD\\_desertification\\_visual\\_synthesis\\_2012.pdf](http://www.droughtmanagement.info/literature/UNCCD_desertification_visual_synthesis_2012.pdf)
  12. Nekushoeva, G., and Akhmadovb, H. M.(2013); “Desertification and Sustainable Agricultural Development of Tajikistan”.
  13. Asian Develop Bank (2010); *Central Asian Atlas of Natural Resources*, Manila, Philippines
  14. United Nations (2004); *Environmental Performance Review: Tajikistan*, Dushanbe
  15. Squires, V. R., & Safarov, N. (2013); “High-Altitude Ecosystems and Biodiversity of Tajikistan: Conservation and Management”, *High-Altitude Rangelands and their Interfaces in the Hindu Kush Himalayas*, 78.
  16. R Squires, V., & Safarov, N. (2013); “Diversity of Plants and Animals in Mountain Ecosystems in Tajikistan”. *Journal of Rangeland Science*, 4(1), 43-61
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