

PN-ABW-225
95300

**POLICY WORKSHOP ON " INVESTMENT PRIORITY FOR
WATERSHED MANAGEMENT IN NATIONAL PERIODIC
PLANS" 11-15 JUNE, 1991, BEIJING, CHINA.**

COUNTRY REPORT

ON

PAKISTAN

BY

**RAFIQ AHMAD, DEPUTY INSPECTOR GENERAL OF FORESTS,
MINISTRY OF FOOD, AGRICULTURE AND COOPERATIVES,
GOVERNMENT OF PAKISTAN**

AND

**ABDUL HAFEEZ QAISAR, CHIEF WATER RESOURCES, PLANNING
COMMISSION, GOVERNMENT OF PAKISTAN**

THE COUNTRY

1.1 Pakistan is situated between 24 and 37 North latitudes and 61 and 75 East longitudes. It occupies a surface area of 79.61 million ha, of which 57.96 million ha (73%) have been surveyed. It has lofty mountains and towering peaks with heights ranging upto 8534 meters in the northern and western regions. The southern fringe is a sandy desert.

2 CLIMATE

2.1 Pakistan has a continental type of climate. The country suffers from a general deficiency of rainfall. Annual precipitation varies widely from less than 125 mm to 1500 mm. Monsoon precipitation dominates in some areas while in other parts a winter precipitation pattern prevails. 60 to 70 percent of the Monsoon rain is received during the months of July, August and September, while the rest of it is received in the winter months from December to February. In the hot weather occasional light rains follow dust storms.

2.2 The average temperatures vary considerably. During the hottest parts of the year, May and June, daily maxima generally exceed 38⁰ c, while in the south and southwest maxima frequently exceed 49⁰ c. In the winter months, the minimum temperatures in some places even in the plains are several degrees below the freezing point. Because of high summer temperatures and the resultant high evapo-transpiration rate, effectiveness of rainfall is low except in the northern belt of Himalayas and Karakoram mountain ranges and adjacent tracts.

3. POPULATION

3.1 Pakistan has the 14th highest rate of population increase among countries with more than 1 million people. The 6th Five Year Plan (1983-88) estimated 105 million people by end of the year 1988. With the present 3.1% growth rate, the population is

expected to become 150 million by the year 2000. Density per sq km by arable land and per acre by cropped area for the last three census reports is tabulated as under:

Table - 1

POPULATION DENSITY PER SQ KM BY ARABLE LAND AND CROPPED AREA PER ACRE IN RURAL AREAS

Area/Province	Density by arable land per sq km			Density by cropped area (per acre)		
	1961	1972	1980	1961	1972	1980
Pakistan	220.51	295.41	365.51	0.868	1.082	1.216
NWFP	427.75	632.31	884.46	1.602	2.358	2.967
Punjab	211.64	253.40	321.21	0.811	0.918	2.052
Sindh	159.74	259.90	340.69	0.588	0.891	1.065
Balochistan	94.36	227.50	367.35	0.663	1.304	1.909

3.2 A rise in the population pressure on arable land and cropped area is discernible from Table-1. The population density per sq km of arable land in rural areas has risen from 221 in 1961 to 365 in 1981. The worsening land man ratio indicates a wide differential in density across provinces. Punjab sustains 230, Sindh 135, NWFP 148 and Balochistan 12 persons per km. in 1981. The population pressure on arable land and average cropped area is highest in NWFP.

4. LAND USE

4.1 Half of the country's area forms the Indus Basin, yet only 25% of it is under cultivation. Approximately 20 million ha. are used for agriculture (nearly 16 million ha. of it irrigated and just over 4 million ha. in rain-fed agriculture). Forests comprise 4.74 million ha. or 5.4% of the total area. The rest of the land consisting of 28.42 million ha. (32.3%) is unclassified. The land utilization profile is given below:

Table 2.
Land Utilization

<u>Land use</u>	<u>Area (million ha.)</u>	<u>%</u>
1. Forests	4.74	5.4
Productive	1.48	
Protective	3.26	
2. Arable land	20.54	23.0
3. Culturable waste	11.03	13.0
4. Not available for cultivation	23.25	26.4
5. Unclassified	28.42	32.2
total:	87.98	100.0

4.2 Agriculture is the major land use in Pakistan. About 33.48 million ha. are cultivable but in absence of irrigation facilities, 20.54 million ha. (23%) are being cultivated. Permanent crops embrace 0.43 million ha. The remaining 11.03 million ha. (13%) are lying waste. A major part of culturable waste land and unclassified area is used as range lands for livestock grazing. The category "not available for cultivation" includes land rendered barren by water logging and salinity, areas under mountains, deserts, roads, canals, rivers, human habitations and, permanently devoted to pursuits other than agriculture. At the time of independence (1947), the percentage of waste land was comparatively high as additional arid areas of Thal in southern Punjab and Sindh have subsequently been converted into irrigated farmlands and forest plantations.

4.3 The forests consist of 4.74 million ha. or 5.4% of the country's area and are distributed according to types as follows:

Table 3.
Forest area by types

<u>Forest type</u>	<u>Area</u>	<u>Productive</u>	<u>(000 ha.) Protective</u>
Coniferous	1959	931	1028
Irrigated plantations	392	142	250
Riverain	296	246	50
Mangrove	347	-	347
Scrub	1702	158	1544
Others	41	-	41
Total	4737	1477	3260

4.4 About 1.5 million ha. (32% of total) are productive forests. The rest, 3.2 million ha, are protective forests which also includes un-productive forests for physical reasons. The supplies of timber from state forests amounted to 0.5 million m³. Against this, farmlands supply about 1.0 million m³ of timber annually. The annual fuelwood supplies from state forests are 2 million m³ and contribution of farm lands is about 20 million m³.

4.5 59% area of Pakistan is such where predominant land use is grazing. Out of total range land of 52.2 million ha only a fraction (10.853 million ha) is under the control of Provincial Forest Departments. The remaining area is un-controlled and un-managed. Rangeland are the major source of feed for about 97 million heads of livestock. These rangelands have been heavily overgrazed in the past, which has reduced the carrying capacity by 10 to 50% of their potential.

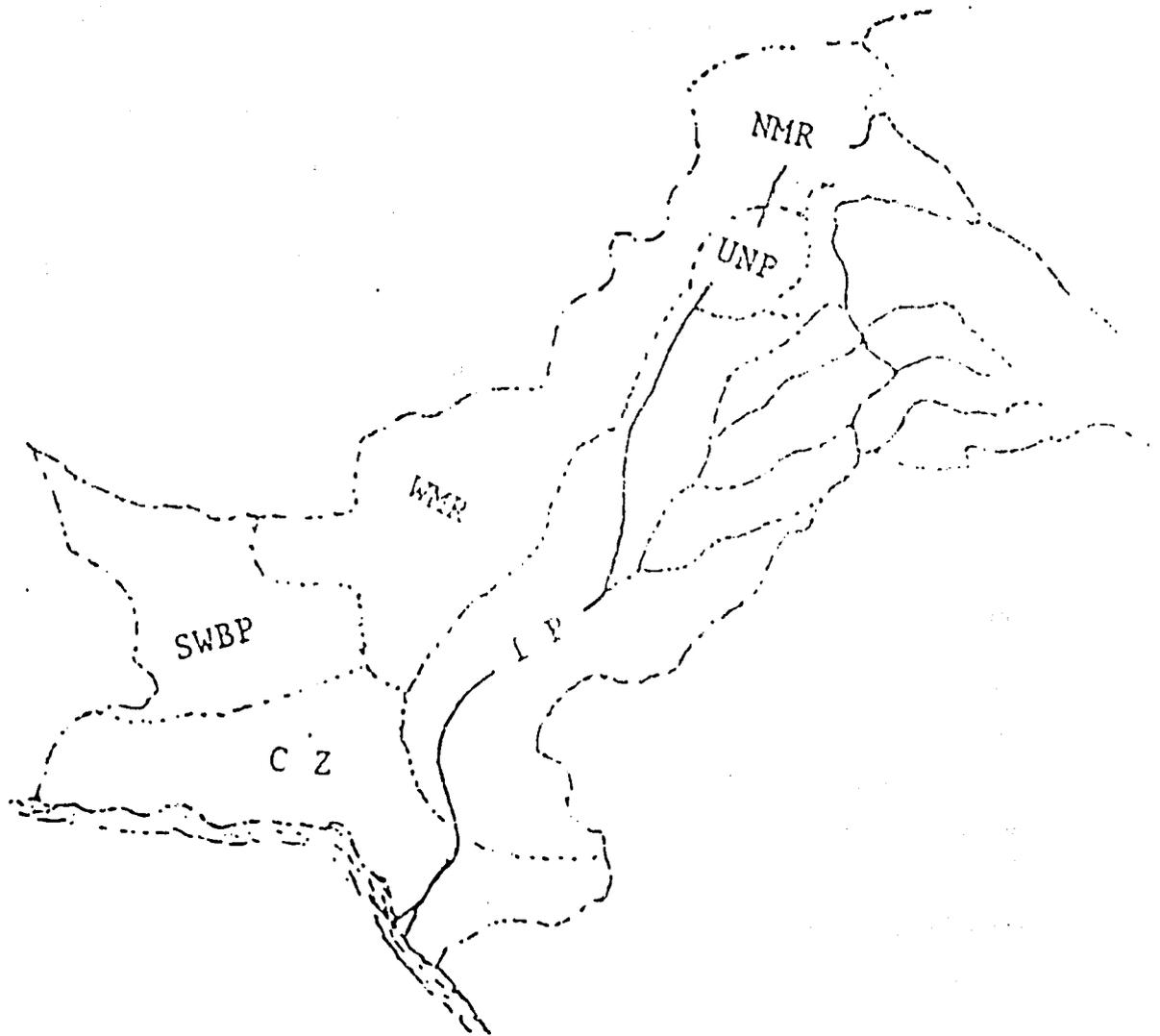
5. THE WATERSHEDS

5.1 REGIONS

5.1.1 Physiographic watershed regions of Pakistan are shown in figure 1. These regions are briefly described as follows:

5.1.2 Northern Mountain Region This area forms the catchments of the rivers Indus and Jhelum. It comprises mountain ranges of Himalayas, Karakoram and Hindu Kush. The total catchment area of upper Indus in the hills is 332,170 sq km out of which 209,668 sq km falls in Pakistan. Soil and water erosion is rampant in this region. Land slides, snow avalanches and other earth movements are quite common, attributable to improper land use because of growing human and live stock population. The major problems associated with soil and water conservation in this region are socio-economic. According to hydrological studies, soil to the magnitude of 200 to 380 tonnes per hectare is eroded annually from this region.

Fig. 1. Watershed regions of Pakistan



LEGEND

1. NORTHERN MOUNTAIN REGION
2. UPLANDS OF NORTHERN PUNJAB
3. WESTERN MOUNTAIN REGION
4. SOUTH WEST BALOCHISTAN PLATEAU
5. COASTAL ZONE
6. INDUS PLAINS

BEST AVAILABLE DOCUMENT

5.1.3 **The uplands of Northern Punjab** This region consist of 1,600 sq km catchment area of Haro and Swan rivers of the salt range. The area is subject to excessive geological and gully erosion. Misuse of lands, deforestation and over grazing are the main contributory factors towards accelerated erosion.

5.1.4 **Western Mountain Region** This area comprises the catchments of Kohat, Toi, Kurram, Zhob-Gomal and small torrents of Quetta Districts. Since the mountain areas are devoid of vegetative cover, therefore, flash floods are common. In this area ground water resources are exploited through an age old system of underground water channels (Karezes). In Quetta-Pishin valleys there are more than 300 Karezes to irrigate several thousand hectares of land.

5.1.5 **South West Balochistan Plateau** This region consists of extensive areas of Chaghi hills and Siahian range. It is not a water producing area because of extreme aridity. Large desert tracts are situated with Naukundi being the driest place with average annual rain fall less than 40 mm. A small part of the area is used for grazing and rain-fed agriculture.

5.1.6 **Coastal Zone** This comprises the catchments of Hub, Dasht and Poraliaud rivers which remain inactive throughout the year. Run offs are usually moderate because major part of precipitation being seasonal is either absorbed by soil or evaporates.

5.1.7 **The Indus plain** It covers 1,60,000 sq km and forms the core of country's land mass. The region itself produces little runoff. On account of alluvial plain, an extensive water distribution network has been developed to ensure regular and ample supply of water for irrigation. The present irrigation system consists of 3 storage reservoir at Tarbela, Mangla and Chashma, 16 barrages, 12 inter river link canals, 2 siphons and 43 main canals.

The total length of main canals, link canals, branches, distributaries, etc., is about 55000 km. Existence of a vast aquifer recharged from natural precipitation, river flows and seepage from canal systems underlying the Indus plain has been identified. The soft alluvial layers of the aquifer are favourable for large scale tube well installation in public and private sectors. About 3,00,000 tube wells have been installed to extend irrigation and supplement canal water supply. The ground water in the Indus Basin is of variable quality. It is non-saline near sources of recharge i.e rivers and major canals. It gradually becomes saline with depth as the distance from the recharge resource increases. Large scale withdrawal of ground water is creating differential zones resulting in lateral and vertical movement of saline water into fresh water zones.

5.2 State of Watersheds

5.2.1 The mountain areas of Pakistan are important for many reasons, notably the customary roles they play as the nation's watershed. These focus attention for those interested in forestry, conservation of wildlife resources, scenic beauty and, as centres of intense agricultural activity. The major watersheds and source of Indus waters are the northern areas, NWFP and mountainous areas of the Punjab. Excluding Balochistan, some 24.5 million ha. of watershed areas in the upper Indus and its tributaries lie within Pakistan. The watersheds suffer from very unfavourable soil and moisture regimes. Their management for forestry, agricultural, soil and water conservation purposes leaves much to be desired. Of the 34.28 million ha. of non-arable land in Pakistan, some 17 million ha. are in Balochistan. But the watersheds of Balochistan have little association with the rest of Pakistan, since they drain either internal or direct is into the Arabian Sea. Balochistan's major irrigation areas, however, depend on Indus water and thus on its upland watershed.

5.2.2 The major river basins are the Indus Basin, the Kharan Closed Basin and the Makran Coastal Basin. The Indus Basin covers about 70%, the Kharan and Makran Basins about 15% each of the country's area. The surface waters of the Makran Coastal Basin have not yet been exploited as the rivers are seasonal and remain dry during drought periods lasting from 3 to 5 years.

5.2.3 The largest potential of water lies in the Indus Basin. Its rivers draw water from albatation (summer snow melt) and precipitation. The rivers of Kharan Closed Basin discharge and evaporate in an inland basin. The Makran rivers originate from flash floods and flow directly in to the Arabian Sea. The river Indus and its major tributaries, Kabul, Chenab, Ravi, Beas and Sutlej form the major sources of surface water. With the implementation of Indus Basin Water Treaty (1960) Pakistan was left with three rivers viz, the Indus, Jhelum and the Chenab. All these rivers rise in spring and early summer with snow melt and monsoon rainfall and have a combined peak discharge in July or August. The annual average mass flow of water in the rivers Indus, Jhelum, Chenab and Kabul is 172 billion m³. For this purpose two multi-purpose dams at Tarbela on the river Indus and Mangla on the river Jhelum have been constructed for water storage of 9.5 MAF and 5.88 MAF and its regulation for irrigation and generation of hydropower. At peak flood level more than 1 million cusecs of water flows down into the Arabian Sea.

5.2.4 The need for watershed management stems from the holistic link between land use and watersheds' physical and biological characteristics. Watershed Management stresses the basic relationship between uplands and lowlands. Upland areas produce water, wood, forage and recreation received or enjoyed by the inhabitants of down stream areas. The prime link between the uplands and low-lands is water; important both in delivery and quality. The upland watersheds produce about 90% of the country's water for hydropower, irrigation, domestic supply, ground water recharge, on-site farming and natural vegetative growth.

5.2.5 The coniferous forests are located on comparatively steep slopes. As such they are not managed under the clear felling or uniform systems but are managed under a selection system which prescribes tree harvesting of specific size. During the last 10-12 years, successful efforts to change the system of management of the Kaghan valley forests from a selection system to intensive forest management, where trees are felled in small groups which are regenerated artificially by planting nursery raised coniferous seedlings have been made. At lower elevations forests of *Pinus roxburghii* are managed under a Punjab shelterwood system which is a modified form of the uniform system. The scrub forests provide valuable protective cover to the watersheds and are a source of fuelwood and fodder to local communities. The main management objective in these forests is to protect the watersheds while maintaining production. This area will never be able to produce large volume of wood per unit area.

6. EROSION AND SEDIMENT TRANSPORT

6.1 The Indus river carries the 5th greatest sediment load in the world through 2,896 km of its river channel from Himalayas to the Arabian Sea. Geological erosion is predominant in the upper Indus falling within active monsoon zone. Massive landslides of the vertical banks, alongwith seasonal glacier melting contribute substantially to the sediment load transported by Indus. The sediment production over the Indus basin is estimated at 4.49 tonnes/hectare. Anything over 5 tonnes per hectare is considered very severe. In the Tarbela catchment area (1,48,925 sq km) soil erosion has been measured at 2-4 kilograms annually per square kilometer, which equals 20-40 tonnes per hectare. An estimated 167 cubic meters of sediment are produced annually on each square kilometer of the Tarbela catchment area. In the first 10 years after construction of the Tarbela dam (1975-85), the reservoir lost 1.59 MAF which is 14% of its storage capacity. The Indus traverses through such difficult terrain that it carries a high sediment load

despite introduction of improved cropping and watershed management practices. Unless this situation is rectified, the Tarbela will lose another 1.59 MAF of storage ability which works out to 16% of its remaining capacity. Contrary to experience in Tarbela catchment, the rate of sedimentation in the Mangla watershed has been reduced from 42,000 acre feet per year in the 1950-60 period to 34,143 acre feet a year in the 1967-83 period because of a farmer-oriented multi-sectorial conservation project. The sediment yield per acre per year from agricultural range and forest land have been computed to be 21.0, 6.2 and 0.62 tonnes respectively. Consequently, annual sedimentation over the whole basin has been reduced to 18.7%. Benefit/cost analysis indicates that the internal rate of return is 25.8%. This calculation has been made on the basis of all the cost data, but using only one benefit stream i.e. the longer life of the Mangla reservoir. Ways to control sedimentation have known and well proved by practical experience in Pakistan for more than 30 years. The costs of such a programme are more than compensated for by the benefits of just the additional hydroelectric power. After counting the benefits to watershed farmers as a result of trees planted and soils conserved, the internal rates of return are even more impressive.

6.2 The trees and other vegetation in the watersheds keep the whole ecosystem intact. This vegetation protects the precariously carved out agricultural field in the Himalayas and keeps in position the huge boulders and rocks through its extensive root system. The thin mantle of top soil is only 15 to 20 cm thick and its depletion would dangerously compromise economic progress. It is therefore essential that the soil-water-plant relationship in the watersheds is kept in suitable equilibrium through proper measures. Forestry is the appropriate land use in the watershed areas for reducing sediment yield but more than 70% area of northern watersheds include agricultural and range lands. The faulty agricultural practices and heavy grazing pressure on range lands accelerate the soil erosion process. Through the loss of fertile

top soil of these watersheds, fertility of agriculture land is being diminished annually. Agriculture production is minimum in watershed areas which affect the overall socio-economic conditions of the mountain dwellers. Consequently, the inhabitants of the watershed areas depend on the forest land to meet their basic requirements for fuelwood and timber. In the words of M/S Hunting Technical Services Ltd. (1961) " the maltreatment of the water gathering grounds in the mountains can no longer be a matter of indifference to any section of the community, and the question of deforestation, population increase, overgrazing and the spread of cultivation in the hills must be faced sooner or later."

6.3 The annual population growth rate which is 5% amongst the mountain dwellers against country's 3.1% has contributed immensely to removal of vegetal cover, unregulated grazing and cultivation of agriculture crops on steep gradients in the watershed areas. As a consequence plant-soil-water relationship has been disturbed causing mass movement of soil such as debris avalanches, debris flow, earth slump, earth flow and soil creep. Road blockade due to landslides is a common feature in the hills. Its effect in the down stream areas is tremendous. In 1973, 1976 and 1988 floods, over 8 million ha. of land were inundated and about 70% standing agriculture crops were lost.

7. INSTITUTIONAL ARRANGEMENT

7.1 There is no single agency responsible for watershed management in Pakistan. The major agencies responsible for watershed management are the provincial Forestry Departments, the Soil Conservation Directorate of the Punjab Agriculture Department, the Watershed Management Directorate of the Water and Power Development Authority (WAPDA) and, the Agency for Barani Areas Development for Punjab (ABAD). These organizations undertake watershed management or soil and water conservation programmes according to the agency objectives. There are overlapping roles

w th the Forestry Departments having the key role in managing the up lands for both watershed and range management. However, these overlapping programme activities lack coordination.

7.2 Efforts to introduce soil conservation practices in the country are about 100 year old. The Land Preservation Act was enacted in 1900 for treatment of hill torrents and denuded hills of the Punjab. In 1939 a Soil Conservation Circle was created in the Punjab Forest Department for implementation of soil and water conservation measures. In North West Frontier Province an anti-erosion programme was initiated in 1946. During the same year, mechanical reclamation of gullied and ravined land was started in the Punjab. Similar type of work under the title of watershed was started in 1956 with the feasibility study for the construction of Mangla Dam on the river Jhelum. As a result of that study, Mangla Watershed Management Project was started in 1959 with the objective of arresting the in-flow of silt into the reservoir.

7.3 Watershed Management assumed significant importance with the signing of the Indus Water Treaty with India in 1960. To help formulate a watershed management project in the catchments of Jhelum and Indus, the U.S. Government sent a team of experts to assess watershed management problem. In 1960, the Government of Pakistan appointed an Agriculture Commission whose terms of reference, besides others, specifically included Watershed Management. Following its recommendations the National Forest Policy was revised in 1962 to provide for survey of the entire watershed areas, examining into the possibility of shifting hill population, terracing of agriculture lands, establishment of cooperative societies, encouragement of planting fruit trees on private farms and elimination of goats.

7.4 The first action oriented to minimize soil erosion and siltation of the reservoir was taken when the "Bhurban Experiment" was started in 1963. Followed by it, 14 watershed management

projects were planned and carried out. All these projects aimed at conservation of soil and water to save the multi-purpose reservoirs through improvement of socio-economic conditions of the local people. The watershed management projects have come to be understood as government programme to protect the reservoirs and not those intended to help the landowners to increase production from their lands. There was more emphasis on the construction of structural engineering work rather than revegetation works which could have contributed to more direct benefit to the landowners and provided longer service in terms of preventing soil erosion and conserving more water. Hence, the landowners did not identify themselves with the programmes. Instead of showing interest for the conservation treatments on their lands and contributing their maximum efforts to help the Forest Departments do the work, they tended to let the government do most of the work and minimize their own efforts (Duldulao, 1987) on account of their lack of awareness.

7.5 For the same purpose, the Directorate of Soil Conservation was created in 1956 which started a pilot project to establish demonstration areas throughout Pakistan. It was followed by projects in 1965 and 1970, covering several plateaus. Subsidy to the land owners was provided from 25 - 100% for use of bulldozer for levelling, planting trees, shrubs and grasses, improvement of water storage facilities, stream-bed training and several other improvement works such as gully plugging, diversion of water from gullies, etc.

7.6 Since 1956, 25 watershed improvement projects have been implemented by the provincial forest departments. As a consequence of operating a watershed management programme on a project by project approach, the efforts have been concentrated on small scattered areas. The larger more meaningful land use problems are ignored and allowed to accentuate until the resource base is degraded from productive to marginal or sub-marginal level. As a result of decreased on-site productivity the cost of productivity

recovery programmes accelerates beyond the means of the country's national budget. In Pakistan the project mode of the watershed management programme has only an effect on 5% or less of the land. It means that 95% of the land has not had the benefit of modern watershed and range management.

7.7 Khan (1987) has estimated the annual loss of Rs.2,589 billion to the nation resulting from degradation of the upland areas. Due to degradation of watersheds, timber supply is no longer adequate to meet the demand of population growing at a rate of 3.1% each year. Hence, Pakistan imports wood and wood products every year. The import bill on account of wood and wood products increased from Rs. 2880 million in 1987-88 to Rs. 3284 million in 1988-89 showing an escalation of 14% in just one year. This amount could have been saved if enough trees were still growing in the watersheds to meet the country's demand. Fuel wood supply is becoming scarcer and the price is increasing steadily. Consequently, considerable expenditure is being spent on procurement of alternate sources of energy such as fossil fuels etc. Because of environmental degradation and deforestation, wildlife which is one of the important components of the national economy for trade and tourist attraction is threatened with extinction. It is, therefore, impossible to quantify the losses to the national economy on account of denudation of watersheds. Nevertheless, it is certain that the loss is colossal and irreversible.

8. Existing Investment in Watershed Management in relation to other Sectors

8.1 The social base influencing watershed management in Pakistan is complex. It rests on a series of dynamic, coexisting conflicts having impact upon the various levels of community. One of the most important tensions is socio-political involving control and management of watershed resource. Another conflict is between traditional economic patterns, land use and socio-economic

inroads of the modern world. There is also a contradiction to exploit watershed resource by the individuals and the state and the need to conserve it for sustainable management. Consequently, upland-watersheds have been adversely affected by population pressure and underdevelopment.

8.2 Following table gives the financial allocation made for watershed management in relation to some of the other important related sectors in the 7th Five Year Plan (1988-93) which has a total outlay of Rs. 660.2 billion which includes Rs. 367.8 billion in public sector:

Table 4

	<u>Rs. Billions</u>
1. Agriculture	10.40
2. Forestry, Wildlife	1.50
3. Watershed Management	0.40
4. Range Management	0.01
5. Water	29.00
6. Rural Development	11.22
7. Population Welfare	3.5
8. Fuels	34.1
9. Power	90.2

8.3 The financial resource allocation indicates that watershed management as part of forestry sub-sector has a share of 21% but when it is compared with agriculture sector the percentage allocation comes to 3.84. The actual figure is abysmally low keeping in view the substantial investment made by the private sector in areas of agriculture, health and education. Management of country's watersheds has a direct relationship to the storage of water and its regulation for power generation which has a maximum allocation of Rs. 90.2 billion. Safety of multipurpose Tarbela and Mangla dams depends on quality of water received in the reservoirs. It has been computed that due to efforts made in the past life span of these dams has been enhanced from 70 to 110 years in case of Tarbela and 100 to 170 years in case of Mangla within a period of 18 and 26 years respectively. The ratio of investment of watershed management to power sector is 1:226. This phenomenal imbalance in

resource allocation if continued, the watershed degradation problem will remain unabated in presence of population pressure mounting at the rate of 3.1% every year. It will contribute to accelerated soil erosion due to cultivation of agriculture crops on steep slopes, incessant grazing, cutting of trees for fuelwood and timber, resulting into transport of sedimentation load and its accretion in the water reservoirs rendering country's food security and power generation at stake.

9. **LINKAGES BETWEEN WATERSHED MANAGEMENT AND OTHER RELATED SECTORS**

9.1 **Agriculture**

9.1.1 The agriculture resource base was expanded in the sixth plan period (1983-88). An additional area of 1.3 million ha. was cropped due to availability of additional water which was increased from 102.66 million acre feet (MAF) to 112.2 MAF because of better management in the delivery system. During 7th five year plan growth rate of 4.7% for the agriculture sector has been envisaged. For this purpose Pakistan will need a minimum increase of 15% in agriculture output in the plan period to meet the growing demand for food. In order to increase the life span of the Tarbela and Mangla dams and reduce sedimentation flow into the water reservoirs for agriculture production, the strategy entails environmental considerations. However, due to lack of commitment and improper infrastructure, inadequate resource allocation and lack of workable and acceptable methodologies emphasis on implementation of watershed management programmes is weak.

9.1.2 For optimum productivity in agriculture, a suitable vegetation cover especially in the watershed areas is essential. About 26% of the rain-fed area where agriculture is being practiced has been carved out by clearing natural vegetation in disregard to its economical and ecological role. Hence, productivity of this

area is extremely low because of soil erosion and intrurruption in the ecological processes. The expansion in cultivation is inevitable due to demand of population for food. It is, however, allowable where possibility of sustainable agriculture exists.

9.1.3 The land cultivation above 2000 meter height, especially on steep slopes is not sustainable and productive. The intensified cultivation on steep slopes has degraded the watersheds by upsetting the fragile soil, water and plant relationship. There has also been a communication gap between the people and the professional foresters to becoming aware of the soil and water conservation needs. Over the years approaches to watershed management in Pakistan have emphasized afforestation and reforestation to promote the values of trees for fuel, fodder and site protection. The acceptance of conservation programmes by the people are mostly attributable to the interest generated by donor funded projects.

9.2 Energy

9.2.1 The prosperity and future welfare of Pakistan depends on support to rapid economic growth with adequate and assured inputs of energy. Shortage of energy supply has been a formidable problem for the country in the last decade. During the 6th Plan, energy consumption increased at the rate of 6.6% per year compared to GDP growth rate of 6.8%. The annual increase was electricity (13.6%) and petroleum, oil and lubricants (8.5%). The growth in energy consumption has contributed to depletion of domestic hydrocarbon fuels and worsening of the balance of the payments due to increased import of petroleum products. Consequently, to overcome the shortage of energy supply in the domestic sector the 6th Plan target included fuelwood planting of 60,000 hectares annually of trees to meet renewable energy requirements. However, only 6000 hectares could be planted because of institutional and funding constraints which led to delays in start up, and later on

implementation of the Forestry Planning and Development Project. During 7th Five Year Plan it is estimated that renewable energy resources, derived almost entirely from biomass and fuelwood will constitute about 32% or 12 Million Tonnes of Oil Equivalent of total energy supply in Pakistan. It is estimated that 90% of the rural households and 60% of the urban households meet their energy needs by use of biomass, including fuelwood. In the 7th year plan, a detailed master plan will be prepared for renewable energy development based on the experienced gained in the 6th plan.

9.3 RURAL DEVELOPMENT

9.3.1 In the 6th Five Year Plan 32% (Rs. 70 billion) of public sector expenditure was allocated for development of rural sector. With more emphasis on rural development and high acceleration provided during last two years (1986-88) of the plan, the estimated expenditure increased to Rs. 90 billion showing a utilization of 128% against the original target. The physical achievements of the 6th plan for rural development pertained to construction of roads (14957 km), village electrification (16525 villages), construction of Basic Health Units (1830) and safe water supply to cover a population of 18 million people. The 7th Five Year Plan aims at continuity of the 6th Plan Programmes to bringing about a substantial transformation in the lives of the rural communities in Pakistan. The relationship between achievement of the Government's clean drinking water objective and the need to conserve country's fresh water resources in clean and healthy state is already recognized in some quarters. Yet, unless the connection is universally appreciated, the likelihood of achieving full alignment of two potentially compatible policies will remain remote.

9.4 IRRIGATION

9.4.1 In the water sector Pakistan enjoys a unique position as the Indus Basin Irrigation System is one of the largest and oldest in the world. In the past, its productivity per unit has been

comparatively low because of the inefficient use of water and outdated irrigation practices. In the recent years more sophisticated methods of water management have been evolved and control over the Indus river and its tributaries has gradually increased. Ground water has acquired importance as a supplemental source of irrigation water. In the 6th Plan period, priority programmes included protection of land from the menace of water logging, salinity and floods and programmes for improvement and extension of the irrigation and drainage system. During the 7th Five Year Plan apart from remodeling of irrigation system, investment in a large number of small schemes which aim at diverting and storing flood water for irrigation, including recharge of aquifers, lift irrigation schemes in the water scarce areas of Balochistan, Azad Kashmir, North West Frontier Province and Northern Areas will be increased.

9.5 POPULATION WELFARE

9.5.1 Pakistan is the 9th most populous country in the world with annual growth rate of 3.1%. About 3 million children are added to the population each year. It places a great burden on the natural resources for agriculture, timber, fuelwood and fodder production. The 6th Plan policy of population planning and welfare aimed at bringing about a behavioral change in favour of small family through concerted efforts of non-governmental organizations (NGOs), and various awareness programmes but the progress could not be achieved. Realizing the gravity of the population problem in the country, the government has given special attention to the level of the investment in the population welfare programme. The 7th Five Year Plan and the perspective plan (1988-2003) therefore, envisage a multi-sectorial approach to adopt a communication strategy, population education and service delivery to achieve a growth rate of 2.8% by the year 2000.

9.6 FORESTRY

9.6.1 Pakistan's forests and rangelands cover some 4.74 million ha. and 6.12 million ha respectively. Forests largely comprise coniferous forests (1.95 million ha) in the northern mountains and scrub forests (1.70 million ha) in the upland and sub-mountain tracts. The demand of a rapidly growing population for food, fodder, timber and fuelwood has resulted in severe degradation of the forest resource in the northern watershed. The degradation of these watersheds areas is also adversely affecting the productivity of the irrigated low lands which are the main resource base for country's agriculture. Present annual timber consumption is estimated at about 2.4 million M³. Private owned forests and farm lands supply about 50% and 90% of annual timber and fuelwood consumption respectively. Imports supply about 36% of timber consumption, having increased at an annual rate of over 5% during the last decade. In 1985, imports of wood and its products were valued at Rs. 1.8 billion. Fuelwood output from state forests has declined in recent years, putting further pressures on private farm land sources.

9.6.2 The 7th Five Year Plan lays greater emphasis on programmes like energy plantations, social and farm forestry on marginal private lands. Under these programmes, demonstration plantations will be raised. On the job training in farm forestry techniques will be provided. Institutional infrastructure will be improved and training imparted to forest and forestry related professionals, technicians and farmers. The production of coniferous and irrigated plantations will be increased by improved management practices, better technology, improved infrastructure facilities and optimizing the utilization of trees through improvement of logging system.

9.6.3 The waters of the Indus Basin rivers transport heavy sediment load especially during floods. The problem has attained seriousness in the northern hills and the Pothawar uplands.

Scientific management of watersheds is, therefore, essential for the safety and extension of the useful life of the existing and proposed water storage reservoirs, barrages, canals and hydro-electric installations. The excessive cutting of these for firewood and timber is dictated by the desire to satisfy the demand of the growing number of population for cooking food, heating their houses and repair of construction of new houses. Prevention of excessive tree cutting in the watersheds can only be successful if more trees are raised to meet the local needs. But this would rather be a difficult and expensive job, if not impossible. During the 7th plan, a Forestry Sector Master Plan for the next 25 years will be prepared with the assistance of Asian Development Bank, FAO/UNDP, GTZ, Netherland Government and other donor agencies. The plan will identify, economically, ecologically and socially viable projects. At present number of studies are being conducted by expatriate and local consultants.

10. **MAJOR CONSTRAINTS IN PROMOTING WATERSHED MANAGEMENT
INVESTMENT IN OTHER SECTORS**

10.1 The 7th plan's sectorial allocations follow broadly the same pattern as the 6th. Hence similar fate likely awaits its social and economic equity objectives. "The most significant challenge to public policy today lies in combatting the growth of divisive social and political forces within the country, which have not so far been mitigated by public policies." On the contrary, the complete absence of any reference to protecting the natural resource base, upon which the attainment of equity objectives depends, is a significant limitation of plan conceptualization. There is thus a need to have a direct reference to both the environment and nature resources in framing general government policies. During 1980-90, the primary impetus to the growth rate came from the industrial sector which grew on average by over 9%. The agriculture sector with growth rate of 3.2% barely kept pace with population growth rate. The environmental degradation in the 1980s was accompanied by serious erosion both of physical and

social infrastructure.

10.2 Unrelenting pressure on Pakistan's natural resources has been exerted by population explosion. The country's population growth rate has accelerated in every decade since independence (1947). Since the formulation of the First Five Year Plan (1955-60) the policy makers are reflective of the cognizance of adverse implications of unchecked population growth for socio-economic advancement of the country. The population welfare programmes have been subjected to changes and experimentation. Lack of political support has been a major hinderance. Despite the fact that family planning programme is over 30 years old in Pakistan, the environments are hardly receptive if not hostile. The 7th Five Year Plan increased allocations for health and education, and the accompanying Perspective Plan (1988-2003) emphasized the need for greater attention to be paid to the social sectors if Pakistan is to alleviate poverty and environmental degradation. Socio-economic conditions of the people living in and around forests in the mountain ranges of Himalayas, Karakoram and Hindu-kush are sub-standard. Small land holdings, lack of communication net-work causing difficulty in transportation of essential commodities, extremely low purchasing power, tribal hold, nomadic life styles and lack of awareness are some of the factors which encourage deforestation for bringing more and more areas under cultivation to carve out new grazing lands and meeting the requirements of heating and cooking. Land is grabbed by cutting and burning trees. On account of lack of policies and infrastructure in the mountain areas to improve the socio-economic conditions of the communities living around forests, the environmental degradation will continue unabatedly.

10.3 Pakistan has been profligate in its use of scarce energy resources. Economic instruments have contributed to excessive energy consumption. Electricity has been under priced partly as an anti-inflationary measure. Biogas plants have not been successful

in Pakistan due to technical draw-backs. In view of the limited supply of the natural gas it has also been under priced. Fuelwood prices have by and large been left to the market. The government has not intervened with sufficient effect, through the price mechanism or programme resources to conserve trees and forests. Consequently, country's 80% forests located in the watersheds are on the decline. The slow pace of development in the forestry sector reflects its low priority in the national development plans and lack of resource commitment to tackle the problem.

10.4 FUND CONSTRAINT

10.4.1 Plan provisions and funds released from 1965 to 1988 in the forest sector are tabulated as under :

Table - 5
Provision of funds

(Rs. in Million)

Plan	Plan Provision	Fund Released	Plan Provision : Fund Released
Ist (1955-60)	39	35	1 : 1
2nd (1960-65)	87	72	1 : 1
3rd (1965-70)	140	92	1.5 : 1
4th (1970-78)	216	212	1 : 1
5th (1978-83)	1223	629	2 : 1
6th (1983-88)	1571	749	2 : 1

10.4.2 The implementation of forest policies announced from time to time and the execution of development programmes have

suffered due to inadequate provision of funds in the Five Year Plans and the Annual Development Programmes. Priority in financial allocations as conceived in these policies did not come through. In fact, the development budget dropped from 0.8% in the 1st Plan (1955-60) to 0.5% in the 6th Plan (1983-88). The table 5 indicates gradual decline in ratio (2:1) between plan provision and funds actually released.

10.5 FOREST POLICY

10.5.1 Pakistan came into existence in 1947. Prior to that forest policy of 1894 was applicable. This policy was mainly based on the principle of maximum benefits to the maximum people for maximum period. Agriculture was given precedence over forestry and forest clearance for farming was encouraged. At the time of independence the forested areas of Pakistan was 2% of the total area. After the merger of princely states and establishment of plantations in new Barrage Zones, the forest area grew to 5.4% of the total area. Accordingly, the forest policy was revised in 1955 to make it more realistic and rational. The major objectives of this national forest policy was conservation of forests on a sustained basis for supply of timber, fuel, fodder and other goods and services. However, the pressure of human and live stock population on the forests continued to grow in subsequent years. In view of the inadequacies of 1955 policy, it was revised in 1962 for enhancement of scope and application. This policy emphasized rehabilitation of watershed areas through afforestation, reforestation, soil conservation and introduction of effective forest management and efficient use of forest products.

10.5.2 The policies of 1955 and 1962 were deficient in terms of quantifiable objectives and viable implementation strategy, especially in respect of enhancing the organizational capability and development of a monitoring and evaluation system. Like-wise, mechanisms for predicting changes in supply and demand patterns

could neither be clearly foreseen nor adequately installed. Certain assumptions and programmes underlying these policies were impracticable. These included shifting a portion of the hill population from Murree and Hazara to the Canal Colony areas in plain, acquisition, and liquidation of all rights and concessions from hill forests and elimination of goats from the vicinity of forest areas. For these reasons the forest policies could not achieve the basic objectives of increasing forest productivity and protecting the watershed values. Hence need was felt to revise the forest policy in 1980.

10.5.3 The 1980 forest policy emphasized implementation of watershed management programmes through involvement of the local communities. Greater thrust was placed on social forestry to produce maximum wood on private farm lands. Due to failure of population welfare programmes in the country the population growth rate escalated. Against the national average of 3.1% , the growth rate in the mountain areas is 5% each year. Watershed areas underwent serious degradation which led to wood shortage with greater reliance placed on use of kerosene oil, natural gas and import of wood and wood products to meet the domestic energy needs and timber requirements respectively. Consequently, the Forest Policy (1980) has been revised in 1991.

10.5.4 The basic objectives of the new Forest Policy (1991) which emphasizes watershed management are as follows :

- Meet the country's requirements of timber, fuelwood, fodder and other products and environmental needs by raising afforested area from 5.4 percent to 10 percent during the next ten years.
- Conserve the existing forest, watershed, range land and wildlife resources by sustainable utilization and develop them to meet the ever increasing demands.
- Promote social forestry programmes.
- Encourage planting of fast growing multipurpose tree species in irrigated plantations, riverain forests and

private farmlands to meet the industrial and domestic demands.

- Improve and standardize the utilization, marketing and distribution of forest produced commodities.
- Conserve biological diversity and maintain ecological balance through conservation of natural forests and other habitats, reforestation, and wildlife habitat improvement programmes.
- Contain environmental degradation in the catchment areas of rivers to check soil erosion, accretion of silt in water reservoirs, and to regulate water supply for increasing the life span of multi-purpose dams and regulating floods.
- Take anti-decertification measures and rehabilitate water logged, saline and degraded lands through biological amelioration.
- Generate opportunities for income and self employment for the rural populace.
- Promote non-governmental and voluntary organizations to educate the masses and create public awareness of the need for environmental improvement.

11. WATERSHED MANAGEMENT PROGRAMMES

11.1 The magnitude of government concern for proper management of the watersheds is reflected in the 12 approved and pipeline projects. The total amount of funds expected/planned to be spent on watershed management during 1987 to 1992 is US \$ 137.29 million. This amount will contribute to rehabilitate watersheds if recommendations of the FAO/WFP Missions are taken into considerations. The Federal and Provincial Governments are concerned about the proper management of watersheds and their effects on the socio-economic future of the country.

11.2 Watershed management research and education at the Pakistan Forest Institute, Peshawar is a FAO/UNDP funded project. The immediate objectives of the project are to establish a nucleus for education and research in watershed management provide,

training, and research support to the provincial forestry departments and field projects.

11.3 Suketar Watershed Management Project funded by FAO/UNDP is under implementation in Azad Kashmir. It has been designed to reverse land degradation and arrest soil erosion through vegetative and structural means. The project anticipates sustainable production of food, fodder, timber and fuelwood through participation of the local inhabitants.

11.4 Dir/Swat Watershed Management Projects assisted by the World Food Programme aims at reduction of soil erosion, increase fuelwood, timber, agriculture and fodder production through improvement of degraded pastures and cultivation of fruit trees. The Netherland Government has contributed cash to the project for wages (WFP 1988).

11.5 Integrated Land Management in Kashmir is assisted by WFP. The objectives of this project are similar to Dir/Swat Watershed Management Project.

11.6 Integrated Hill Farming Development in Azad Kashmir is supported by World Bank. The project which started in 1984 will terminate in 1993. The project enhances agricultural productivity, farm fodder production and foster tree planting. Since 1984 10,400 hectares have been attempted.

11.7 Malakand Social Forestry Project is sponsored by the Netherland Government with the main objectives to increase the standard of living in the project area through initiating community development activities for making better use of environments, develop production in the watershed areas on sustainable basis through active participation of the community, and ensuring distribution of plantation benefits to the current users of marginal areas inperpetuity. In order to achieve these objectives

village development committees have been formed for undertaking activities and management as far as plantations, grazing grounds and cultivation of fruit trees are concerned.

11.8 Range Management Project in Malakand Division financed by the Netherland Government aims at to conserve and develop the waste land resources in the project area through afforestation and upgrading of rangelands for wood and forage production.

11.9 Kalam Integrated Development Project, a joint venture of the governments of Switzerland and Pakistan; began in Swat in 1987 and is scheduled to terminate in 1992. The project has been designed to develop of agriculture programmes alongwith activities pertaining to social forestry and pasture management. It also envisages training and development of timber harvesting techniques.

11.10 The Agha Khan Rural Support Programme located in Northern Areas is a long term involvement. The objectives of the project concentrate on creation and support of broad based village level organization, training, identifying and preparing proposal and developing strategies for the use of natural resources.

11.11 Income generating project in Afghan Refugees affected areas is supported by World Bank with the aim to reforest the degraded areas and construct checked aims to arrest soil erosion.

11.12 Pak German Integrated Rural Development Project located at Mardan is supported by GTZ. The activities under this project are mostly infrastructure oriented and watershed management is viewed as a sectorial exercise.

11.13 Assistance to Tarbela and Mangla Watershed supported by WFP is scheduled to terminate in 1991. The project activities are restricted to reforestation, soil conservation and cultivation of fruit trees.

11.14 The Forestry Planning and Development Project funded by United States Agency for International Development is due for completion in 1993 after 8 years of implementation. The project activities include introduction of social forestry concepts, fodder production, soil conservation, training, assistance to Tarbela Watershed Project and support to NGOs and PVOs for environmental stability in the rain-fed and irrigated areas. As the project offers a package of incentives such as free distribution of seedlings and technical advice to the farmers, therefore, it is one of the most successful development activities in the country aiming at providing opportunities for uplift of the rural poor.

11.15 Environmental Monitoring of Improved Forest Harvesting and Management in Neelam Valley, Azad Jammu Kashmir assisted by UNDP/FAO (PAK/88/059) envisages to establish and assist in the training of an environmental monitoring unit within the forest department. Environmental inventory and monitoring will be carried out in the Jagran Sub-Catchment to observe changes associated with timber harvest. The watershed is 1641 ha in size.

11.16 Watershed Planning and Management in Balochistan sponsored by UNDP and WFP. (PAK/88/051) (GOB, 1989), is a multi-sectorial project with the primary aim of strengthening the capacity of the forestry department to plan and manage watershed rehabilitation by establishing and staffing a watershed planning and management unit within the department.

11.17 Integrated Range development, Balochistan with UNDP/FAO support (PAK/88/071) (UNDP, 1988) aims at to improve the management of Balochistan grazing lands so as to improve the vegetative cover and environmental conditions while enhancing the living standard of the rural population.

11.18 Range Management Research and Education at the Pakistan Forestry Institute, Peshawar will be executed by FAO (PAK/88/065)

(UNDP, 1988). The project, anticipated to start in 1991, is to establish an applied research and educational programme plus establish a Range Management Division at PFI to improve planning and rangeland management.

11.19 Soil and water conservation works in Balochistan under consideration by the World Food Programme (3937, WFP, 1989). Activities will concentrate on (1) ground water recharge in the Quetta area, (2) sand dune stabilization in Mustung and (3) establishment of two integrated catchment management demonstration sites.

11.20 Tarbela watershed management Forest (1990-91 to 1994-95) with proposed assistance to the Pakistan Water and Power Development Authority (WAPDA) by the German government (WAPDA, 1990). This is an ongoing project which is being assisted to by the WFP. This new assistance would help with soil survey, planning, afforestation, soil conservation structures, engineering structures and improvement of cultivated banks.

11.21 Mangla Watershed Management Project (1990-91 to 1997-98) of the Pakistan Water and Power Development Authority (WAPDA) with proposed assistance by the German government. The objectives are similar to the Tarbela project.

11.22 The Forestry Sector Master Plan is sponsored by Ministry of Food, Agriculture and Cooperative, Government of Pakistan with multi-lateral technical assistance of International donor agencies i.e Asian Development Bank, UNDP, FAO, Government of Netherland and German Agency for technical cooperation (GTZ). The Master Plan will be for a period of 25 years with the two objectives; i) meeting future demand for forest and rangeland products and ii) reversing the deterioration of national resource base. It will contain priority programmes to optimize tangible and non-tangible benefits, determine the maximum potential to increase area under

forests and develop implementable project proposals, investment needs, institutional strengthening and policy measure as integral component of long term development plan in accordance with the parameters of the Tropical Forestry Action Plan.

11.23. Proposed Forest Policy Action Plan

11.23.1 Pakistan has a meager (5.4% of the country's area) forestry resource. Due to arid climate, water constraint and financial limitations, additional area cannot be taken up for forestry in public sector. The existing pattern of forest management and timber harvesting in hill forests is traditional. Demand for wood and its products is mounting because of 3.1% per year population growth rate. In order to meet the growing demand of wood in the country, there is a need to expand the forestry resource base by planting trees on private farmlands. For this purpose Pakistan's forest policy (1991) conceives the following action plan with special reference to the rehabilitation of watershed areas :

11.23.2 Management of Hill Forests

- Intensive management of forests and replication of the pilot projects started in Kaghan valley in Hazara and Kalam valley in Malakand Civil Divisions at other suitable locations.
- Extraction of conifers from forests to be limited to public sector only. Timber exploitation from forests has already been departmentalized. Departmental harvesting to be extended to the Northern areas also.
- Reliance to be placed on artificial re-stocking of cut-over area and for that purpose central nurseries are raised from known seed sources of good quality. Special attention has to be paid to fast disappearing broad leaved associates of conifers.
- Revision of existing working plans to ensure multiple and integrated use of the forest resource, in conformity

with wildlife conservation and other environmental needs.

- Improvement of existing road density of 2 meters per hectare to at-least 10 meters per ha. to facilitate timber extraction in log form.
- Mechanization of forest operations by installation of aerial rope-ways and skyline cranes, in particular for sites where road construction is undesirable, difficult or costly.
- Rationalization of the jurisdictional charges of forest personnel to make the forests more manageable.

11.23.3 Strengthening and Expansion of Social Forestry

- Effective steps to make available planting stock to the farmers through " Kissan nurseries " raised by the farmers themselves.
- An effort to rehabilitate degraded, salt infested, waterlogged marginal lands both in public and private sector through short-term leases/mutual agreements.
- Streamlining of pricing and marketing structure ensuring reasonable returns to the tree farmers and private entrepreneur. Additionally, new end uses of various tree species would be found to ensure sustained market of otherwise poor species.
- Women will be encouraged to adopt forestry as a profession and involved in all appropriate activities associated with social forestry programme.

11.23.4 Utilization, marketing and distribution of forest produce

- Development of amiable and close working relationship between the producer and the end user.
- Sawing of logs in accordance with the end user's demand.
- Assessment of further demands of wood based industry.
- Collection of information on market requirements and trends.
- Transportation of wood in log form to reduce damage in transit.

11.23.5 Forest Extension and publicity

- Launching of outreach/extension programmes featuring social forestry concepts, ideas and opportunities at the relevant audience.
- Training of staff, motivator, NGOs and PVOs in outreach and extension techniques and methods.
- Development of a system for monitoring and evaluation of the outreach programmes.
- Provision of feedback mechanism in which researchers interact with both professionals and practitioners of farm forestry so that future research efforts could be tailored to solve real constraints.
- Establishment of demonstration areas serving as visit points for farmers' tours/workshops and on-farm research trials in collaboration with research institutions to attract active participation of the farmer community.
- Arrangement of requisite publicity through press, T.V. & Radio.

11.23.6 Forestry Research and Education

- Upgrade training facilities to expand and improve forestry education to cater for the future requirements of trained personal in the following specialized fields:
 - i) Commercial Forest Management
 - ii) Urban Forestry
 - iii) Social/Farm Forestry
 - iv) Watershed Management and erosion control
 - v) Wildlife, parks and conservation areas management
 - vi) Forest products & logging engineering
 - vii) Range Management techniques and practices
 - viii) Forest Economics and resource analyses
 - ix) Minor Forest Produce
- Integration of forestry education in Pakistan Forest Institute with a university system.
- Induction of women in forestry profession through training programmes.
- Revision and up-gradation of in-service training for the forest service cadres in line with modern trends of emphasis on social aspects of forestry.
- Development and strengthening of research programmes

which provide technologies on the social and scientific management of forest and rangeland resources.

- Establishment of regional research stations to conduct research on specific local problems such as arid zone afforestation and mangrove rehabilitation etc.
- Involvement of Provincial Forest Department and industries to finance research on problems relating to forestry and forest products.
- Evolvement of effective mechanism for coordination of research on forestry and forest products by Federal and Provincial Institutions and Universities as well as attainment of coordination at international level.

11.23.7 Resource Surveys

- Periodic physical/mapping surveys of forests, watersheds, rangelands and wildlife areas.
- Implementation of a programme for the improvement of statistics relating to forests and wildlife which includes remote sensing laboratory and Geographical Information System (GIS).

12. RECOMMENDATIONS FOR PRIORITIZATION OF INVESTMENT IN WATERSHED MANAGEMENT IN ECONOMIC DEVELOPMENT

12.1 Effective integrated watershed management programme to reverse the process of degradation and to actively involve the farming community is essential. The programmes should include among others the benefits of cultivation of fruit plants on steep slopes, timber, fuelwood and fodder yielding trees, and agricultural productions maintained through soil stabilization and water conservation activities.

12.2 The cost to achieve the watershed management programmes will be useful for overall economic development of the country. It will contribute to achieve self-sufficiency in food and forest products, favourable balance of trade from both substitution effect and direct increase in export of products produced in the watersheds. Employment opportunities in the rural areas will be

generated which will increase equitable distribution of income in the poorer areas.

12.3 For implementation of future programme for watersheds emphasis is required to be placed on their proper management. Neglect to implement these programmes will lead to increased cost of degraded upland rehabilitation and further decrease in their productive potentiality. For this purpose Government of Pakistan in accordance with the forest policy 1991 will be required to allocate sufficient funds and resources to watershed rehabilitation programmes without which progress as envisaged in the 7th five year plan will not occur. For this purpose specific areas are required to be assigned due recognition to meet the future requirements of the population :

12.4 INSTITUTIONAL SET-UP

12.4.1 "The existing forest administrative structures are primitive in scope and practice " (Jan, 1989). There is no governmental agency that is responsible for watersheds at the national level. However, the forestry wing of the Ministry of Food and Agriculture is assigned the functions of policy formulation and planning. Forestry, being a provincial subject, looks after the watershed management programmes without coordination from other government departments. Consequently, disjointed programmes of other agencies are being implemented in the watershed areas. For example road construction in the hilly terrain involves blasting of rocks which destabilizes the fragile eco-system and disturbs the soil-water-plant relationship. The concerned agency which is other than forest department is least aware of any programme or action required to undertake works to stabilize land on the steep slopes to avoid land slides and soil erosion. Hence an organizational change is required which may undertake integrated developmental activities.

12.5 Resource Survey

12.5.1 There is a lack of statistical base in the country which may provide information to analyze the status of watersheds. It is estimated that the natural resource information to assess the hydrological functions of the watersheds is available in 5% of the area because of evaluations and research undertaken by various donor agencies and the national research institutions. The survey of watersheds is therefore essential to gather information about the land and water ecosystem and transpose this knowledge to land and water management activities.

12.6 Land use Zonal Planning

12.6.1 Pakistan has diverse ecological system. The watershed areas having fragile ecosystem are under severe population pressure. People are cultivating agriculture crops on steep gradients exceeding 45°. Trees are being cut for fuelwood and timber and land is being cleared to bring additional area for food and fodder production. Consequently, sediment is transported to Tarbela and Mangla reservoirs. Whereas, forestry is the best landuse in the mountain areas to protect the watershed values, it is therefore, imperative to develop a landuse plan according to the ecological zones under proper legal cover to bring environmental change for betterment of the people and the country.

12.7 Watershed Management Plan

12.7.1 For a holistic approach the 7th five year plan has made reference to the preparation of Forestry Sector Master Plan. Under the terms of reference of this plan, a report on Upland Degraded Watersheds is being prepared by FAO. This report is expected to be finalized in the near future.

12.8 Training and Education

12.8.1 Implementation of watershed management programme needs trained man power. Pakistan Forest Institute, Peshawar has been declared as a focal point for watershed management, research and education in South Asia. Over the years with the assistance of FAO/UNDP and GTZ, staff has been trained for imparting education and conducting research. Continuity in the training and education for watershed management at Regional level is essential for which Pakistan looks forward to involve and input of international organizations for introduction of new concepts and constant flow of knowledge. According to the new Forest Policy (1991) the forestry education in Pakistan Forest Institute, Peshawar will be integrated with the university system. For an integrated approach the policy aims at induction of women into the forestry profession through training programmes. The forestry schools are required to be strengthened to train technicians in accordance with the modern concepts of watershed management.

12.8.2 There are number of agencies implementing their development programmes in the country. In order to educate the professionals of these agencies regarding watershed management and integrated activities, training programmes are required to be introduced at Pakistan Forest Institute, Peshawar and at universities in the country.

12.9 WATERSHED RESEARCH

12.9.1 Watershed research is being conducted by Pakistan Forest Institute, Peshawar and Pakistan Agricultural Research Council. There is a need to investigate large scale land-use change effects and test models on watershed recovery. Social and technological studies are required to chart a future course for watershed management.

12.10 OUT-REACH

12.10.1 The Forestry Departments lack proper out-reach service especially in the watershed areas where 80% of the country's forest areas are situated. For participatory involvement at community level Malakand and Kalam Projects and Agha Khan Rural Support Programme provide lead for development of extension service. Under Forestry Planning and Development Project institutions of NGOs and PVOs are being strengthened. For effective implementation of watershed management programmes forest extension service is required to be institutionalized to launch out-reach activities featuring social forestry concepts. Under this programme training of staff, change agents, NGOs and PVOs in extension techniques and feed-back mechanism will be essential.

12.11 FARM FORESTRY

12.11.1 Substantial areas on farms could be brought under tree culture. Of the 33 Million ha farm area, about 11 million hectares is identified as cultivable waste which would be best suited for trees. The National Commission on Agriculture estimated that the wood production from farmlands could be doubled, the benefits of which accrue to both the farming community and the farmlands. The best use of land in watershed areas is forestry, with clear limits to agricultural cropping. But the population pressure has led to wide-spread at improper extension of cultivation on steep slopes. Under watershed management and social forestry programmes saplings of fruit trees and fuelwood species are distributed. Experience under the various watershed projects has shown that the farming communities in the mountains are reluctant to plant forest tree species because of long gestation period and small land holdings. Due to this, fuelwood shortage in the hilly areas is a common phenomenon. Consequently, bulk of the fuelwood is transported from the plain where irrigated agriculture is practiced. It is, therefore, essential to promote social forestry practices in the irrigated areas alongwith agriculture to augment fuelwood supply to

the watershed areas to avoid cutting of trees by the mountain dwellers from the forest areas.

12.11.2 According to the experience gained over the last 8 years while implementing the US assisted Forestry Planning & Development Project to promote energy tree plantations on the private lands a break through has occurred. The farmers are taking interest in tree culture on their own lands because of package of incentives such as distribution of seedlings free of cost and technical advice. After termination of the project in 1993, there is a need to implement a follow up project of similar concept for which financial and technical assistance of international agencies would be required.

12.12 GULLY REHABILITATION

12.12.1 There are about 1.3 million ha of gullied land which can be commonly seen in the uplands of Northern Punjab (Pothwar Plateau). These have been classified as economically waste lands. Pakistan Agricultural Research Council (PARC) has developed models to rehabilitate these lands into economically viable productive units. The technology consists of integrated farming systems of growing grasses, wheat, fruits and common trees depending upon the steepness of slopes, rainfall, soil type and watershed management practices (Khan 1987). This technology is required to be extended in the gullied lands for soil and water conservation and increasing production in the rainfed areas.

12.13 Technology Transfer

12.13.1 Current domestic wood consumption is expected to grow from 22 to 33 million tons by the year 2000 on account of increase in population. In view of limited energy resources, both commercial and non-commercial, it becomes imperative to minimize loss of energy in cooking and industrial applications. Appropriate Technology Development Organization under the Ministry of Science

and Technology sponsored an adoptive R&D Programme for evolving economical cook stoves using wood, coal, gas and kerosene oil as fuels. Economical wood stoves designed and tested are efficient upto 28% as compared to 6-12% efficiency of the conventional stoves. It is estimated that an average house in Pakistan consumes 150-200 Kg wood each month. Consumption at this rate in 12 million

cook stoves in the rural areas works out to be 21.6 to 28.8 million tons of fuel wood each year. If the technology transfer of economical cook stoves takes place and the people adopt it, a saving of 40% of wood worth Rs. 4500 million annually could be achieved. The additional unmeasurable benefit of the use of economical cook stoves will be stabilized environment especially in the fragile watershed areas due to less consumption of fuelwood.

12.13.2 Introduction of improved biogas technology and solar cook stoves in the mountain areas where temperature for most of the year remains low will also help in reducing the use of wood and creating positive impact on environments through forest protection, soil stabilization, water conservation and enhancement of productivity in up and down-stream areas.

12.14 Population Flow

12.14.1 Watershed areas of Pakistan are located along the traditional route of migration. For centuries, they have borne the onslaught of migration from Central Asia. Since 1979, Afghan refugees (3.5 million) have contributed to the degradation of the watershed areas by cutting trees and incessant grazing. It has resulted into wanton destruction of forests, soil erosion and unsustainable agriculture in the fragile mountain ecosystem. Thus, the mountain dwellers have been forced by the circumstances to migrate to the urban areas to seek alternative source of sustenance and income generating opportunities. It is estimated that irrigated agriculture area of Indus Basin is capable of supporting twice the present population. If this pattern of population flow

from the mountains to plain areas is encouraged, the shortage of farm labour will be overcome, watershed areas saved from further degradation, life span of multipurpose dams increased and maintenance cost of 55,000 km long canal network reduced.

12.15 Financial Benefit of Investment

12.15.1 The watershed management programme in Pakistan is beneficial in economical as well as environmental terms. Past experience has shown the successful implementation of Mangla Watershed Management Programme at the cost of Rs.136 Million incurred from 1964 to 1988 which led to the increase in life span of the dam by 70 years. As there are many parameters up and down stream which are immeasurable, therefore, on the basis of the one factor i.e enhancement of life span of the reservoir the cost benefit ratio has been worked out to 1:2.5. The main canals (down stream) have 31% Internal Rate of Return (IRR) which is the highest in Pakistan. Against this, watershed areas fetch IRR equivalent to 26% and if down-stream benefits such as low siltation of canals and their reduced maintenance costs for smooth water channelization for agricultural productivity are added then the IRR soars as high as 35 to 40%.

12.15.2 Keeping in view the cost/benefit analysis based on Mangla Watershed the priority of watershed management programmes in Pakistan is justifiable for financial investment. Against the existing level of investment of Rs.0.5 billion in 7th Five Year Plan, 8th Five Year Plan should, therefore, envisage watershed management programmes worth Rs. 5 billion for environmental improvement and economic uplift of the country.

BIBLIOGRAPHY

1. Ahmad, Rafiq Role of Watershed Management in the Development of Arid Lands of Pakistan, International Seminar on the "Management of Arid Lands", Man and the Biosphere (1987)
2. Duldulao, Anacleto Analysis of the Thirty Two Years of Experiences in Watershed Management in Pakistan. FAO, (1987).
3. FAO Draft Report on Upland Degraded Watershed Component of Forestry Sector Master Plan, Rome (1991)
4. - Report on Approaches to Watershed Management Monitoring and Project Evaluation with special reference to Pakistan, Sri Lanka and Thailand (1986)
5. Government of Pakistan National Conservation Strategy
6. - Problems and Prospects of Forestry in Pakistan (1989)
7. - National Policy for Forests, Wildlife, Watersheds and Rangelands, 1991
8. - Pakistan Fact Sheet Water.
9. - Fuelwood Energy Development Strategy, Country Report for Pakistan. Regional Wood Energy Advisory Committee Meeting Bangkok, 31st October - 3rd November, 1989.
10. - Seventh Five Year Plan 1988-93 and Perspective Plan 1988-2003
11. Huntings Technical Services. Mangla Watershed Management Study, Vols. 1 & 2 Borehamword, Herts, England (1961)
12. Jan, Abeedullah Social Forestry In Pakistan: A Review 1990
13. - A Report On Grazing Rights in Forests and open Pastures in Himalays. Regional Seminar on Rangemangement in Himalays (1989)

14. Khan, C.M.Anwar & Mohammad, Noor Range lands in Pakistan. Proceedings of Workshops on Arid Lands Development and Desertification Control, PARC (1987)
15. Khan, Sardar Riaz Dryland Agriculture in Pakistan. Proceedings of Workshop on Arid Lands Development and Desertification Control, PARC (1987)
16. NESPAK Ltd. National Flood Protection Plan Report (1986)
17. Pakistan Forest Institute, Peshawar The State of Forestry in Pakistan (1990)
18. - Tenth World Forestry Congress, Country Report (1990)
19. Pakistan Academy Renewable Sources of Energy in Pakistan of Sciences (1986)
20. Qazi, I.A. Arid Land Development in Pakistan(1987)
21. - Land Use Policy and Forest Legislation. Proceedings of Seminars on Social Forestry in Pakistan, FAO, Rome (1986)
22. Reader-Roltzsch, J.E Watershed Regions of West Pakistan and Related Problems. Proceedings of Ist West Pakistan Watershed Management Conference (1968).
23. Sheikh, M.Iqbal Arid Lands in Pakistan. Proceedings of Worskshop on Arid Lands Development and Desertification Control, PARC (1987)