

## **Role of Agroforestry in Wood Productions and Farmer Perception in Pakistan: A Review**

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**Abstract:** Agroforestry has been defined as a dynamic ecologically based natural resources management system that through the integration of trees on farms and in the agricultural landscape diversifies and sustains production for increased social, economic and environmental benefits for land users at all levels. About 80% of the people of Pakistan are directly or indirectly concerned with agriculture. Farmers, in this region, are generally small holders and thus, an attempt with agroforestry practices can result an increase in their earnings without endangering the fragile ecosystem. Forestry is faced with the challenge of meeting an increasing demand for goods, as well as for an expanding array of services, like clean water, soil conservation and wildlife habitat, from a fixed or shrinking land base. Solutions that balance forestry with the sustainability of other sectors, like agriculture and communities, are needed. This paper highlighted the role of agroforestry systems in ecosystem management and socio economic development of the people of Pakistan.

**Keys words:** Agroforestry • Soil conservation • Wood production • Pakistan

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### **INTRODUCTION**

Pakistan is a unique combination of deserts, alluvial plains, low and high hills, valleys and a long coast line. The diversity in climate and soil is well reflected in the ecological distribution of fauna and flora. The climate is generally arid subtropical. The average rainfall is 250 mm, while some of the driest regions receive less than 123 mm annually [1]. The country has a narrow forest resource base extending over only about 4.8% (4.59% excluding farmland plantations) of its area, which is insufficient to provide the material needs of the growing population and expanding industry and to retard and arrest the ongoing environmental and ecological degradation process. Almost 80% of the productive forests are located in the north (Hazara, Malakand, Azad Kashmir and Northern areas, whereas 80% of the population and wood based industry is located in the southern and central parts of Pakistan [2]. Pakistan's fast growing population of about 152.53 million is dependent for its wood and wood products requirement on a meager forest resource base of 4.2 million hectares (The Pakistan National Conservation

strategy, 2006). The per capita forest area thus is only 0.0265 ha [2], compared to the world average of one hectare. Only 1/3rd of the total forest area is productive, while the rest is of environmental and protective value only [3]. It is becoming increasingly difficult to meet the demands of the growing population for fuel wood, fodder, agriculture implements and raw material required for wood based industries [4]. There is no doubt that scanty tree cover is the result of the gross mismanagement of forests in the past. The development of modern infrastructure and developmental pressure has further facilitated destruction of meager tree cover in the country [5], in that the forests are open to a multitude of adverse factors. In wake of the fast depletion of trees and forest cover, agro forestry/farm forestry has evolved as a discipline in the developing countries. At large it focuses people to obtain and meet their demands for fuel wood, fodder and timber besides keeping intact the environment by planting suitable trees on farms. Basically farm forestry/agroforestry as a distinguished land use system is practiced to maximize benefits when forest crop is grown on agricultural fields. However, by definition and concept, both differ from one

another. Agroforestry encompass the approach when forest crop is grown intentionally with agricultural crop in combination with /without livestock; in order to increase soil fertility that ultimately maximize benefits from the same unit of land. Farm forestry is based on the concept of planting of trees in linear or compact form on private farm lands along with the crop field. The common trees species grown on farmland include *Acacia nilotica* (kikar), *Dalbergia sisso* (Shisham), *Bombex ceiba* (Simal), *Morus alba* (Mulberry), *Salix spp* (Willow), *Melia azedaricht* (Bakain) and *Populus deltoides*. Besides these indigenous spp, some exotic species have also been introduced including, *Eucalyptus spp*, *Robinia pseudocacia* and *Aillanthus altissima*. All these species serve as important source of fuel wood, timber, furniture and fodder. Economic value of Frash and Eucalyptus cannot be over looked. It serves as one of the sources that boost up GNP. Many agroforestry/farm forestry spp have leading share in the production of timber and fuel wood. It is unfortunate that its potential and value is not comprehended and assessed. According to available reports in Pakistan the total current consumption of timber is about 3 million cubic feet, where 18% demand is fulfilled from the state forests while 47% is met from the import. In this pretext, the rest 35% of the demand is met from the trees grown on farm land. According to an estimate the current annual demand for fuel wood is 22.15 million cubic while the recorded production from the state owned forest is merely 0.4 million m<sup>3</sup>. At domestic level, Pakistan meets about 90% of energy requirements of fuel and 40% of timber needs from land resources. In face of this scenario, still the promising interventional planning is far lacking, as an immediate measure. Aforestation rate is low, negligible area is planted and major focus is on farm lands. Hypothetically, if more land is made available to expand the almost static resource base at the rate of twenty thousand hectare per annum, it is assumed to require about 100 years to cause an increase in forest area just by 2.5%. With these assumption and factors in spotlight the only adoptable concrete alternatives and means appear to be feasible are raising trees on private farmlands. This is envisaged to cause the local people actively participate in this more with an aspiration to produce the required volume of wood as a solution to gracious demand. This will enhance local people interest and understanding to raise trees with agricultural crops to benefit both personally and commercially. In this review paper, role of agroforestry systems in ecosystem management and socio economic development of the people of Pakistan is described.

**Review of Literature:** In the past forest used to be considered as forester's domain but in the near past the concept has been changing and the new emerged concept of agroforestry and farm forestry are in board. As agro/farm forestry arrangement or combination depends on owner's wishes and objectives. To understand the u-turn in the perception of people about forest. The available literature, documentation and materials have been reviewed and some of the relevant have been given in this chapter. Amjad *et al.* [6] observed that popular in substantial quality is covering Peshawar and Mardan valley. The tree is grown around the agricultural fields by the farmer. Ashraf *et al.* [7] conducted a study in Attock district to find out the perception of farmers about trees planting. He selected 54 house hold heads randomly for a structured interview schedule. It was conducted that 77% farmers were willing to plant more trees on their land. Farmers were neither willing to purchase nor wanted to continue tree growing business if the government incentives were withdrawn. Main problem perceived by the tree farmers was making their produce. Education had no signified effect on the farmer's view regarding effect of trees on their agriculture crop. Bourke *et al.* [8] summarized the resources for the limited planting of trees on farms and discussed possible solutions. He suggested that a well informed extension service combined with financial incentives, including grants for trees growing and fencing and rate concession and tax allowances for soil conservation work will help to reverse trees decline on farms. Carter *et al.* [9] species composition and population structure of trees (planted and natural regeneration being grown by farmers in sari (1400-2000m altitude) 1988-90 are discussed by the [9] with reference to field observation at farmer's comments. Trees were used by the farmers for fodder, fuel wood, timber production, fruits and for miscellaneous other products (food, medicine, fiber etc) in erosion control and far various social (including religious) purpose. Production of tree product for marking is not yet important in the area. The affects of shade on crop yield were an important factor in the location of tree farmland and in relation to altitude. Dove *et al.* [10] presented and discussed about a survey carried out in 118 villages in the Punjab, Khyber Pakhtoonkhwa and Balochistan. On farmer interest in farm forestry (in relation to villages location, land type land tenure and labor availability) the views of farmers on farm forestry schemes and farmer practices. Interest in the farm forestry was lower in vicinity of government forests; higher as the distance from towns increased and unaffected by proximate to

refugee camps but higher in proximity to normal camps. It was also higher in villages with consolidate lands (because of low labor requirement of farm forestry) interest was neither higher nor lower in irrigated villages. Farmers perceived the major constraints on their cultivation of trees to be the difficulty of production, the lack of interest and experience on their part and perceived inadequacy of Government assistance. Because of the historic focus of forest department on public lands on large scale private planning's, farmers have not in the past turned for assistance with tree cultivation. However the department FP&D (forestry, planning and development) project directly addressed all these problems and helped to develop the latent interest among common farmers in receiving Government inputs in to their farm forestry activities. Traditional methods for protection and treating trees demonstrate the tree mindedness of most farmers and offer a starting point for extension effort. Traditional religious attitude towards tree cultivation can also support these effects. Village's level institution and groups are likely to be useful in farm forestry development. Dove [11] in another study reported and discussed a survey of house hold from villages in Punjab, KPK and Balochistan on interest in trees planting at the farm level. The majority farmers were interested in planting trees and hence are potentially receptive to farm forestry development efforts by forest department. While interest was highest among farmers with higher education and larger irrigated holdin. The same was also observed among uneducated farmers with smaller, rainfed holding, since the latter predominate in the country side. It is suggested that they should be the main targets of the development of efforts. Development efforts should also target farmers with some wastelands, because their interest in the tree planting was also high farmers had their own species preference, which the forest department should take in to account in development efforts. At present department commercial species for which future markets are uncertain. Since most farmers wanted to plant fewer trees. It was recommended that efforts by the forest department to develop farm forestry should concentrate on small holding. Fakiha *et al.* [12] conducted a study to identify species mostly grown by the farmers. About 60 farmers were interviewed in district Haripur and data was processed. It was concluded that major reason for planting trees by the farmers was subsistence. They mostly used then obtaining fodder, fuel-wood and timber for domestic consumption. Only 3.4% of the respondent planted trees for additional income where as 8.4% of the farmers planted trees just for the soil conservation. Gerald

Foley and Geoffrey Barnard in 1984 discussed about the constrains on tree growing. They mentioned that the land tenure system is one of the problems in tree growing. Those who firmly control the land they can plan accordingly. But the tenant who expects his land lord to evict him or shift him to another plot after several years to prevent him from establishing title by prescript is not able to plan with the same security. He may be perfectly aware that terracing live fencing or wind breaks eventually improve land and yet be certain that he will gain nothing there by. Thus he may opt for short term investments in soil fertility. Hakim Shah *et al.* [13] conducted a survey in KPK to assess tree growth on farmland. The province was divided in to three broad zones i.e. North plain (Peshawar Mardan civil division), South plain (Kohat, DI Khan Division) each zone was subsided into irrigated and un-irrigated. The survey concluded that average number of tree per hectare is 46 Poplar (24%), Bakain (81%), Shisham (15%), Ailanthus (13%) and Mulberry (10%) are pre-dominant species in irrigation area. Kibriaul Khaleque (1988) reported that Bangladesh homestead farm is being overcut to meet increasing demands for fuel-wood and timber. A survey was made and information collected by the interviews with 50 house hold heads in each of 7 villages. The survey revealed that almost every homestead has a combination of different tree species, a bamboo grove and shrubs. Farmers generally prefer to grow fruit trees because they are multipurpose providing fuel, fodder and timber. Bangladesh farmers are aware of the value of the trees and want to plant more. The major constraints preventing this are lack of quality seeding, fencing materials, financial support and extension services and provides desired seeding and other support to farmers. Mamoon *et al.* [14] in a study which reveals that trees grown are based on perceived benefits by the rural communities themselves. The forest department and ongoing projects in the area do influence the choice of species for plantation. However, rural people also keep in view the intangible benefits in addition to commonly perceived benefits. The analysis also indicated that rural people plant trees irrespective of consequential effects on crop production and do not consider environmentalists issues. Farmers are growing traditional as well as some exotic species. Eucalyptus species have better survival and resist grazing and browsing pressure. However, farmers are determined to continue with the present traditional practices to meet their demands. Out of the trees planted, *Dalbergia sisoo*, *Melia azedarach* and *Morus alba* are worth mentioning as these are sources of income for the rural communities. Marmillod *et al.* [15]

studied the farmer's perception of an agroforestry development project and the problems of the project sought to alleviate in the mountain area of Acosta and Puriscal in Costa Rica. In areas which were more developed and which had higher population density the following challenges were noted; less diversity in land use, lower incidence of trees with crops and pasture and greater preoccupation about future fuel wood supplies. Marmillod *et al.* [15] although many farmers approved of laws controlling tree felling, there was a mixed reaction attributable to the bureaucratic problems, which affect the granting of permits. Most of trees in the area were naturally regenerated; particularly those used for coffee shade and fuel wood as well as most timber trees. The main motivation for planting trees was fruits production followed by the timber production. There was no evidence that the farmers believed in a link between deforestation and small land sides, which are common in both areas. It was concluded that the farmers would be receptive to tree planting (agroforestry) programs provided that their interests are met. It was suggested that priorities for the tree components of such a program should be fruit trees fast growing trees that produce poles; and timber trees for saw logs, emphasis should be given to the possibilities of establishing trees in underutilized fences lines [15]. Matthews *et al.* [16] a mail questionnaire was developed by the Agroforestry department at the University of Guelph, Ontario to determine the level of awareness and interest in the adoption of agroforestry system by land users (farmers) from four township in Wellington country. The majority respondents were familiar with conventional agroforestry system such as windbreak and wood lots/plantations (80% and 62% respectively) the level of interests in the adoption of these practices was significant (74% and 66% respectively) response rates lower for riparian plantation and intercrossing probably because of the low level of familiarity with these practices. Respondents commented that agroforestry systems would have a natural effects on farm income and would increase land stewardship in some areas industrialist indicated a willingness to participate in agroforestry system even though they anticipated increase in over head and labour industry however, this was only true when they held land steward as a priority. Land user was more concerned with the economic aspects of agroforestry as determinant to the future adaptability of particular practices. It was concluded by the study that the success of agroforestry programmes on farms is due to nontraditional agriculture systems. Mamoon *et al.* [14] reported reasons for the limited commercial use of

populous species in Canada. The study indicates that populous species are well suited to fiber board and particle board manufacture and their use in these products is likely to increase as economics and markets permits. Specific recommendations are made for research on the use of poplar for the other products. Provosto *et al.* [17] reviewed the statistical data on the area of forest and yield of forest produce in Italy. The paper also analyzed the country balance of industrial wood and made an evaluation of the consistency of poplar growing in Italy. The supply and demand for poplar wood the yield of stands and the financial return were also obtained. The poplar is considered as a valuable crop on the valley farms and prospects for extension of poplar growing for production of industrial wood are considered to be higher than before. R.H Westveld and R.H Peck mentioned in the book "forestry in farm management" printed in USA dated January 1947 that the chief use of fuel wood on farm is for heating the home. Small quantities are used each year or intermittently in some farming section for smudges in orchards curing tobacco boiling cane, butchering and smoking meals. Where wood is the only fuel used the requirement would vary from above 15 standard cords per year per farm in the south to 20 or 25 standard cord per year per farm in the extreme North. Although wood is used less extensively for fuel on farms now than formerly its use in the future is not likely to decrease very much where wood is plentiful. The development of improved wood burning stove and furnaces now in progress may even help to increase the use of wood for fuel in future. The use of home ground fuel provides the farmer an opportunity to direct to some other use the cash that would otherwise spend for fuel. Rao *et al.* [18] studied the economic return for marginal and small farmers. These species namely Eucalyptus, Babul and Shisham were recommended for planting on farm and private land by the author. Said *et al.* [19] conducted a socio economic survey in the Mardan District of KPK Pakistan to develop a sound knowledge of the area, its people and the crop they grow. Data was collected from 270 farmers using questionnaire containing 29 questions. The study revealed that farmers of Mardan grow a number of multipurpose trees on their lands. Some of these trees (*Populus deltoides*, *Dalbergia sisso* and *Salix* species etc) are used in wood based industries generating US \$ 2 Million income and contribute to the economic up lift of the area. The study also showed significant difference among ownership categories at tehsil as well as district level. Baig *et al.* [5], conducted a study of three plantations to assess people participation in the farm

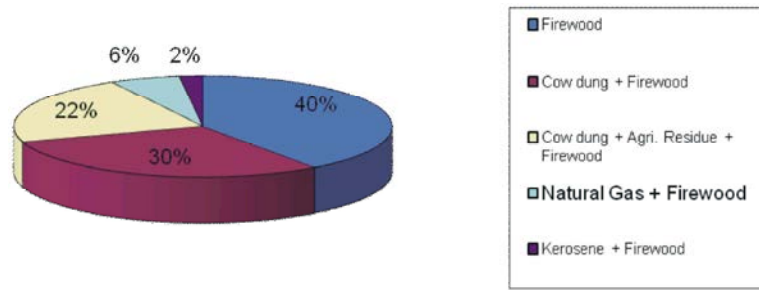


Fig. 1: Various Fuel sources

Table 1: Various Sources of fuel.

| S.No | Sources of Fuel                       | No. of respondents | Percentage |
|------|---------------------------------------|--------------------|------------|
| A    | Firewood                              | 20                 | 40         |
| B    | Cow dung + Firewood                   | 15                 | 30         |
| C    | Cow dung + Agri. Residue+<br>Firewood | 11                 | 22         |
| D    | Natural Gas + Firewood                | 3                  | 6          |
| E    | Kerosene + Firewood                   | 1                  | 2          |
|      | Total                                 | 50                 | 100        |

Table 2: Source of seedlings.

| Source of seedlings | No. of Respondents | Percentage |
|---------------------|--------------------|------------|
| Forest department   | 6                  | 12         |
| Private nursery     | 19                 | 38         |
| Market              | 12                 | 24         |
| Own Arrangement     | 13                 | 26         |
| Total               | 50                 | 100        |

forestry program in West Bengal. About 15% of the participants' farmers from each plantation were randomly selected as respondents. The primary data was collected to cover consumption pattern of beneficiaries, sources of information relating to planting and attitude towards farm forestry. It concluded that the participant had failed to realize the programs as means of economic profits following improved and use. Provosto *et al.* [17] carried out brief analysis of species indigenous to Peshawar valley and found these slow growing. Under such circumstances a multipurpose fast growing tree species (poplar) successfully planted to the advantage of grower. It provides important raw material for match industry, sports good, veneer and pulp and paper, chipboard, packing cases doors windows, scaffolding, furniture making and housing of Afghan refugees. The rates of poplar woods are settled between the grower and buyers at different time i.e. before harvesting during the time of cutting and after the wood has been staked. The poplar growers use mechanized transport like trucks and trailers as well as traditional means like animals and their packing. The grower sold 15.29% of the poplar to village retailer and 77.65% to outside traders. A substantial tradition is

made to price of poplar wood by marketing agents and the poplar grower received only 25% the retail price in Mardan. There is a wide gap between the consumers pays or poplar that received by the farmers for his produce. He stated that the planting of trees on farm and marginal lands is not a new concept in Pakistan. Farmers have been planting trees on their lands usually in un-systematic way even since they started agriculture. Pakistan meet 90% of her domestic energy requirement of fuel wood and 50% of the timber needs from farmland resources. Matthews *et al.* [16] describes that the farmers in Mardan valley have been planting various kinds of trees as part of land management system. Introduction of poplar was of great significance and dramatically changed the rural landscape. It constitutes raw material vital not only for flourishing matches industry, but also for well established veneer and sports industries. Match factories offer good price for wood supplied by the poplar growers. Poplar from other locations in Pakistan has been found inferior in quality and color to that of Peshawar and Mardan valleys. Caviglia and Kahn (2001) stated that due to changes in the forest management policies during the last 15 years farm forestry in Viet Nam has been developing rapidly and widely. According to statistics there are at present about 60758 farms of which 1630 are forestry farms (only 2.6% of the total number of farms in Viet Nam) having land area more than 10 ha and annual goods value more than 40 million Viet Nam dong. In farm forestry on an average forest land occupied 90%, agricultural land occupied 8% and other lands occupied 2% Farm forestry in Viet Nam is distributed unequally from place to place, found mostly in the north of the central zone (18.7%) and northern mountainous zone (13.7%). However, farm forestry in Viet Nam is now at early stage of development and has mostly no harvest. Farm forestry in Viet Nam has, different types, of which comprehensive farm forestry is the most popular. The main tree species used for planting in farm forestry in Viet Nam are Eucalyptus, Acacia, Pinus and Melateuca. Although farm forestry is newly developed in Viet Nam;

it has already contributed greatly to rural livelihoods and created more jobs for the local people. Some sustainable and effective farm forestry models have been successfully established. A number of large forestry farms operate on sustainable forest management and are on the way of getting forest certification.

**Advantages of Agroforestry:** It should be noted that the attempts being made under agroforestry are to optimize the use of land for agricultural production on a sustainable basis at the same time meeting other needs from forestry [20]. Nitrogen-fixing and non-nitrogen-fixing trees thrive adequately in agroforestry with annual crops, presents a farming system in which arable crop yields can be enhanced. The tree rooting system brings about stability that can lead to soil conservation. What is needed would be mutual interaction and proper management techniques that would reduce the adverse effects that may result when trees are integrated into agro-ecosystem [21]. Various authors (Kang *et al.*, 1990; Young, 1986) were of the view that successful agroforestry practices benefits the farmers in the following ways:

- Consistent restoration of the fertility status of the soil through the recycled litter deposition and nitrogen fixing mechanism of trees.
- A variety of products, firewood, poles, woodcraft, fodder, medicinal herbs and food for livestock and man respectively.
- Prevention of wind and water erosion by trees acting as wind break and intercepting the raindrop impact on the soil respectively.
- Improving the micro-climate effect of the immediate and adjoining environment.
- Restoration of water table to an absorbable level for crops use.
- Increased income opportunities.
- Increased economic stability
- Reduce cost for establishing plantation
- Increased ability to manage for sustained yield.

### CONCLUSIONS

The role of Agroforestry in sustainable land use system cannot be over emphasized. Agroforestry practices offer practical ways of applying various specialized knowledge and skills to the development of rural production systems. It evolves a synergy between agricultural production and forestry that is beneficial for increased food production, sustainable wood production

and improvement of the quality of the soil. In present study, it is well recognized that systemic and scientific introduction of woody perennials in farming system (with proper operational strategies) is sound for sustainable development and resource conservation for generations to come. In general, an effective agroforestry strategy should provide sustainable productivity, economic viability, ecological suitability and social acceptability to the rural poor. Agroforestry programme need to be implemented through the active participation of farmers who will be the beneficiaries of the project. Role of women through active participation for self employment should also be vital in agroforestry practices. Agricultural Universities, Agriculture Department & Environment and Forest Department should work hand in glove in an organized manner and have to provide all the technical guidance to the farmers for raising nursery, planting and after care. Thus, it can be concluded that holistic approach through agroforestry holds promise to satisfy all human needs (food, fuel, fodder, timber etc.) and it also can act as an insurance against drought, flood and natural calamities those are familiar to north-east region of India. Besides, agroforestry can provides soil and environmental protection, wasteland development, conservation of biodiversity and long term economic security ensuring high cash return and employment opportunity to the rural poor.

### RECOMMENDATIONS

In the light of above conclusion following recommendations are made.

- Forest extension service be expanded and intensified in the Pakistan.
- Privatization of nurseries will transfer skill and increase job opportunities.
- There is a lack of coordination between farmers and forest department.
- Farmers should be motivated and educated to grow trees along the periphery of agriculture field in North South direction to minimize its negative effects on agricultural crops.
- A balanced agreement between owner and tenant/lessee regarding the trees growing on farmlands is required. Owners should be motivated/ convinced to share the benefit of farm trees with tenant/lessee.
- Poor farmers should be provided seedling on subsidized rates to encourage them to plant more trees on their farm lands. This will have social and

- environmental impact in the larger interest of society.
- Suitable wood tree species need to be introduced to the farmers.
- There is a need to create awareness among the farmers regarding the importance of indigenous species as well.

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