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GIANT DEFORESTATION LEADS TO DRASTIC ECO-ENVIRONMENTAL DEVASTATING EFFECTS SINCE 2000; A CASE STUDY OF PAKISTAN

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ABSTRACT

This article draws attention to the problem of deforestation and systematically identifying its root causes, by incorporating the point of view of all stakeholders, forestry sector experts and policy makers from the Federal, provincial and local level. It provides a brief overview of the perspectives of different stakeholders in the forests and the degradation of forests in the country. The main causes of deforestation are growing demographic pressure, poor management of natural forests, rural and urban communities' household dependency on fuelwood, unscientific pastures beyond capacity, forest fires and storms, the lack of financial inputs and the lack of participation of stakeholders in the policy process. Due to poor governance and inappropriate policies, the forests decline since 2000 has led to negative impacts on the environment. Among the other devastating effects soil erosion and flooding are the main after effects of deforestation in the country. The analysis shows that irrespective of their interests, the participation of all stakeholders in the process of policy making should go a long way to arrest a sharp forest decline in Pakistan.

Key words: causes of deforestation, diverse stakeholders' perspectives, giant deforestation, Pakistan forestry.

INTRODUCTION

Deforestation is the intentional or natural clearance of forests on a massive scale, often resulting in damage to the quality of the land and adverse environmental effects. Forests still cover about 30% of the world's land area, but sweeps at average 75,625 km^2area lose every year (Costa *et al*., 2007; Shakoor *et al*., 2011). If the current rate of deforestation continues the world's rain forests could completely vanish in a hundred years (Laurance *et al*., 1999).

Asia covers one-quarter of earth's land area, but holds almost 60% of the world's population. Tremendous population pressures throughout the region have contributed to the region's substantial forest loss (Angelsen *et al*., 1999; Laurance *et al*., 1999; Ali *et al*., 2005). According to the latest FAO report the average annual forest loss was 9.6 million acres (3.9 million hectares, (Mha)) in tropical Asia from 1990-2005 (1.15% annually). The deforestation rate (1.1%) is slightly lower since 2005 as a result of declining forest cover and increasingly ecological interest of people and governments. Additionally, many Asian-countries have entered a period of sustained spectacular economic growth in the past few years, resulting in the increased consumption of forest resources (Brooks *et al*., 1999; Houghton *et al*., 1999; Kohlin *et al*., 2001; Annamalai *et al*., 2013; Shyamsundar *et al*., 2014; Giri *et al*., 2015; Indarto *et al*., 2015).

Forest cover in Pakistan is less than 5% of the total land area (Government of Pakistan, 2007) and is said to be rapidly declining, especially in the mountainous regions (The World Conservation Union (IUCN), 2002) (Government of Pakistan, 1991, 2003). The total forest area is 39,804 km^2 which is being decreased at an average annual loss of 270 km^2 that accounts for a 4-6% decline in its wood biomass per annum. The rate of deforestation is estimated to be 1.5% which is highly alarming. The deforestation rate in the country is about to be the second highest in the world (IUCN 2002) (Government of Pakistan, 1991). The World Conservation Union (IUCN) has estimated that with the current population growth with no alternative fuel-wood, wood consumption in Pakistan would increase by 3% every year (Ahmed *et al*., 2015). Hence, according to IUCN, if the present rate of deforestation continues, Pakistan's forests may die out within the next 10-to-15 years.

In order to eradicate the fundamental causes of deforestation, forest policies of many countries as well as the international lending institutes play vital role in turn to develop more appropriate and adequate policy on forestry for rural development and poverty alleviation. Hence, forestry is considered an instrument of policy rather than an object of the policy. Therefore, the current trend in shaping forest policies has the potential to maintain a balance among the four pillars of sustainable development and environmental protection. Pakistan is also attempting to adopt this trend with the financial assistance of some international development agencies like FAO and IUCN *etc*. Thus forest evaluation in Pakistan makes an interesting case study to assess the role of environmental policies in fostering sustainable development and environment.

The foremost objective of the article is to raise awareness against the contemporary deforestation in Pakistan and their adverse environmental effects. We will analyze the causing factors of deforestation for the 15 years period, from 2000 to 2015. The destruction of forests is occurring due to various reasons, one of the main reasons being the short-term economic benefits. The cutting down of trees for furniture, building materials, and paper products have a major impact on forest life. Other most common causes are: commercial purposes, agriculture, grazing land, used for fuel, and illegal logging ((FAO), 1998). Mainly the commercially exploitation is clearing forests for mining and oil exploitation, making roads and highways, wildfires, acid rain, and slash and burn farming techniques. Growing population increases the demand for foods and other agricultural products, therefore forests are cut down to clear land for growing crops, build farms, other food growing lands and ranches for grazing. People, especially those who live in rural areas where gas and electricity are unavailable, resort to use of firewood as a source of household heating and cooking. The giant deforestation is caused by the illegal loggings where trees are cut down indiscriminately, to fulfill the wood market demands.

Deforestation is directly affecting the soil quality, water cycle, and habitats loss (Treydte *et al*., 2006). Other indirect effects of deforestation are the environmental changes, flooding, cultural displacement, and agricultural and financial losses. In this article we have suggested some possible solutions for the contemporary deforestation. The last but not the least, to suggest possible solutions to the government agencies specially the Forestry Ministry and Environment, provincial forest departments, the local government, and rural development department, by bringing into their notice concerns of the timber traders, purchasers and forest owners' rights to policy makers of the country.

MATERIALS AND METHODS

Area of Study: Pakistan is a country located in South Asia that covers an area of 796,100 km^2 whose map is shown in Figure 1 (Government of Pakistan, 2003). Pakistan is edged between India, with whom it shares a 2,192 km borderline to the east, and Iran and Afghanistan, with whom it has 909 km and 2,430 km, respectively, of common border. In the south, it borders the Arabian Sea, with a coastline of 1,046 km and stretches north to the great Karakoram and Hindukush mountain ranges, with peaks as high as the K2 (8,611 meters) and the Nanga Parbat (8,126 meters). It also shares a 523 km border with China in the north.

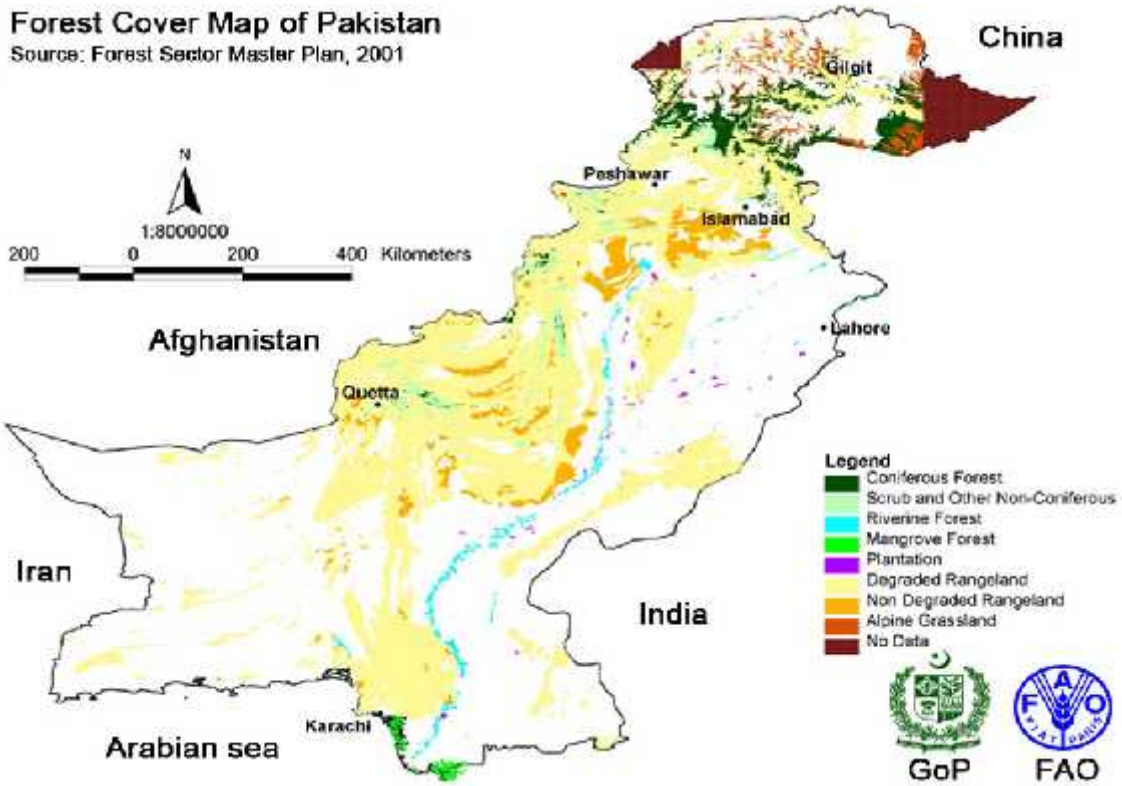

Figure 1. The agricultural and land distribution map of Pakistan

In 2005, forests occupy 4.6 Mha (46000 Km^2) which is 5.778% of the total land area of Pakistan (Forestry Department 2010; Government of Pakistan, 2010).These forests are inclusive of the hill coniferous (43% of the total forests), scrub and/or foot hill forests (37.2%), irrigated plantations (0.294%), riverain and/or mangroves (0.813%) in the delta Indus River, and other miscellaneous plantations (18.693%).The chart, in Figure 2, presents that most of the forested area comes under the northern part of the country such as KPK (24.6%), Gilgit-Baltistan (21.1%), and AJ&K (8.8%). The forest cover in Sindh, Punjab and Baluchistan is 13.8%, 12.5%, 20.1%, respectively, (UNDP Human Development Report, 2011).

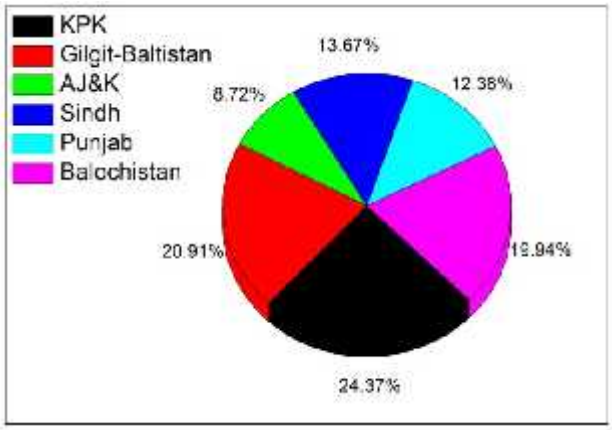

Figure 2. The forest distribution in different provinces of Pakistan in 2000

Data Sources; a) UNDP country reports, b) FAO assessment reports, c) Federal and provincial forest departments, d) Ministry of Environment (GoP), e) The Ministry of Agriculture (Ministry of National Food Security & Research), f) Pakistan Bureau of Statistics, g) Government of Pakistan federal flood commission Ministry of Water & Power, and h) Ministry of Environment (Pakistan Environmental Protection Agency, GoP).

RESULTS AND DISCUSSION

Critical Analysis on Forest Policies; This section will shortly analyze the forest policies of Pakistan. Pakistan's forests are very diverse in nature and of significant importance for the livelihood security of millions of rural people who live in and around these forests (J. F. M. Ahmed *et al.*, 1998). Forest policies, managements, institutions and processes form the context within which households and individuals construct and adapt livelihood strategies, on the other hand these institutionally shaped livelihood strategies may have an impact on the sustainability of natural resource use.

After independence, the first forest policy of Pakistan was issued in 1955 by Central Board of Forestry followed by the forest policies in 1962, 1975, 1980, 1988, 1991, 2005 and the latest in 2010, including provincial policies (Shahbaz*et al*., 2006). Most of these forest policies were associated with the instability of governments. There is immense need to develop a sustainable, research-based, workable, and people-friendly forest policy enable to catering to the changing needs of stakeholders including government. It is found that, most of the policy initiatives aimed at forest conservation but ignored the livelihood provisions for local communities. However, unfortunately those policies were never implemented effectively even for the conservation aspect. People's participation in forest management and plantation was not given sufficient attention and therefore ignored social and cultural aspects of forest management.

The previous forest policies were associated somehow with the change of the governments to meet the government's political objectives. However the policies after 1991, 2005 and 2010, are claimed to be participatory, but the civil society organizations blamed these to be benefit driven policies, ignoring the ground level realities and needs of the local population. The two most recent policies provide the concepts such as active participation of stakeholders, sustainable forest management, sustainable livelihoods *etc*. But this policy continued negative aspects such as encouraging the police like behavior of the forest department. However, the dilemma with most of the forest policies in Pakistan in the recent past has been the absence of attention to human dimension aspects and a focus on "environment and forest protection" approach even at the cost of local livelihoods. Part of the problem stemmed from the culture discrepancy and lack of awareness that prevailed in the country.

Unfortunately, Pakistan, like other developing countries, lacks good governance. Although during the new policies formulation, the consultation with a group of experts has become a common practice, yet the consultation process remains confined to the particular professionals' circle. Thus, the policies become stronger on technical consideration but lacking the required flexibility to make them work in practical situations, presenting multiple sets of problems. Resultantly, the stakeholders often find themselves in a situation where state policies either do not support or have destructive effects on their livelihood. Therefore, these policies do not meet the expectations of the people who in turn are forced to utilize the forest resources to secure their livelihoods. Consequently neither the developmental nor the conservational objectives are met.

Annual Change in Forest Cover; According to Food and Agriculture Organization (FAO) report on the Forest

Resources Assessment, between 1990 and 2000, Pakistan lost an average of 41,100 hectares of its natural forests per year (Forestry Department 2010). The average annual deforestation rate was 1.63%. Between 2000 and 2005 the rate of forest change increased by 24.4% to 2.02% per annum. This increase in the rate of forest change continued to 2.26% per annum between 2005 and 2010 with the total forests loss of 215,000 hectares. Until January 2015, the highest deforestation rate is found to be 2.54% per annum at an average annual deforestation of 42,800 hectares is summarized in Table 1. In the last two decades Pakistan has lost 8.852% (1995 to 2005) and 22.55% (2005 to 2015) of its forest cover which is 205,000 and 429,000 hectares, respectively (K. Ahmed *et al*., 2015; Zubair *et al*., 2011).

Table1.Forest cover and the annual rate of deforestation

	1995-2000	2000-2005	2005-2010	2010-2015
Total Forest Area in the base year (Ha)	2321000	2116000	1902000	1687000
Annual Forests Loss (Ha)	41100	42800	43000	42800
Annual Rate of Deforestation (%)	1.63	2.02	2.26	2.54

Data sources: Government of Pakistan and FAO 2010 (Anonymous, 2015; Nations, 2010)

The total area of forests in Pakistan according to the Table 2, is 4.265 million hectares which is 5.36% of the total land area also shown in Figure 3. However, it may be mentioned here that the other wooded land (including rangeland) and linear plantations along roadsides, canal sides and railway sides covering an estimated area of 1794,000 ha and 998,000 ha respectively do not constitute forests within the context of legal, ecological or management/silvicultural definition of forests. If the area of these three categories of plantations is excluded from total forest area of 4.265 Mha, then the latter is reduced to 1.473 Mha which is approximately 1.85% of the total land area.

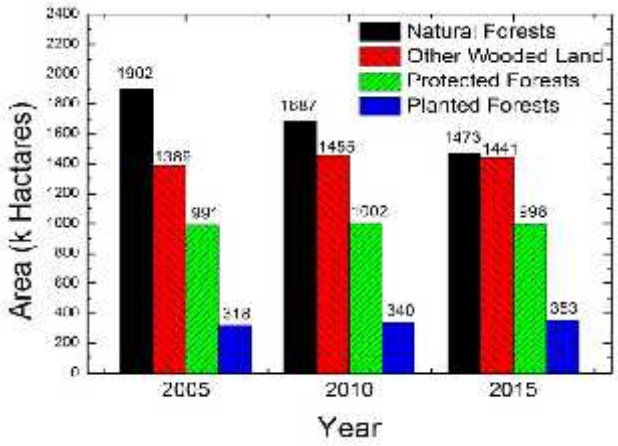

Figure 3. Forest share by type since 2000

Measuring the total rate of habitat conversion (defined as change in forest area plus change in other wooded land) for the 2005-2015 intervals, Pakistan lost 11.5% of its forest and woodland habitat. This rate of deforestation is reasonably alarming and there is actually a need of time to do something to protect these forests otherwise they will be totally diminished in next few decades.

Table 2. Forest cover classification in the last 10 years.

Year/Forest cover	2005	2010	2015
Forest Area (ha)	1902000	1687000	1473000
Other wooded land (including rangeland) (ha)	1389000	1455000	1441000
Plantations (ha)	318000	340000	353000
Protected forests (ha)	991000	1002000	998000
Total forests area (Mha)	4.600	4.484	4.265

Data sources: Derived from GoP(Anonymous, 2015)

Compared to the data provided by the Forest and Agriculture Departments, the data of Soil Survey Department is shown in the Figure 4, which depicts that variation is in almost all the land use categories. This warrants a serious re-classification of the present land use status.

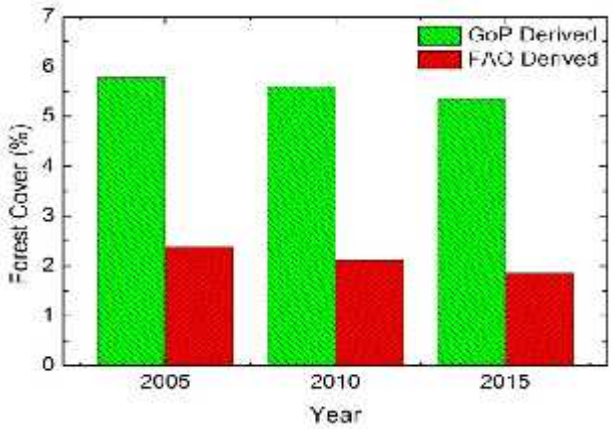

Figure 4. Comparison between the forest cover statistics provided by the Government of Pakistan and Food and Agriculture Organization in the last fifteen years

Causes of Deforestation: According to the United Nations, in Pakistan (like other developing countries) subsistence agriculture is responsible for 48% of deforestation, with commercial agriculture is responsible for 32% of deforestation, and commercial logging is responsible for only 14% of deforestation, charcoal and other fuel wood removals comprise less than 6% of deforestation, however, those uses can generally be assigned to subsistence practices (Forestry Department 2010). These causes are discussed in detail as follows;

Agriculture; One of the biggest drivers of deforestation is agriculture. According to the United Nations Framework Convention on Climate Change, the predominant driver for deforestation worldwide is the clearing of trees to expand agriculture (Costa *et al.*, 2007). Often many local small farmers each year cut down trees to clear a few acres to feed their families and burning them in a process known as "slash and burn" agriculture. Others cut down forests to clear land for growing crops, ranches, build farms and other food growing lands (Nations, 2010, Yao *et al.*, 2014). Rangeland forest degradation is mainly caused by the subsistence agriculture. It can be seen in Table 2, between 2005 and 2015 the rangeland and other wooded land is decreased from 1.389 to 1.441 Mha which is 3.74%. Rangelands covers are mostly decreased due to overgrazing and receive no investment or input to maintain their productivity and potential.

The malfunctioning of the management departments is the dilemma in Pakistan. Management of range lands, if any, is confined to those in the control of forest departments, which constitute a small percentage of the rangelands in the country. Whereas the livestock is under the management of livestock departments but the two departments work in isolation (Anonymous, 2007;Amjad *et al*., 2014,).

Urban Construction; Urbanization is another drive for deforestation where forests are cleared to accommodate expanding urban areas. The cutting down of trees for lumber that is used for paper products, building materials, and furniture have a major impact on forest life. This results in massive deforestation and loss of forest area. There is a large gap in the consumption and production of wood. According to the Forestry Sector Master Plan, in 1993, the consumption of wood was 29.5 million cubic meter (Mm^3) (Aftab *et al*., 2010; Atta *et al*., 2013). At present, Pakistan is producing only 14 Mm^3 of wood which is projected to go up by 32.6 Mm^3 by 2016. By 2016, it will require 33 Mm^3 of wood in order to cater to demands of the people. The consumption of (construction, furniture, village carpentry, mining timber, and industrial fuelwood) between 2003 and 2013 is increased by 42% from 3123000 m^3 to 4434000 m^3, shown in the Table 3. This large gap in the production and consumption of wood is one of the main factors of deforestation (Anonymous, 2007, Government of Pakistan, 2003).

Commercial Purposes; There are also some commercial perspectives where clearing forests for mining and oil exploitation, to make roads and highways, wildfires, slash and burn farming techniques, and acid rain. Forest fires are occurred, sometimes naturally but in most cases deliberately by man to clear huge forest for their financial interests. In some cases, these forests may recover, but usually the cleared land is used for agriculture and construction purposes. This leads to loss of forests and resultantly loss of habitat for the local wildlife. Of 4.26 Mha (of forest area), only 1.12 Mha (26.3%) produce timber and firewood and the rest are meant to protect the erodible lands and the watershed areas.

According to Forestry Sector Master Plan of Pakistan, Consumption of wood for commercial purposes is Construction 1320 thousand m^3 which is 37% of the total wood consumption (Anonymous, 2015). The commercially used (crates and boxes, plywood, fiber-boards, particle-boards, boats, trains, trucks and buses, railway ties and matches) wood consumption is increased to 42.6% in 2003, 44.5% in 2013 and expected to be 46.6% by 2018, Table 3.

Table 3.Wood consumption for deferent purposes.

Consumption (Km^3)	**1993**			**2003**			**2013**			**2018**		
Construction+Furniture+ Village carpentry	1711	2216	62.7 %	2381	3123	57.4 %	3322	4434	55.5 %	3930	5310	53.4 %
Mining timber +Industrial fuelwood	505			742			1112			1380		
Commercial Purposes	1320	37.3%		2319	42.6%		3551	44.5%		4633	46.6%	

Data sources: Forestry Sector Master Plan of Pakistan 1992~2014 (Anonymous, 2015)

Commercial Exploitation and Poverty; Poverty and lack of scrutiny helps commercial exploitation and harvesting of forests. Contractors with the involvement of the concerned officials is not only causing deforestation on a massive scale but also exploiting small forest owners with weak financial positions. Researches carried out

show many contractors are involved in the cutting and selling of trees in consent with the timber mafia. Due to the weak financial condition of the country, government has failed to eradicate poverty in forest vicinities, and check fuelwood cutting by providing alternative means of livelihoods. Moreover, unfortunately, forest management laws and approaches are heavily slanted in favor of income generation and do not consider economic and social conditions of the communities (Khan *et al*., 1990). Therefore, the forest related departments have failed to bring them to book and rectify the situation.

It has been estimated that 70-79% of Pakistani households use fuelwood as a main source of energy. It is expected that this dependence will remain high in Pakistan in the foreseeable future, mainly because the country's fluctuating economic development which is not able to shift into the modern fuels (Government of Pakistan, 2003). The high demand for domestic fuelwood is believed to be the main cause of Pakistan's rapid deforestation. The deforestation rate in the country is about to be the second highest in the world (Anjum *et al*., 2010). The World Conservation Union (IUCN) has estimated that with the current population growth with no alternative fuelwood, wood consumption in Pakistan would increase by 3% every year.

Local poor communities consume available natural resources for their survival. For example, in the absence of the provision of the availability of renewable sources of energy, electricity and gas at affordable rates, wood is the only source of energy for the forest surrounding communities. Insecurity of tenure and uncertain property rights lead the locals to resort to actions such as cutting of trees. This evidence establishes close correlation between poverty and deforestation.

Legal and Illegal Logging; In countries like Pakistan, loggers, some of them acting illegally, also cut countless trees each year. In order to get more financial benefits, they build roads to access more and more remote forests causing further deforestation. As a must, government agencies are fighting against illegal logging to protect the forests. However, any type of logging illegal or legal leads to deforestation. In the recent policies (1991, 2005 and 2010), bans are imposed by the government on cutting trees. Nevertheless, it has not prevented the timber mafia from logging forests because of corruption, political interference, lack of serious commitment, and theft on the part of the government to bring the criminals to verdict. Resultantly, the timber traders are using all possible means to smuggle wood for their short term financial benefits.

Due to the recent policies and government attention, only 20 timber licenses were issued, covering a total forest area of 910 thousand hectares. As a result of the government's recent strict forest conservation policies, there was a significant decrease of 79% in the number of active timber licenses. To meet the market demands, government encourage the private sector to venture into industrial forest plantation and boost the timber supply, in the last decade, there were 172 Industrial Forest Plantations existed. Therefore, approximately 53% of the total timber production was attributed to Industrial Forest Plantations and Timber License Agreement holders. As a continuity of the Industrial Forest Plantations, it can be seen in the Table 2, between 2005 and 2015 the plantations has significantly increased by 11%, from 318 to 353 thousand hectares, respectively.

Natural Factors; Not all deforestation is intentional. In most cases it is caused by a combination of human and natural factors like wildfires and subsequent overgrazing, which may prevent the growth of young trees. The natural factors affecting forests are arid climate, heavy dependence on irrigation water, fragile watershed and rangeland, and long gestation periods of forestry (Eckholm *et al*., 1975, Yu *et al*., 2015). Another main reason of deforestation is that more than 70% land area of Pakistan is semi-arid and arid with annual rainfall of 250-500 mm which is too low and erratic to sustain natural vegetation and reforestation.

Environmental effects of deforestation: Deforestation has many harmful effects on the environment and also drives climate change. Without protection from sun due to the tree cover the moist soils in the forests quickly dry out. At the same time trees also help perpetuating water cycle by returning water back into the atmosphere in the form of vapors. In this way, many forest lands can quickly become barren deserts without trees to fill these roles. The removal of trees deprives the forest from shelter, which blocks the solar rays during the day and holds the heat at night. This disorder leads to more extreme temperatures which can be harmful to animals and plants.

Global warming is an issue for environmental scientists of the day and trees play critical role by absorbing greenhouse gases from the environment. Therefore deforestation cause larger amounts of greenhouse gases entering the atmosphere which increase the severity and speed up global warming. Other adverse effects of deforestation include agricultural degradation, biodiversity loss, cultural displacement and local climate change. Usually, farmers face problems in raising some crops which then result into the increased food prices. Some of harmful environmental effects are discussed in the following;

Soil Erosion; Soil erosion, as a natural process is always being accelerated by deforestation. Trees and plants offer a natural barrier to the water flow in the land by roots to anchor the soil and prevent it from washing away due to the slowdown of water flow (Treydte*et al*., 2006).

Besides, trees also function to retain water and topsoil, which provides the rich nutrients to sustain healthy forest life. When deforestation takes place, it results into the soil exposure to the sun, absorbing less water, becoming dry very quickly, loss of various nutrients, and infertile. Additionally, during the rainfall the rest of the nutrients are washed away with the rainwater into waterways. Ultimately, this land will become impossible for cultivation and the land becomes useless.

Table 4, shows the extent of the area affected by the soil erosion. There was about 13.05 Mha of area affected by water erosion in the year 2006. The rate of soil erosion is also alarming which is mainly caused by deforestation in the northern part of the country. In total there was 49.84% of the overall soil erosion, 32.89% and 16.95% in KPK province including AJK, and Gilgit-Baltistan (Portal *et al*., 2013). There is prominent water erosion on Potohar track and other surrounding steep slopes of Punjab and Baluchistan provinces where these areas are extensively used for cultivation. The highest recorded annual rate of erosion is estimated to be 150-165 tonnes/hectare. According to a report in 1990, the Indus River carried 4.49 tonnes/hectare sediment load which is the fifth largest in the world. According to some estimates, the annual suspended sediment load is about 430 million tonnes to the Tarbela Reservoir, reducing the life of the dam to somewhere around fifty years (Ali *et al*., 2005).

Table 4. Area affected by water erosion (000 ha).

Degree of erosion	Punjab	Sindh	KPK/AJK	Baluchistan	Gilgit-Baltistan
Total	1904.0	58.9	4292.2	4583.0	2212.1
Percent area	14.59%	0.44%	32.89%	35.12%	16.95%

Data sources: Government of Pakistan (Portal, 2013)

Without the adequate forestation, the soil erodes and washes away, causing farmers to give up on cultivation. If perpetuates the cycle in this way it affects indigenous people and cause culture displacement for the local communities. The barren land which is given up for cultivation in the wake of unsustainable agriculture is then more susceptible to flooding, specifically in coastal regions. Coastal vegetation decreases the impact of winds and waves associated with a storm surge. Without the sufficient vegetation, coastal villages are susceptible to floods damaging. As an example, according to FAO in 2008, cyclone in Myanmar proved this fact to catastrophic effect. Scientists believe that the removal of mangrove forests from the coastal areas over the past decade caused the cyclone to hit with much more force.

Climatic influences: Emissions of greenhouse gases like carbon dioxide (CO_2) into the atmosphere cause global warming. Trees absorb carbon dioxide from the atmosphere, which is then assisting the process of photosynthesis to produce energy and growth. As a result of deforestation many of the trees are burnt or disintegrated which results in releasing more carbon dioxide. In this way greater concentration of carbon dioxide is released in the atmosphere.

Temperature and Water Logging: The increased greenhouse emission causing global warming effects, leads to temperature rise. The increase in temperature is directly affecting the glaciers melting in the northern parts of Pakistan in summer. Therefore, increase in temperature not only creates unpleasant situation on humans' practices but also affects the perpetual rainfall cycle. It is evident from the last 15 years monsoon rainfalls, increased prominently, proportional to the increased rate of deforestation. The unusual increase in the rain occurrence directly linked to the other natural disastrous effects such as floods, water logging, agriculture, and food crises.

Rainfall and Floods: Diagnosing the right causes is perhaps the first step towards pinpointing and suggesting an appropriate framework of action. As in 2010, two thousand people are being reported dead and twenty million severely affected, have therefore invariably drawn attention from various quarters (Portal *et al*., 2013). Since 2003 till now, the floods in Pakistan continued to leave its disastrous footprint every day, the causes which contributed to these ravaging floods need to be addressed by the Government of Pakistan floods and environmental departments.

Although heavy rainfall and some hold monsoon patterns responsible for flash floods, others consider dams' sediment, climate change and deforestation as playing the trigger for the floods. Between the vying explanations, the facts available on the existing timber mafia in Pakistan are the most telling. According to the National Disaster Management Authority of Pakistan the denudation is one of the main reasons for aggravating the floods as only 5.6% of land in Pakistan is covered by forests. More than 70 percent of forests were illegally cut down between 2007 and 2009, when the security situation was in its worst condition in the militants controlled zone of KPK province, reported by the provincial government. Another report in the Guardian 2010 claims that the flooding has been intense in areas where the timber mafia is active. The felled trees stacked in ravines for the purpose of smuggling were dislodged by the force of water, thus sweeping away roads, bridges,

livestock, people and weakening the dam walls along its way. In fact, according to the reports, the timber filling is one of the major causes of sediment in Tarbela dam reservoir, thus blocking any storage space. The deficient forests are therefore leading to problems like farms inability and increased flooding. We will summarize shortly the deforestation caused, increased flooding in Pakistan. Deforestation caused climate change at the massive scale which then led flooding in different parts of the country, briefly described below and their effects and casualties;

Since the birth of Pakistan in 1947, heavy floods were recorded in the last 15 years. In 2003, above normal monsoon rainfall caused flooding in Sindh province, these floods also affected urban areas like Karachi where 284.5 millimeters (11.20 in) rainfall continued for two days created havoc in the city a summarized in the Table 5. Rainfall caused flash floods in many districts where Thatta district was the worst hit with 404 millimeters (15.9 in) of rainfall. In total around 4,476 villages in the province were affected and at least 484 people died (IRW, 2009, Portal *et al*., 2013). In 2007, again due to unusual monsoon rainfall a larger area of the country was badly affected particularly KPK province, coastal parts of Baluchistan province, and Sindh province. Khyber-Pakhtunkhwa was affected due to heavy rainfall and melting glaciers in July and August. Coastal parts of Baluchistan and Sindh were affected by Cyclone Yemyin in June and then torrential rains in July and August. At least 2,000 were internally displaced and 130 people died in KPK in July and 22 people died in August, while 815 people died in Baluchistan and Sindh due to flash floods (Government of Pakistan, 2014).

In 2010, record breaking rains hit Punjab and KPK, the overall Pakistan was affected due to the massive flooding. The number of people affected by the flooding exceeded the combined total affected by the 2010 Haiti earthquake, 2005 Kashmir earthquake and the 2004 Indian Ocean tsunami (K. Ahmed *et al*., 2015). At least 2,000 people died and almost 20 million people were displaced by it. In 2011, as a result of monsoon rainfall floods were caused in Sindh province where 5.3 million people and 1.2 million homes were affected leaving behind at least 361 casualties, as well as 1.7 million acres of arable land inundated. In the year 2012, intense monsoon rainfall battered in Southern Punjab, KPK, and Upper Sindh killed about 100 people, thousands of homes vanished, and thousands of acres of arable land affected. In August 2013 flooding also called Afghan-Pakistan floods, where more than 80 people died. Most recently, in September 2014, massive rainfall in AJK as well as Jammu & Kashmir and in Punjab resulted into flood situations in Jhelum and Chanab rivers (K. Ahmed *et al*., 2015; Anonymous, 2010, Devaraju *et al*., 2015, Silhan *et al*., 2015).

Table 5.Floods occurrence in the era from 2000 to 2015.

Year	Casualties	Internally Displaced	Land Inundated	Probable Reason
2003	484	4,476	Continued	two days of unusual rainfall
2007	967	>2,000	------	Tropical cyclone due to landfall, rainfall, and snowmelt
2010	>2000	20,0000		Heavy rainfall
2011	361	5,300,000	1.7 million acres	Unusual rainfall
2012	100	800,000	760 acres	snowmelt
2013	80	23,000	-----	Afghanistan floods
2014	78	1,800	-----	Monsoon heavy rain
2015	39	7,900	-----	Unusual rainfall

Data sources: National Disaster Management Authority of Pakistan, Environmental Department of Pakistan (Anonymous, 2010; Government of Pakistan, 2014, Groninger et al., 2012, Portal et al., 2013).

Possible solutions and recommendations: The quickest solution to deforestation would be simply monitor and stop cutting down trees. Though deforestation rates have slowed a bit in the recent 5 years, financial realities make this unlikely to occur. Due to the latest forest policies, government involvements and awareness, the change in the rate of deforestation is decreased by 79.75% in the last 5 years compared to the last 10 years. Therefore, up to some extent it is encouraging for the forests in Pakistan that the rangeland cover and other forest are going to be preserved in the near future. There is enormous need to increase the area under tree cover, not only to meet material needs of growing population but also to enhance environmental and ecological services being provided by the forests.

The more workable solution is to eliminate cutting of trees at massive scale to make sure that forests remain intact by careful management of forest resources. At the other hand artificial forestation should be planted in order to balance the uncontrolled deforestation. However, currently the new tree plantations are not enough to compensate the forest degradation. The more practical recommendations for further forest protection in Pakistan should be as follow;

Firstly, there is an immense and urgent need to develop forums of multi-stakeholders at federal, provincial and local levels to review the forest development at ground realities. In the past, forest policies have been prepared in isolation from population planning, water, the energy sectors, fisheries, wildlife, agriculture, tourism, and education. There is a need to develop correlations with other sectors for sustainable resource management and development. In some cases, foresters have poor understanding of the real issues related to forest biodiversity, forest certification, international trade of forest products, and management of forests as carbon sinks, are some of the deficiencies with the institutions.

Secondly, the lack of indicators and criteria for forests management in different ecological zones is problematic. The existing forest classification is based on the 1935 classification and description. There is a need to develop the internationally accepted ecosystem-based classification system. Strengthening of the institutional is also required to assure the monitoring and implementation and review of different forest related policies and programs. Government support in accordance with international conventions is also needed for conducting reviews to collect scattered items of forest legislation into a uniform format.

Thirdly, the subjects of international protocols, nationally important issues such as watershed rehabilitation, biodiversity conservation, and a broad monitoring system of forest flows and stocks that draws upon provincial forest resource accountability systems should continue to remain under the control of the central government. Stakeholders (NGOs and other government departments, biodiversity specialists, and local communities) are not involved in the management plans preparation process, which should be considered by forming a committee on both the provincial and federal levels. The provinces should focus on all aspects of forest management and investment, harvesting, afforestation, credit, sale, the preparation of working plans, research and training. There should be linkage up to the district and village level organizations involved in forest management. Provinces should also set up their internal forest resource accounting systems to provide miscellaneous information on forests.

Fourthly, the government needs to incorporate taxonomy in forest management. Including women in forest management decisions and forestry projects should address the gender dimensions of deforestation. In the final analysis the effective enforcement of the existing laws and regulations on forests use and management and involvement of the communities in the policy making process from the very outset enables the government to address and arrest sharp forest decline by creating a feeling of sense of ownership and empowerment among communities.

Fifthly, there is an urgent need for a permanent think tank outside the government and advocacy groups to support forest policy formulation and implementation process on a perpetual basis as reflected in the Forest Policy 2001. The government should focus on improvement of forest management practices to prevent the loss of biodiversity by reducing the practice for giving preference to certain species for their commercial value and ignoring other species. The integration of ecosystem approach into forest management can prevent further fragmentation of forest habitats.

Finally, in order to cope with the increasing demands of the paper industry government should develop a policy to maximize the recycling of paper waste. Additionally, there should be limited interval in cutting of trees which should be as long as a tree takes time to re-grow. Against the cutting of a tree planting of 10 new trees should be practically implemented.

Conclusions: The lack of attention at the government level, wealth and power due to harvesting of the riches of the forest, population growth and urbanization are some of the common causes. Other most common causes are; commercial purposes, agriculture, grazing land, used for fuel, and illegal logging. Also summarized the adverse effects of deforestation in the country including; soil erosion, disruption of water cycle, biodiversity loss, flooding and drought, climate change and global warming, increased greenhouse gases, destruction of homelands and cultural displacement, agricultural and financial losses. In this article we have suggested some possible solutions for the contemporary deforestation.

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