# Economic Analysis of Forest Management in Pakistan - A Case Study of Changa Mange and Muree Forest

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# ECONOMIC ANALYSIS OF FOREST MANAGEMENT IN PAKISTAN- A CASE STUDY OF CHANGA MANGA AND MURREE FOREST

By

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## Abstract

Increasing demand of timber along with the rising concerns towards environment create a need to analyze the management system of forests in Punjab. Both natural and planted forests are present in province of Punjab. They are different in nature and thus have different management plans. This study is conducted by taking into account major species of Changa Manga and Murree forests. *Dalbergia sissoo, Morus alba, Eucalyptus camaldulensis* (from Changa Manga), *Pinus roxburghii* and *Pinus wallichiana* (from Murree forest) are the species included in this study. Estimation of NPV (Net present value) and IRR (Internal rate of return) is made to determine the financial performance of management plan. Impact of Interest rate variability and one year delay in revenue is also calculated. The results show that NPV decreases with increase in interest rate and delay in revenue whereas the IRR remain same in both cases. *Dalbergia sissoo, Morus alba* showed most inefficient results whereas *Pinus roxburghii* and *Pinus wallichiana* gave most efficient results. Besides that the existing management plan is not efficient and there is a need of Sustainable Management Plan for forests.

## 1) Introduction

Forest is referred to the area where trees exist close together in high density. Forests are both natural and planted, utilized for different purposes. The distribution of forest varies throughout the world but they do exist in both hemispheres (south and north) of the earth.

The challenges faced by forests depend upon there area of existence. Lack of funds and proper polices, more population burden and dependence of people because of poverty, the forests of under developed and developing countries bear a lot of pressure and difficulties in management. On the other hand, in case of developed world, the environmental awareness is increasing and so the willingness to expend on mitigating environmental issues. People are living good quality life, they have facilities and luxuries to live with and so the think about environment, nature, its protection and betterment. The presence of better research centers, efficient policies and good institutional capacity improve the situation and reduce the burden from natural resources. Like all other fields of life the changes in forestry ids dependent upon global scenarios (political, economic and social) so the factors like peace or war, the income status of people, cultures and traditions etc. plays prominent role in forest condition of any region. (FAO report, 2009)

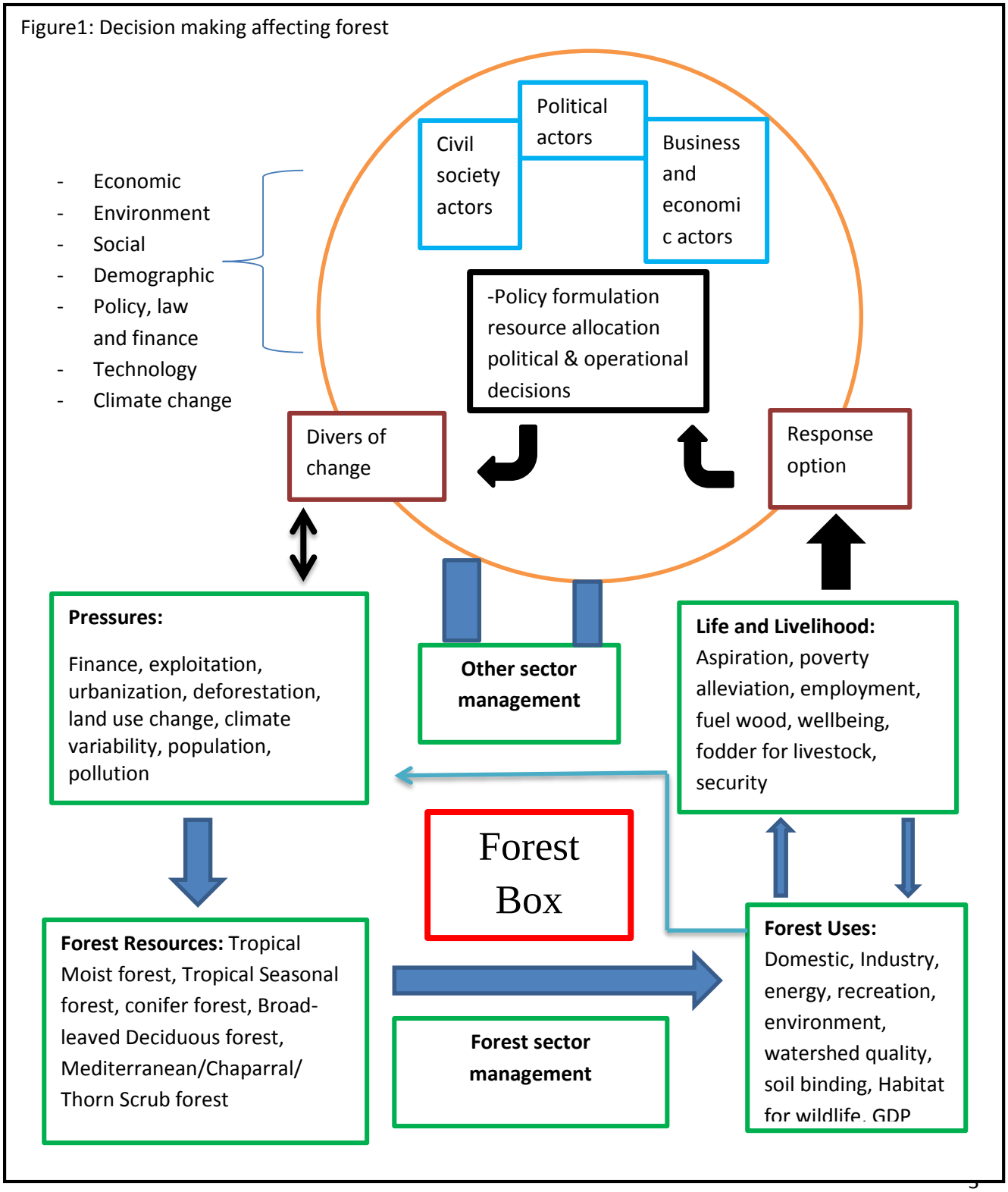
The characteristics of forests also vary with climate and with their geographic location. Tropical Moist forest, Tropical Seasonal forest, conifer forest, Broad- leaved Deciduous forest, Mediterranean/Chaparral/ Thorn Scrub are some of the type of natural forests where as Irrigated forests are type of artificially planted forest. The diversity hold by these different types of forests is of great variety depending upon the features they contain and the physical parameters they provide to living organisms. (Cunningham,2005)

### 1.1 Forest in Asia and Pacific:

According to the FRA estimation in 2010 in Asia and Pacific region the area occupied by forests is little less than one-third of total area and it is contribute round about 18% in world's forest area. Forest region in Asia faces great fluctuations from last twenty years. At one end the area declared as protected increases but on the other side primary forests faces stress. 0.7 Million hectares were the rate of forest loss per year in 1990s whereas in previous decade due to afforestation and increase in planted forest area the overall cover improves and the annual increase of 1.4 Million hectares has been observed. India, China and Viet Nam leads in forest

plantation and play major role. Dependence of people on products obtained from primary forest is very high compared to the rest of the world. (FAO report, 2011)

Figure1: Decision making affecting forest



1.2 State of Forests in Pakistan:

Pakistan is an Islamic state in South Asia, which covers an area of 796,096 $km^2$ and attains an important geographic location. The country is very diverse in terms of climatic conditions, topography and physical parameters it holds, varies from coastal zones to desert, plain area, range land, plateau and mountains. Keeping in mind the variety of physical features Pakistan contain different type of forests in it which have different biodiversity and are distinguishable from each other on the bases of their unique characteristics.

In the ecosystems of Pakistan, forests along with watershed are very important part and cover an area of 4.22 million hectares. The total forest cover in Pakistan is 4.8% of country's area which is quiet low as compared to the global standards. The semi-arid and arid climate of country is the reason of small forest cover and close act as a barrier in afforestation and rehabilitation activities. Azad Kashmir comprises the major portion of forest area that is 20.7% Khaber pakhatun khan (KPK) contains 16.6% whereas Northern areas, Balochistan, Sindh and Punjab hold 9.5%, 1.7%, 2.8% and 2.9% respectively (Government of Punjab, 2011)

In Pakistan out of total forest area some 71.8% has maintained for protection purpose while 28.2% has utilized for commercial uses. Country's timber consumption is approximately 0.0239 $m^{3,}$ to meet the demand of timber it is attained from state owned forests, imports and farm lands as three prominent sources. They contribute 14.4 %, 46.3% and 39.3% respectively.

Fuel wood provided by forests fulfills the needs of 88 million rural people of Pakistan. 50% of fuel requirement is meeting through the utilization of fuel wood. Forests are source of building materials, fodder for livestock, and fuel for heating and cooking purpose, add up the scenic beauty. They provide employment to people, recreation through wildlife and give peace of mind and body. Forests contribute both goods and services to people. (Government of Punjab, 2011)

Forest goods exported by Pakistan includes some carved wooden furniture and sports related products like hockey stick, squash and tennis rackets etc. Whereas imports consist of cork, cane, products related to paper industry etc. The cost of imports per year which is 3 million is near about 5 times that of revenue generated from imports. Due to small forest cover availability the contribution of forest in states economy is just 0.3% of GDP. (Forest department Punjab)

Pakistan is facing high rate of deforestation which has many adverse impact and according to estimation the loss bear by nation per year due to deforestation is around PRs 2.3 billion in the form of floods, soil erosion, siltation of reservoirs etc. So in Pakistan there is a need to give proper concentration to forests and take steps to expand them. (Government of Punjab, 2011)

## 1.3 Forestry in Punjab, Pakistan:

Punjab is one of the provinces of Pakistan. It is the most populous province of country and the most fertile one as well. The area of this province is 20.63 million hectares. The south of province is dry desert area but the northern part has mountainous hill so Punjab is full of topographical diversity. 65.34% (13.48 million ha) of total area of province is under cultivation whereas forestry department has control on only 0.63 million ha which is land not under use of agriculture and is managed as range land.

Within the province of Punjab different type of forests are present and have various distribution patterns. It includes Coniferous forests, Scrub forest and Rangeland, Riverine forests, Irrigated Plantations and plantation (Farmland trees, linear plantation).

In Punjab wood produced is of two types' soft wood and hard wood. The timber obtained from conifer like *Pinus excelsa* (blue pine), *Pinus roxburghii* (chir pine) and *Cedrue deodara* (deaodar) of Murree hills come under softwood category. They are produced in moist temperate forest. Whereas timber from trees of riverine forest, linear and irrigated plantation are hardwood. Trees like *Dalbergia sissoo* (Shisham), Morus alba (Mulberry), Eucalyptus etc.

The natural forests in Punjab are facing severe deforestation; rate of cutting tree is beyond the limit of sustainability and thus results in depletion of natural resources. Large amount of wood extraction is for meeting domestic needs of indigenous people. Tragedy of commons and large population size is reasons of burden on resources. Land use land cover is another prominent feature causing pressure. Increase in agriculture land and rapid urbanization pursues man to clear forest and utilize it for other economically profitable options. (Government of Punjab, 2011)

## 1.4 A Glance on Forest Management:

Forest Management is a process in which the opportunities and resources available on particular forest is identified, the expected financial gain and long term perspective is analyzed, the steps

required to maintain the yield of forest and to enhance the benefits gain from tangible and non-tangible products are determine and their implementation is ensured so that the forest can work according to desires of owner. (Perez and kuhns, 2012)

The concept of sustainable forest management is evolving and dynamic. Sustainable forest management put emphasis on enhancement of social, environmental and political values of forests of all kind, in order to get benefit in present without affecting the ability of future generation to meet their needs. If forestry is done without proper management plan-with target to use the natural forest resource wisely, serious consequences can be seen with in short time period (few decades). On the other hand if managed properly forests are renewable resource and contribute its part in national GDP. Forests also fulfill the need of people and are useful in biodiversity conservation. (Good practice guide by CBD and IUCN, 2009)

In Pakistan forests have two important roles to play first is to protect the watershed and purify water and second is to provide timber as prime source. Country has small forest cover and high population pressure. It is important to conserve forests and manage them properly for the stability of environment and for uninterrupted production of wood and related products. Unfortunately there is no proper management system of forests in Pakistan. Department of Forestry is considered as biggest threat to forests. Illegal cutting and trading is common practice in country which is supported by Government official. There is no system of accountability of officers, rules are present to punish public if they do prohibited actions but no policy talks about punishing the official who bring harm to forest or do corruption. There is a strong influence of politicians on forest department. Politicians use their power to violate laws and it badly affects the functioning of forest department and is a hindrance on the way of implementing proper management system and well-defined policies. Government takes no interest on the implementation of policies and thus put no effort in reduction of illegal practices. So it is very important to define proper lines about management of forest, to introduce a system free from external pressure and a way to make official accountable as well. (Hassan.L, 2001)

## 1.5 Objectives:

Following are the objectives of study:

- To calculate the NPV (net present value) and IRR of some plant species inhabit in the forests of Punjab.
- To estimate the impact of Interest rate variability and the 1 year revenue delay
- To highlight the flaws in the management system of Punjab Forests.
- To support sustainable development for the long lasting availability of resources and for simultaneous progress in economic development, environmental protection and social betterment.
- To build comparison between natural and planted forests as well as their economic and ecological worth is highlighted.

### 1.6 Organization of study:

This study consists of total six chapters. The sequence of 5 chapters excluding Introduction is; 2nd chapter is about Literature Review followed by chapter 3 "Methodology", than comes Chapter 4 "Results" and after that its Chapter 5 "Discussion" and in the end References are given.

## 2) Literature Review

There is a lot of literature available on the economic analyses and optimal rotation of trees. Literature shows the importance of Forest Management, policies and proper implementation of policies for the better functioning of forests. As the environmental awareness is increasing the concern toward forest is also increasing and now focusing on sustainable forest is a common practice and considered as the only solution of forest management problems.

Cubbage. F et al (2007) – The authors highlight the importance give to sustainable forestry in present time. Now Sustainable forest management is taken as cross-cutting theme in forestry. Forests provided variety of benefits which are social, environmental and economical in nature so the policies dealing with forest should be multi-dimensional. Factors having impact on forest policy are analyzed and traditional and latest tools for policy making are discussed.

Bacha. C and Rodriguez. L (2007) – This study discusses about the effectiveness of ITTO project introduced by Brazilian government to reduce the impacts of deforestation and for the maintenance of biodiversity. Project IRR is analyzed. The economic and social benefits of forest

management project is estimated and results show that proper management techniques are very effective in terms of sustainable forestry.

Hummel. S (2008) – writer discuss the silviculture in forestry and show how it works and which domains are included into it. The ecological forest management is discussed and silviculture is declared as a best way of dealing with forests to get sustainable forestry. This is efficient economically, environmentally and socially.

Gatto. P et al (2009) – Writers talk about the cost and benefit associated with environmental and economic consideration in forest management. Cost benefit Analysis (CBA) is utilized for doing calculations. The results show that using the approach of CBA is helpful in analyzing social, environmental and economic parameter in forest management as well as other kind of managements like pest management.

Ying. Z et al (2010) – Author talks about the need of sustainable forest management and utilized NPV and IRR as a tool to monitor the financial performance of study area. The environmental and ecological problems of site are discussed and support sustainable forest management as solution to deal all current pressure. This study suggests that giving attention to forest ecological problems and its layout is very important. Sustainable forest management should be the applied approach.

Leite, A. F. B et al (2011) – Writers consider the problems related to thinning of Tectona grandis plantation and the related economic variability. Four different management plans were considered and they are analyzed by using NPV and IRR. All alternatives are good and viable for the wood production.

Farahmad. K (2012) – This study discusses the forest management in accordance with two parameters, the growth of trees annually and the utilization of trees. There should be a balance between the consumption and so that forests remain a renewable resource. Statistical Model is used to analyze three different cases related to forest growth; utilization and over exploitation are considered. It is concluded that for the better forest management monopolistic regime is suitable than competitive regime.

## 3) Methodology

### 3.1 Data Source:

The study is based on secondary data collected from forest department of Punjab, Pakistan. Latest available Working plans are used for obtaining data regarding financial forecast of timber while the Inventories of selected forests are analyzed to study the species structure in forest and for selection of most prominent ones.

### 3.2 Study Sites:

This study is done by considering two forests in Punjab. Changa Manga forest which is artificially planted, irrigated forest and Murree Forest which is ta natural forest. The selection of these two sites is done to compare different factors in planted and natural forests.

#### 3.2.1 Changa Manga Forest:

Changa Manga is a human made forest, planted during British Rule in 1864 for timber supply required in Peshawar to Karachi Railroad construction program. Location of Changa Manga forest is 48miles from Lahore city in Southwest direction. The Total area of this forest is around 12,515 acres. Forest receives water from water canals and plays an important role in the weather of surrounding areas. Despite being in arid zone it reduces the temperature in neighborhood. (Aslamkhan. K and Salman. C, 1969)

Forest contain a rest house and a recreational area as well which attract people and provide them a source of pleasure. WWF- Vulture Center is now also situation there which adds up the spice to Changa Manga. Forest is managed by Government Forestry Department and is used for commercial forestry. Clear cutting pattern is in practice in which a selected patch is cut down and then reforested. Changa Manga is an important source of timber.

Loop holes in management plan and lack of proper concentration is causing great harm to forest and it is losing its dense cover, wildlife and diversity due to unchecked wood gutting and wood stealing.

3.2.2 Murree Forest:

Murree is a natural forest having diverse type of plants in it and thus a complex biological structure. Majority of plants are conifers whereas some of broad leaves plants are also present. The area is mountainous with steep slopes and the elevation varies from 6000 to 7300 feet above sea level. Climate of Murree is temperate. The temperate is moderate to low in the area. Range of temperature is maximum 24.02 $C^0$ to minimum below $0C^0$ (Government of Punjab, 1997)

Due to extensive development, road construction, tourism pressure has been built up on Murree forest. The area has around 350 hotels and most of them have violated law in construction according to report. Illegal cutting is in practice and some people also have saw mills at homes. Deforestation is seriously destroying the stability of area and scenic beauty. (IUCN Pakistan, 2005)

3.3 Species included in study:

Following species are considered in my study due to their abundance in selected sites.

- Dalbergia sissoo (Shisham)

It is inhabitant of some Asian countries which includes Pakistan, Iran, Iraq, Bangladesh, Afghanistan, India, Nepal and Indonesia.

Four provinces of Pakistan- Punjab, Balochistan, Sindh and Khyber phaktunkhan (KPK) have this tree in them. In the artificial plantation of Sindh and Punjab this specie has cultivated widely. It is also present on farms, roadsides and other scattered areas.

Dalbergia sissoo is also known as Rosewood, Tali, Tahli, Shisham and sissoo.

Some of the main features of Shisham are: It is deciduous tree which is large with height around 25-30 meters and 1.5-3.0 meter in diameter. It has compound leaves having leaflets 3-5 in number and oval to oblong in shape. Yellowish white to pink flower flourishes on it during the time period of March to May whereas pod is the fruit containing 1-4 seeds whose ripening season is from November to December. Bark of tree is grey in color and has deep cracks in it.

The wood of Shisham is hard and durable known as king of Pakistani wood. Wood has medium strength in bending, and hardness whereas high in crushing. Sapwood is vulnerable to fungal and borer attack and do not response to preservative treatment.

It is mainly utilized for making of furniture, cabinets and plywood etc. Shisham wood is also used for flooring, ordinance and turning articles, agriculture implements and decorative boxes etc.

- Morus alba (Shahtoot)

Range of this tree is Pakistan, Burma, Iran, Afghanistan, Japan and India. In Pakistan artificial plantation hold it greatly; it is present in KPK, Punjab, Sindh and Northern areas up to an elevation of 3300 meters.

Its common names are Toot, Tut, white mulberry and silkworm mulberry.

Mulberry is deciduous tree with moderate height, around 10-18meter and diameter is 0.6-0.8m. It has simple ovate to round leaves which are approximately 20 cm in length. Flowers appear in February having shape of catkins and are monoecious. Its fruit is a berry of pinkish to red or black in color and from March to June they ripened up.

Heartwood and Sapwood are easily distinguishable having bright yellowish brown and white color respectively. The heartwood color turned into dull brown with passage of time after cutting. Strength of wood is moderate. Durability of wood varies from medium to good durable wood when used indoor. Its bark has vertical cracks and orange or dark grayish brown color.

Working with wood of Shahtoot is quite easy and good results can be achieved if worked properly.

It is mainly utilized in making of sports goods like tennis, squash and badminton racquets and hockey etc. its other uses includes making of dowels, camp furniture, bobbins and bent wood articles.

- Eucalyptus camaldulensis Dehnh. (Safeda)

Some of the common names of this plant is Illachi, River red gum, Murray red gum, Rostrata gum.

This plant is native of Australia, from where it spread and now found in Pakistan, South Africa, Portugal, Egypt, Spain, India and many other countries of the world. Within Pakistan it present in KPK on up to 1400 meters high elevation whereas plains, forests and cultivated areas of Punjab have this plant.

Safeda is a tall tree with height of 30-40 meter approximately. Its diameter is around 1-2 meters. Small flowers blossom on it in the form of group during May to June. It has Capsule shaped fruit with tiny seed ripened from September to October.

The wood of plant is fairly strong and hard. Sapwood has pale to light gray color whereas heartwood has red to reddish brown color so they can be differentiated from each other. It has smooth bark of white to pale gray in color, having reddish plates.

Paper and pulp industry, particle board and fiber making, flooring, heavy construction are some of the main area where Safeda wood is used. It is also used as fuel, charcoal, mining timber, ship building. It is sometimes used for furniture but not favored for this purpose.

- Pinus roxburghii Sargent (Chir)

This plant is native of Himalayas, found in Nepal, Pakistan, Bhutan, Afghanistan and India. It is present in range of 460-2400 meter elevation covering an area of Murree, Dir, Abottabad, Malakand, Northern Agencies, Manshera and Azad Kashmir. Chir is also planted as ornamental plant.

It is an evergreen plant with narrow crown. It is tall with 30-50 meters height and 0.8 meter diameter. 20-30cmm long needle like leaves are its characteristic. Cone is its fruit which on maturation turns woody. The flower is monoecious. Ripening of seeds occur in September to October.

Heartwood and sapwood are identifiable. Sapwood color is creamy white whereas heartwood has light red color when cut down which later changes into reddish to yellowish brown. Wood of Chir has moderate strength but heavy. Its bark is scaly, thick and has reddish brown color.

Large quantity of resin presence cause difficulty in working with Chir's wood.

After treating with preservatives it can be used for making of railway sleepers, poles, transmission boxes etc. Its other uses include fuel, cheap furniture, house fitments etc.

Resin of commerce extraction is done which is also known as turpentine oil.

- Pinus wallichiana Jackson (Kail)

This plant is indigenous to Himalayan range found in Pakistan, Bhutan, China, India, Afghanistan, Tibet, and Nepal.

In Pakistan it is present mostly in KPK and Azad Kashmir.

It is evergreen, straight, tall tree with height of around 30-45 meters and diameter 1.0-1.5 meters. Cone is fruit and flower is monoecious. Leaves are needle like, arranged in groups in a way that each set has 5 needles.

Heartwood is light pinkish red to red in color whereas sapwood is yellowish white in color. Wood is strong. The wood is not durable if used out door but durable indoor.

It is easy to treat with preservatives. Bark has cracks and dark gray in color.

It is utilized for: making of railway sleepers, construction purpose, carpentry, drawing boards, packing cases etc.

It can be used as a fuel but produce pungent resinous smoke when burns (Shabbir. A,2009)

3.4 Role of NPV and IRR in forest management:

In 21st century the concern is sustainable development and wise utilization of resources. In case of forests the target is to achieve healthy, self-sustaining forest with a balance and for that a proper management plan is required. Net present value is an important tool in this regard. It helps

in making appropriate decisions regarding forest by showing financial parameters. (Zhou. W and Gong. P, 2004)

Understanding about the potential yield and determination of financial efficiency of forest is very important for its sustainable management. This target can be achieved through utilization of IRR (Internal rate of return) and NPV (net present value) in management process. (Van Gardingen. P.R et al, 2003), (Ying et al, 2010), (Kosonen. M et al, 1997).

3.5 Procedure:

In this Study IRR and NPV has been utilized as a tool for sustainable forest management. To improve the efficiency the most recent available data has been used. All calculations are made on species basis and all species have been deal separately. Yield, Cash inflow (expenditure breakup and revenue), NPV and IRR has been estimated for each spices and Microsoft Excel is used as a software to make sheets.

Later the comparison between natural and cultivated forest is made and the suggestions to improve both kind of forest to achieve sustainability has been discussed.

3.5.1 Method used

It is an economic principle that value of NPV should be positive if investing in forest management is wise. IRR and NPV are used for analyzing and comparing the profitability of investment.

In this study the NPV of selected species to analyze their management conditions and for this purpose the following formula has been used.

$$NPV = \Sigma^{n}_{Y=0} [R_Y/ (1+r)^{Y} – C_Y / (1+ r )^{Y}]$$

Where: R is revenue, C is cost, Y is no of years, r is annual interest rate. NPV shows Profits expected in future, discounted to year 0.

IRR has also calculated for specie separately. In simple words IRR is rate of discount at which NPV of an investment is zero. Sometimes IRR is utilized for roughly analyzing the profitability of an investment when screening opportunities. (Ying. Z et al, 2010)

## 4) Result

In this study the economic efficiency of management plan for Changa Manga and Murree forest is analyzed through NPV method. Following conclusions are derived from obtained results.

5.1 Financial performance:

Results show that the system of forestry is not economically efficient in nature. IRR of some major species are below that of interest rate which makes investment in them less suitable. This is because the expenses bear by department and the revenue they generate against it does not offer returns equal to interest rate. It means that investing same money in bank or market will return more profit than what is attaining from foresting these species. In case of Changa Manga-irrigated forest, Firewood shows high IRR that is 106% at interest rate of 12%, the reason is that firewood is attained from Mulberry and Shisham and have no additional expense on working cycle level. It's all expense is carriage and felling cost. On the other hand it provide handsome amount of revenue. IRR of Eucalyptus is 14% whereas that of Shisham and Mulberry together is 7%. Short working cycle, less input requirement and high demand in pulp industry makes Eucalyptus beneficial at 12% interest rate. Shisham and Mulberry comprises the major portion of expenses of Changa manga and early harvesting of them reduces the revenue and so make it non profitable. The highest IRR is 172% by Chir and Kail (Murree forest) which is much greater than 12% interest rate. Naturally grown and fallen trees are utilized for wood extraction and thus provide high internal rate of return because in less money this forest can be maintained and remain functional.

NPV shows the present value of expected future returns. Higher the value of NPV higher is the value of NPV higher is the value of future in today term. Higher NPV means that investment made are giving higher present returns.

5.2 Working on break-even:

Results show that forest department is working on break- even point. Slight change in market trends can result in loses. The expenses of forest department are very high and on the other hand the price on which h sale goods is quite modest. There is no cushion for variables used by forestry means that the price at which wood is being sold makes them risk prone.

5.3 Interest Rate Variability

The interest rate variability is analyzed by increasing the discount rate. Three different rates that are 12%, 15% and 18% has been used.

The results show that with increase of discount rate the NPV decreases because by doing this higher value has placed on future. When interest rate rises that means for every thousand rupees that are spend today the return will be higher in future and vice versa. So when discount rate is higher than the value of discounted profits decreased.

In case of Eucalyptus the NPV is PKR 776,445.31, PKR -288,552.17 and PKR -1,243,689.93 at interest rate 12%, 15% and 18% respectively. NPV is decreasing with the increase of interest rate.

For Shisham and Mulberry NPV is PKR -4,303,153.73 at 12% interest rate, PKR -6299336.515 and PKR -7819246.916 at 15% and 18% respectively. And same is the trend with firewood where the NPV is PKR 10,110,442.66, PKR 9,350,626.88 and PKR 8,649,859.60 at 12%, 15% and 18% of interest rate.

For Chir and Kail NPV is PKR 18,788,676.79 at 12% interest rate, PKR 18,298,537.39 and PKR 17,833,320.34 at 15% and 18% respectively.

Table 1: Over all Interest rate variability results of selected species

| **Type of Forest** | **Specie/ Timber form** | **NPV(PKR) at interest rate 12%** | **NPV (PKR) at interest rate 15%** | **NPV(PKR) at interest rate 18%** |
|---|---|---|---|---|
| Commercial Forest | Shisham and Mulberry | -4,303,153.73 | -6299336.515 | -7819246.916 |
| | Eucalyptus | 776,445.31 | -288,552.17 | -1,243,689.93 |
| | Firewood | 10,110,442.66 | 9,350,626.88 | 8,649,859.60 |
| Natural Forest | Chir and Kail | 18,788,676.79 | 18,298,537.39 | 17,833,320.34 |

Results highlight that NPV has indirect relationship with Interest rate which means that NPV decreases with interest rate increase in all considered cases.

5.4 Delaying in Revenue by 1 Year:

In this case the revenues are delayed by 1 year to determine its impact. The results of this technique depict that NPV reduces with delay in revenue.

When revenue of Eucalyptus is delayed by 1 year the NPV reduces from PKR 776,445.31 to PKR -2,297,809.84. Same happens in case of Shisham, Mulberry and firewood where NPV decreased from PKR -4,303,153.73 to PKR -5,288,370.79 in Shisham and Mulberry case and from PKR 10,110,442.66 to PKR - 6,103,745.00 for firewood.

1 year revenue delay of Chir and Kail decreased NPV from PKR 18,788,676.79 to PKR 15,607,873.21

Table 2: overall result of 1 year revenue delay when interest rate is 12%

| **Type of forest** | **Species/ timber form** | **NPV (PKR) at original time** | **NPV (PKR) at 1 year delay** |
|---|---|---|---|
| Commercial Forest | Shisham and Mulberry | -4,303,153.73 | -5,288,370.79 |
| | Eucalyptus | 776,445.31 | -2,297,809.84 |
| | Firewood | 10,110,442.66 | - 6,103,745.00 |
| Natural Forest | Chir and Kail | 18,788,676.79 | 15,607,873.21 |

So it is clear that if the same revenue would obtain after 1 year delay from original time it's worth decreases.

All the results made it clear that existing management plans are not efficient and there is a need to improve the system and adopt sustainable approach to improve the performance of system.

## 5) Discussion

Pakistan is a country with small proportion of forest area. With ever increasing population the country's demand of timber is also increasing. Due to high pressure and less resource availability

the import rate is very high in case of timber. Over exploitation is distorting the natural balance forests and high rate of deforestation does not give proper time for regeneration and thus results in forest cover loss. Policies violation, Timber mafia and high dependence of local make the management of forests a big challenge in country. (Gizweski. P and Dixon. T. H, 1996)

6.1 Lack of ability to deal with sudden shock, disease etc.

As the results show that commercial forest is not working efficiently, even the slight change in market trend can have great impacts which mean that the system lacks the ability to deal with market up and down. If any catastrophic or unpleasant event occur than the current system is unable to deal with it and it might collapse.

6.2 Simplified selection criteria for plantation species:

Species selected for plantation is usually based on their growth rate and yield. Plantation for commercial harvesting is based on the target of high quality and quantity of wood. Meeting the demand of people and exporting the surplus is the way on which market functions. So the quality of species like resistance toward pests and environment, native to area, ecological importance are usually ignored. (Ying. Z et al, 2010)

Native species are very important as they keep intact the biodiversity of an area, play their role in the stability of respective ecosystem. Removal of native species cause many problems.

For example: introduction of Eucalyptus due to its fast growing nature cause the problem of water table level lowering and the preference to this plant leads toward ignorance of native species of less importance.

Qualities other than production rate should be considered to improve the system of forestry.

6.3 Less biodiversity:

Natural forests are rich in biodiversity both in terms of plants and animals. Different kind of plants (like grasses, herbs, shrubs, trees shade loving, light preferred plants etc.) including countless species in them are present. There is a complex network of connectivity among all living and non-living things which resulted in a stable and balance ecosystem.

In case of commercial forestry the scenario is quite different. Only handful of species is promoted depending upon the demand of time and the requirements of targeted market. Human prefer species of interest and do not consider the intrinsic value of species. Introduction of exotic species add up competition for native species and stress out their growth. Simplification of ecosystem has been result which makes it more prone toward risk factors.

6.4 No implementation of policies, rules and law:

In Pakistan the main infrastructure required to make a better policy and to implement is lacking. Government shows no interest in the forest area of country and never took action against those who break the law. Timber Mafia is so very common. Major portion of annual wood cutting is illegal. Government has property issue with local people in forest areas which further worsen the situation. (Hassan. L, 2001)

Since 1985 the green felling is banned in Murree by forest department, this means that commercial harvesting is not allowed in Murree and not practiced by Forest department. (Forest department Punjab) But despite of that the forest of Murree is reducing. The rate of deforestation is very high, illegal cutting is at peak and there is no one to stop wood stealing.

6.5 state of land ownership:

In Pakistan two types of forests are present on the basis of ownership (i) Private (ii) Government owned. Majority of forests are government owned. Before British era forests were property of tribes living around them which later during British raj is taken by government but still the tribes have not accepted this act and take it as depriving them form their birth right. This approach is a main reason of forest management failure because local people violate all laws and stand against government. (Hassan. L, 2001)

6.6 comparisons between Planted and Natural Forest in Pakistan:

Natural forests have variety of species varying in densities and random distribution. Usually plants grow through natural process of seed dispersal through wind. Due to ban on commercial harvesting revenue is generated only from dead and wind fallen trees on yearly bases.

Planted forests are used for commercial harvesting. They are pure or few species containing forests. Trees are harvested and recultivated through proper cycle. Their main purpose is to meet demand of timber on commercial scale.

Both kinds of forests are important as if managed properly they leads forestry toward sustainability by meeting the demands of people, providing source of revenue generation and doing conservation natural habitat and species.

6.7 Sustainable Forest Management:

Forests are very complex and sensitive kind of ecosystem which hold majority of terrestrial biodiversity. Forests provide both tangible and non-tangible goods. Millions of people depend upon forests for livelihood. For example, 80% wood extracted in Africa is utilized for domestic purposes. Deforestation and Land use land cover change are major threat to forests as nearly 13 million ha area of forest land coverts into agriculture land every year. This is an alarming situation and there is a need of Sustainable forest management to improve the scenario. (FAO, 2011)

Sustainable forest management (SFM) is an approach whose target is that the needs of present people related to forest are met and simultaneously forest resources are conserved for the protection of biodiversity and so that people in future will also be able to enjoy forest as renewable resource. SFM acknowledge the importance and role of forests in carbon sequestration, climate, on wind speed and in water flow and availability of pure water. (Putz. F. E, 1994)

SFM is an holistic approach which merges social, environmental and economic benefits together to meet demand of people by utilizing resources in a wise way.

The hurdles in the way of sustainable management in Pakistan are; the sense of insecurity regarding land ownership, the stakeholders conflicting demands toward forest resource. People want to generate money out of forest by selling related goods but do not consider the ecological role of forests and never give sufficient time required by forest to regenerate and maintain trees as renewable resource.

Keeping in mind the importance of sustainable forestry it is now being promoted by the forest department in Pakistan. In 2002 national forest policy was made which is based on the provision of sustainable development. Guidelines were made by government to achieve the target of rapid afforestation, enforcement of forest law and sustainable forest management. Integrated natural resource management approach was taken into account to improve the situation. With the association of Asian development bank government of Pakistan initiated study to determine the gap between timber supply and demand. (Wani. B. A, 2003)

Despite of all these steps lack of commitment and sincerity forests of Pakistan are in very bad condition. Rate of deforestation is very high and timber mafia is simply out of control. No one follows law and because of all that forest cover is reducing very quickly. Sustainable Forest Management and loyalty is the way to improve the situation as it deal with all parameters, bring together all problems under one cover and provide solution to them. Sustainable management is a need of time and now it should be implemented in Pakistan to prevent forests of country from terrible future.

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