

AGROFORESTRY IN KHYBER PAKHTUNKHWA: CURRENT SITUATION AND FUTURE PROSPECTS

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ABSTRACT

Agroforestry is the most viable option for increasing tree cover and fulfilling growing demands for timber and fuelwood in the country. Agroforestry has made substantial progress in Khyber Pakhtunkhwa under various social forestry projects launched by the government with support from international donor agencies. However, the adoption of agroforestry practices are slow in the province due to several reasons. Farmers' attitude and perception, small landholdings, land tenure system, limited marketing opportunities and shortage of planting material are the main reasons for slow adoption of agroforestry practices in Khyber Pakhtunkhwa. There is an urgent need to promote agroforestry in the province which will diversify farm income, reduce land degradation, improve agro-biodiversity and enhance carbon stocks in the farming systems. This can be achieved by strengthening research and extension services in the agroforestry sector, providing incentives to farmers to grow trees on their farmlands and developing their capacities to produce quality planting stock at local level and manage farm plantations.

INTRODUCTION

Pakistan is an agricultural country where the majority of the population depends on agriculture for their livelihoods. Agriculture contributed 24% to the Gross Domestic Product (GDP) of the country during 2005-2010 (Govt. of Pakistan, 2010). Wheat, rice, maize, cotton and sugarcane are the major crops grown in the country. Beside agricultural crops, trees are also grown on farmlands for domestic and commercial purposes. Over the last three decades, wood production on farmlands has significantly increased. About 72% of timber and 99% of fuelwood requirements are obtained from farmlands (Wani *et al.*, 2004). According to an inventory of farm plantations there are about 330 million trees on farmlands with an average density of 20.5 trees/hectare in Pakistan (Govt. of Pakistan, 1992). Out of the total cultivated land of 22.15 million hectares, only 2% has so far been brought under tree cover. This can be easily increased to 10% (Nouman *et al.*, 2006). However, agroforestry is faced with numerous challenges due to which the full potential of tree cultivation on farmlands has not been exploited. There is a pressing need to increase tree production not only to meet the material needs of the growing population but also to enhance the environmental and ecological services being provided by the trees. The only viable option to meet this goal is to increase tree cultivation on private farm lands by promoting agroforestry.

Agroforestry has been practiced in Khyber Pakhtunkhwa for centuries; it is an important source of timber and fuelwood as 70% of urban and 97% of rural household use fuelwood as the main source of energy (Khurshid, 2005). An inventory of farm plantations shows 80 million trees growing on farmlands of which 67% are on irrigated farms and the rest 33% on rainfed farmlands. Average tree density was 47 trees per ha in

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the province. Poplar, making up 24% of the total tree stock, is the predominant species grown on farmlands (Amjad, 1991).

Agroforestry is defined as land-use systems and practices where woody perennials are deliberately integrated with crops and/or animals on the same land management unit (ICRAF, 1992). Actually, agroforestry is a new name for a set of practices and approaches that have been developed by farmers over thousands of years. Agroforestry is practised in Khyber Pakhtunkhwa in different patterns and forms which range from mere protection of naturally growing trees to artificial planting of trees on farmlands. The more traditional form of agrogorestry in the province is a complex agrosilvopastoral system that combines native trees, shrubs, grasses, agricultural crops and animals on the farmland. It is generally practised at a subsistence level (FFSP, 2008). However, this system has been more recently converted into a more commercial agroforestry by donor-funded social forestry projects which have encouraged fast-growing exotic timber species to be incorporated into the system.

The government has been trying to promote agroforestry in the province to increase wood supply and reduce pressure on the natural forests. In this connection, numerous social forestry projects have been implemented in the province with technical and financial assistance from international donors to improve tree production on farmlands. Though encouraging results were achieved by these projects in terms of increasing farmland plantation and motivation of the general public towards tree protection, progress has not been as rapid as expected due to the lack of large-scale practical measures (Ahmed and Mahmood 1998). People's participation in agroforestry activities is low because most social forestry projects mainly focused on biological and technical aspects while the socio-economic aspects were largely ignored and little attention was given to the perceptions and priorities of landholders (Akbar *et al.*, 2000). The objectives of this study are to examine the current situation of agroforestry in Khyber Pakhtunkhwa, identify barriers to plantation on farmlands and suggest measures for promotion of agroforestry in the province.

Forest Resources of Khyber Pakhtunkhwa

Located in the mountainous north of the country, Khyber Pakhtunkhwa is the smallest and most forested province of Pakistan. It has a total area of 10.17 million hectares with 17.7 million population. It has a forest cover of 17% against 4.8% of the country's overall forest cover (Steimann, 2004). A comparison of the landuses in Khyber Pakhtunkhwa and overall country is presented in Table 1. The province is gifted with highly valuable natural coniferous forests which host rare biodiversity and protect upland watersheds that are the sources of water supply for irrigation and hydropower generation for the whole country (Ali *et al.*, 2007). These forests also provide timber, firewood, fodder and non-timber forest products, not only for the local population but also for other parts of the country.

Table 1. Comparison of land use in Khyber Pakhtunkhwa with whole of Pakistan

Landuse	Pakistan		Khyber Pakhtunkhwa	
	Area (million ha)	%	Area (million ha)	%
Forest	4.244	4.8	1.684	17.0
Agriculture	20.580	23.0	1.546	15.0
Rangeland	28.507	32.0	4.894	48.0
Barren land	26.893	31.0	0.138	1.0
Water bodies	0.913	1.0	0.064	0.9
Urban	0.138	0.2	0.004	0.1
Unclassified	6.725	8.0	1.844	18.0
Total	87.98	100	10.174	100

Source: Govt. of Pakistan, 1992.

Agroforestry in Khyber Pakhtunkhwa

The history of growing trees on farmlands in Khyber Pakhtunkhwa, like other areas in the world, is as old as farming itself. The modern concept of agroforestry in the province was born with the introduction of donor-assisted 'Social Forestry' in Pakistan in 1980s. The basic concept of social forestry was to grow trees outside traditional forest areas mainly to meet the growing demands for fuelwood, timber and fodder and thus reduce the pressure on natural forests (Afzal and Malik, 1999). The efforts to increase tree cover on farmlands were further strengthened when the scientists of the Pakistan Forest Institute started research on two important exotic tree species, *Eucalyptus* spp. and *Populus* spp. The research findings showed that *Populus* spp (*Populus euramericana* and *P. deltoides*) and *Eucalyptus camaldulensis* are highly suitable for plantation on farmlands in the country and particularly in Khyber Pakhtunkhwa. It was also found that *Eucalyptus camaldulensis* was exhibiting very fast growth and biomass production in irrigated and marginal lands and thus it was recommended for planting on a variety of lands including irrigated and rainfed farmlands, saline and waterlogged areas and barren hills where other species had largely failed. The remarkable performance of poplar and *Eucalyptus* made them the predominant planting species in Khyber Pakhtunkhwa and other parts of the country (Baig *et al.*, 2008).

Agroforestry is practised on commercial basis in the central plains (Peshawar valley) of the province where irrigation water is abundant, soil is fertile and landholding size is relatively large. In these areas poplar (*Populus euramericana* and *P. deltoides*) and shisham (*Dalbergia sissoo*) are the preferred species, planted mainly on the boundaries of agricultural fields and along water courses (Khurshid, 2005).

Irrigated farmlands have more tree density than non-irrigated farmlands. The average number of trees per ha were 72 and 27 on irrigated and non-irrigated farms respectively (Amjad, 1991). Poplar, Shisham, Bakain and Mulberry are the predominant species in irrigated areas whereas Ber, Ailanthus are the main species grown on non-irrigated farms.

Social Forestry Projects in Khyber Pakhtunkhwa

Agroforestry was mainly promoted by social forestry projects in Khyber Pakhtunkhwa. Most of these projects were predominantly donor-financed, a few were NGO-driven and some have been initiated by the government (FFSP, 2008). An overview of the forestry related initiatives in Khyber Pakhtunkhwa is presented in Table 2. Most of these projects have attempted to increase tree cover on the farmlands which have high potential for tree growth. Some of the promising projects are discussed in detail below.

Table 2. List of Social Forestry Projects in Khyber Pakhtunkhwa

S.No	Project	Donor	Budget (million US \$)	Period
1.	Watershed Mgt. Project	WFP	150	1971-2001
2.	Siran Development Project	GTZ	25	1981-2000
3.	Kalam Integrated Development Project	SDC	20	1981-2005
4.	Malakand Social Forestry	SDC	20	1985-1995
5.	Social Forestry Project	USAID	50	1985-1995
6.	Forestry Sector Project	ADB	14	1996-2004
7.	Farm Forestry Support Project	SDC	-	2000-2008

Source: Baig *et al.*, 2008

Agroforestry Systems and Practices in Khyber Pakhtunkhwa

Agroforestry is practised in Khyber Pakhtunkhwa in different patterns and forms, ranging from mere protection of the naturally growing trees to artificial planting of trees on farmlands (FFSP, 2008). An agrosilvicultural system is the most common agroforestry system practised in the area. This system was mainly promoted by social forestry projects in the area. In this system fast-growing exotic tree species such as *Populus euramericana*, *P. detoides*, *Ailanthus altissima*, and *Eucalyptus camaldulensis* are raised on the boundaries of agricultural fields and along water courses, in single rows but sometimes double and multiple rows with spacing ranging from 2X2 m to 5X5m. The trees are raised on 8-10 year rotation and the timber and firewood are either sold to middlemen or directly supplied to wood industries or enterprises. Agricultural crops grown in agrosilvicultural system include wheat, maize, sugarcane and different kinds of vegetables (Subhan, 1990).

An agrosilvopastoral system is another agroforestry system applied in this area. It is the complex combination of multipurpose trees, shrubs, grasses, agricultural crops and animals on farmland (Stepler and Nair, 1987). This system has traditionally been practised in Khyber Pakhtunkhwa. The trees are grown for fuelwood, fodder, timber or soil conservation, and are a source of cash income whereas agricultural crops, including cereals and vegetables, provide food for the farm household. Animals provide manure for crops and food for the household and are also used as a source of cash income. This is a highly complex, interdependent and integrated form of agroforestry. Traditionally mainly

native tree species like *Acacia modesta*, *Zyzyphus nummularia*, *Morus nigra* and *Dalbergia sissoo* were grown in this type of agroforestry system. But now, exotic species (mentioned under Agrosilvicultural system) are becoming dominant. Various shrub species like *Sesbania seban*, *Leucaena leucocephala* and *Acacia* are also grown for fodder or soil conservation and soil fertility management. The grass is allowed to grow in inter spaces and cut for stall feeding of livestock. Sometime the grass is used for hay making. Silvopastoral systems that combines trees and pastures are practised on limited scale (Amin, 1987).

Another system is the cultivation of blocks of nitrogen-fixing trees like *Acacia nilotica*, *Robinia pseudoacacia* and *Sesbania sesban* to restore soil fertility of agricultural fields with side benefits of firewood and fodder (Dove, 1997). In some areas, intercropping of food and or vegetable crops is found between tree rows. In most cases the trees are scattered along the boundaries of agricultural fields or planted along water courses. Linear and block plantations are rare. Trees are also grown in clusters in the courtyards of farm houses and around the traditional wells to provide shade to the oxen that are used as motive force to draw water from the wells by Persian wheels. Zubair and Garforth (2006) reported that farmers mostly grow trees on the boundaries of their farms as shelterbelts to protect crops from wind and other climatic extremes. However, due to the farmers' lack of knowledge about silvicultural requirements of trees, no attention is given to proper spacing and form of plantations which can reduce the shade effect.

In the northern part of the province, the soil and climatic conditions are highly favourable for fruit cultivation. In this area fruit orchards have been established in canal irrigated farms and timber species are grown on the boundaries of the orchards, mainly as shelterbelts (LEAD, 2004). The most common fruit species are citrus, apple, peach, apricot, plum and pear. This type of farming is now gaining popularity due to better financial returns compared to other farming systems. Fish ponds are also being integrated into the system to make it more diversified and efficient. Sericulture and apiculture are also practised but on a limited scale (Dove, 1997).

Constraints and Challenges in Agroforestry in Khyber Pakhtunkhwa

Though agroforestry has made substantial growth in Khyber Pakhtunkhwa, its wide adoption is hampered by several factors. Some of the main challenges for agroforestry in Khyber Pakhtunkhwa are discussed as follows.

Farmers' attitude and behaviour

Adoption of farm forestry is mainly affected by the farmer's perception of the economic benefits coming from tree cultivation. McGinty *et al.* (2008) argue that economic incentives are most important for farmers in undertaking tree planting on their farms. Similarly, Katze *et al.* (1963) assert that the rate of adoption of innovation is directly influenced by the economic attribute of that innovation. The decisions of farmer are also influenced by short-term economic and social benefits. Zubair and Garforth (2006) found that farmers are willing to grow trees on their farms even if trees have bad effects on agricultural crops because of the high profits and low cost associated with trees.

Small Landholdings

In Khyber Pakhtunkhwa average landholding size is less than 3 ha whereas the national average is about 4.5 ha. This landholding is too small to support commercial farm forestry (Khattak *et al.*, 1980). Most farmers are primarily concerned with food production, firstly for domestic requirements and secondly, as cash income. A commonly reported concern of farmers regarding tree cultivation on farmlands is their depressing effects on annual crop yields. Farmers worry about tree-crop competition not only for light, soil and water but also for labour. Therefore, they show little interest in growing trees on farmlands. Trees are mostly grown on marginal lands which are not suitable for annual crops.

Land Tenure

Land tenure is an important factor in the success or failure of agroforestry initiatives. Land tenure is highly complex and ill-defined in Khyber Pakhtunkhwa. Agroforestry on private farmlands has several dimensions depending on the land tenure arrangement in the farmlands. Where the farmland is cultivated by the landholder himself, the chance of success of farm forestry is high (Zubair and Garforth, 2006). On the other hand where the farmland is cultivated by the tenant on the basis of crop sharing, farm forestry is usually not successful as most such arrangements exclude tree benefit sharing with tenants. About 45% of total farms are managed by the tenants who take little interest in protection and raising of trees and sometime develop hostile attitudes towards trees on farmland (Govt of Pakistan, 1992).

Marketing

Marketing of tree products is an important aspect of farm forestry. Unavailability of markets and lack of access to information about marketing has resulted in serious constraints for tree cultivation in the province. On the other hand, this has enabled the middlemen to establish their monopoly on the wood trade and maximize their profits in the farm forestry business at the cost of tree growers (Khurshid, 2005). Due to the involvement of middlemen in the wood trade, growers have not received the expected returns from the sale of trees. Social Forestry projects emphasizing tree production did not realize the importance of proper marketing for the produce. No industry was established for the consumption of timber grown on farmlands. For example *Eucalyptus* was mainly promoted for pulp and paper production but when the crop reached harvestable stage, there was no industry to utilize this large quantity of wood (Akbar, *et al.*, 2000). As a result the tree growers were highly discouraged and they had no option but to sell their crops for fuelwood purpose on very low prices. A platform is needed at local and district level where tree growers get information about marketing and can directly contact industries to sell their products. Moreover, introduction of supporting wood prices by the government as is done for agricultural commodities will also help to encourage tree growing on farmlands.

Shortage of Planting Material

Shortage of planting material in the planting season is also a major deterrent for farmers. There is no network of nurseries in the province. Most of the seedlings are

provided by Forest Department nurseries which are not easily accessible to the majority of farmers. These nurseries are either situated in the forest areas or deficient in the desired planting material (Dove, 1997). Farmers do not have the skills and resources to establish their own nurseries to generate planting stock. It is generally thought in social forestry circles that seedlings are never in such short supply as to pose a constraint to tree cultivation, but the case is different in Pakistan and particularly Khyber Pakhtunkhwa where the lack of nurseries coupled with poor access is a major constraint to farm forestry.

Other Factors

Cultivation of trees on farmlands is driven by numerous variables such as location of village, presence or absence of natural forest resources and availability of labour (Khurshid, 2005). The location of a village near a natural forest reduces the willingness of farmers in that village to plant trees on their farmlands as they can easily access the natural forest to meet their wood requirements. Similarly, the location of a village near an urban centre results in low interest in farming activities, as most people in that village pursue off-farm means of livelihood. On the other hand, where there is shortage of labourers, landholders prefer perennial crops like trees which require less labour than annual crops.

Future Prospects of Agroforestry in Khyber Pakhtunkhwa

Since the area under forest cover in Pakistan is very small (less than 5%), and the population is very large (170 million), the forest resources are insufficient to meet the demands of growing population (Afzal and Malik, 1999). Forest areas cannot be increased by converting fertile agricultural land into forests due to the rising demands for food by the growing population. In addition, water resources are scarce and cannot be used for raising plantations on wasteland. The only viable option to increase wood production in the country is increasing tree cultivation on farmlands. According to Singh, (1987) "If integration of trees with agricultural systems is needed anywhere in the world, the plains of Pakistan deserve the highest priority".

Despite numerous challenges, agroforestry has significantly increased in the last few decades. About 46% of timber and 90 % of fuelwood requirements are met from plantations on farmlands (Wani *et al.*, 2004). Though farmers are still not fully convinced to incorporate trees into their farming systems, the introduction of poplar, a multipurpose tree, has changed the rural scene in some areas. There is tremendous demand for poplar wood from various wood-based industries in Pakistan and it is now increasingly exported to neighbouring Afghanistan where it is used in house construction and light furniture. It has also been established that *Eucalyptus* can be successfully grown on marginal lands where average annual rainfall is about 300 mm. Thus, there is a wide scope for promotion of these species in Khyber Pakhtunkhwa.

There is good scope for promotion of agroforestry in Khyber Pakhtunkhwa due to the end of the formerly abundant supply of free wood from nearby common forests. It is now becoming difficult to collect wood from distant forests due to the degradation and depletion of these forests. This has intensified the local demand for farm wood as the

local population continues to increase. Thapa (1990) has also reported that farmers' attitudes regarding fuelwood and fodder plantations on their farms depend on the availability of fuelwood and fodder from public forests. As long as these commodities are easily available from public lands, farmers will have little interest in growing trees on their farmlands.

Wood marketing is improving for tree growers due to the steep rise in wood prices. Besides, wood demand is also continuously increasing due to the growing population in the country and also due to reconstruction efforts in neighbouring Afghanistan which mainly depends on wood supply from Khyber Pakhtunkhwa. Though middlemen are still dominant in the wood business, their role is now helpful in promoting wood marketing (Keerio and Kella, 1996). The private sector is now becoming more efficient in marketing trees and the institution of middleman is not inherently bad, it is the distribution of benefits among the growers, middlemen and consumers that needs to be rationalized through access to updated marketing information for promoting tree production on farmlands (Rafique, 1993). A more promising option is to rationalise the distribution of the benefits among growers, middlemen and consumers.

Policy Implications

Agroforestry development requires durable and effective policies at local, provincial and national levels. Currently there is no specialized department overseeing agroforestry in Khyber Pakhtunkhwa. The Forest Department is concerned with natural forests and has few linkages with farmers whereas the Agricultural Department focuses on food production and has no expertise in tree production (Afzal and Malik, 1999). There is a need to establish a full-fledged department for promotion of agroforestry in the province. Promotion of farm forestry will diversify farm income and thus assist in poverty reduction in rural areas. Plantations on farmlands will reduce land degradation, improve agrobiodiversity and enhance carbon stocks in the agricultural systems paving the way for climate change mitigation. Farmland plantations will also increase wood supply in the country and will divert pressure from the natural forests for fuelwood, timber and fodder.

Research and extension services in the agroforestry sector need to be strengthened. Research should be conducted to fully investigate the effects of various trees on different agricultural crops and best combinations of trees and food crops in various ecological zones of the Khyber Pakhtunkhwa should be identified. There is also a need to determine proper spacing and cultural practices to minimise negative impacts of trees on crops and agricultural fields. Farmers are willing to plant trees provided the species are fast growing and have a good market value. The information available so far indicates that a great potential exists for agroforestry in Pakistan. However, the development efforts need to be backed up by necessary research to find solutions to the various problems encountered (Sheikh, 1987). The findings of research should be communicated to farmers through effective extension services at community and farm levels.

Farmers can be motivated by providing them incentives in the form of reducing water prices for tree growers and providing them with saplings and fencing materials. There is also a need to develop the skills of farmers in nursery raising and planting and

provide technical and financial support for this purpose. This will not only increase seedling supply for planting on farmlands but will also provide farmers with an additional source of income (Zubair and Garforth, 2006).

CONCLUSIONS

Due to enormous efforts by the government and donor agencies to promote agroforestry in Khyber Pakhtunkhwa, some significant landmarks have been achieved and the tree density on farmlands in the province increased to 47 trees per ha in 1991 which was more than double of the national average. However, overall adoption of agroforestry has been slow and its full potential has not been exploited. Plantations on farmland still face several challenges. Agroforestry has not been properly organized and a large majority of the rural community is still not fully motivated to plant trees on farmlands due to their mistaken beliefs about the impacts of trees on agricultural crops. People's participation in agroforestry activities is low because most social forestry projects have mainly focused on biological and technical aspects while socio-economic aspects have been largely ignored. Little attention has been given to the perceptions and priorities of landholders in agroforestry interventions. Poor marketing, the land tenure arrangements and the narrow base of the traditional farming systems in the province are some other constraints to agroforestry.

Despite numerous challenges and constraints, there is good scope for agroforestry development in Khyber Pakhtunkhwa. Plantation on farmlands is the only viable option for increasing wood production in the country and reducing pressure on the meagre natural forests. Due to the growing population, demands for fuelwood and timber also increase. As a result, wood marketing is improving and tree growers are now obtaining better returns for their produce. There is also a need for a durable farm forestry policy and provision of incentives to encourage farmers to grow trees on their farmlands. The skills of farmers in nursery raising and planting need to be developed and technical and financial support should be provided for this purpose. Development efforts should be backed up by necessary research to find solutions to the various problems still encountered in agroforestry.

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