INDIGENOUS PRACTICE OF NATURAL RESOURCE MANAGEMENT AT PIPAL DANDA, PALPA.

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Introduction

Natural environment of the Hills of Nepal is deteriorating at an alarming rate. Land degradation problems arising from soil erosion, landslides and flood are occurring frequently. Encroachment in marginal lands for agriculture and over-exploitation of vegetation for fodder, fuelwood, litter etc. have resulted in disastrous consequences. "There is no better place to begin an examination of deterioration of mountain enviroment than Nepal. In probably no other mountain country are forces of ecological degradation building so rapidly and visibly," says Eckholm. (Eckholm 1976). Hill people of Nepal have involved themselves economically, socially and biologically in a very close relationship with their complex physical environment. The alarming growth rate of hill population is the major cause of environmental crisis in Nepal. The pressure of population on natural retources is relatively high in the middle hill of the country. The increasing demands of population are at present less and less fulfilled from the locally available resource in the Hills. Farmers in fact have a thorough knowledge of surrounding environment since for a very long time they have been knowing very well how closely integrated and interrelated the various aspects of daily life are. However, pressed by immediate needs, the wisdom of local people also sometimes fails to direct them from their traditional behaviour. Indigenous practice of resource conservation has only very recently attracted the attention of the schlolars when large conservation project and pious preachings have hardly been able to meet their targets for conservation practices without knowing the limitation and capabilities of local residents. So the already existing knowledge of the rural people can not be neglected in the integrated hill developement programmes and practices. The study of indigenous knowledge and the existing technique is extremely urgent in the light of the fact that these are disappearing rapidly through the absorption of new ideas and techniques by the indigenous communties. Similar to the disappearance of indigenous practices there has been a loss to the world's body of knowledge the local sustainable ways of existing in harmony with nature. Such practices that are yet to be found in the local communities are very laudable indeed.

Study Area

The study area, Pipaldanda VDC is situated between 28^0 50' N and 28^0 54'64" parallels of latitude and between 84^0 38' 20" East and 83^0 41'52" East meridians of longitude. It covers 20.5 square kilometres in area. It lies in the North part of the Palpa district in the Lumbini zone of the Western Hill Region of Nepal. (fig 1.) Topographically rugged hilly area contains considerable height, which ranges from 375 metres to 1775 metres above sea level. Within a short horizontal distance of only 4.9 kilometres the difference in altitude is as much as 1400 metres. The slope of the land varies immensely ranging from a moderately steep slope to very precipitous ones. The area can be divided into the main watersheds drained by Angahakhola, in the Southwest and Sahidikhola in the Northeast; a small portion of the North part of the VDC is drained by small rivers which flow directly to the Kaligandaki river. All of moderately sloping lands including the most flat land are located at the bank of Angahakhola area and Kaligandaki river. The main river of the VDC is the Kaligandaki river although it flows only for a short shretch of hardly 3

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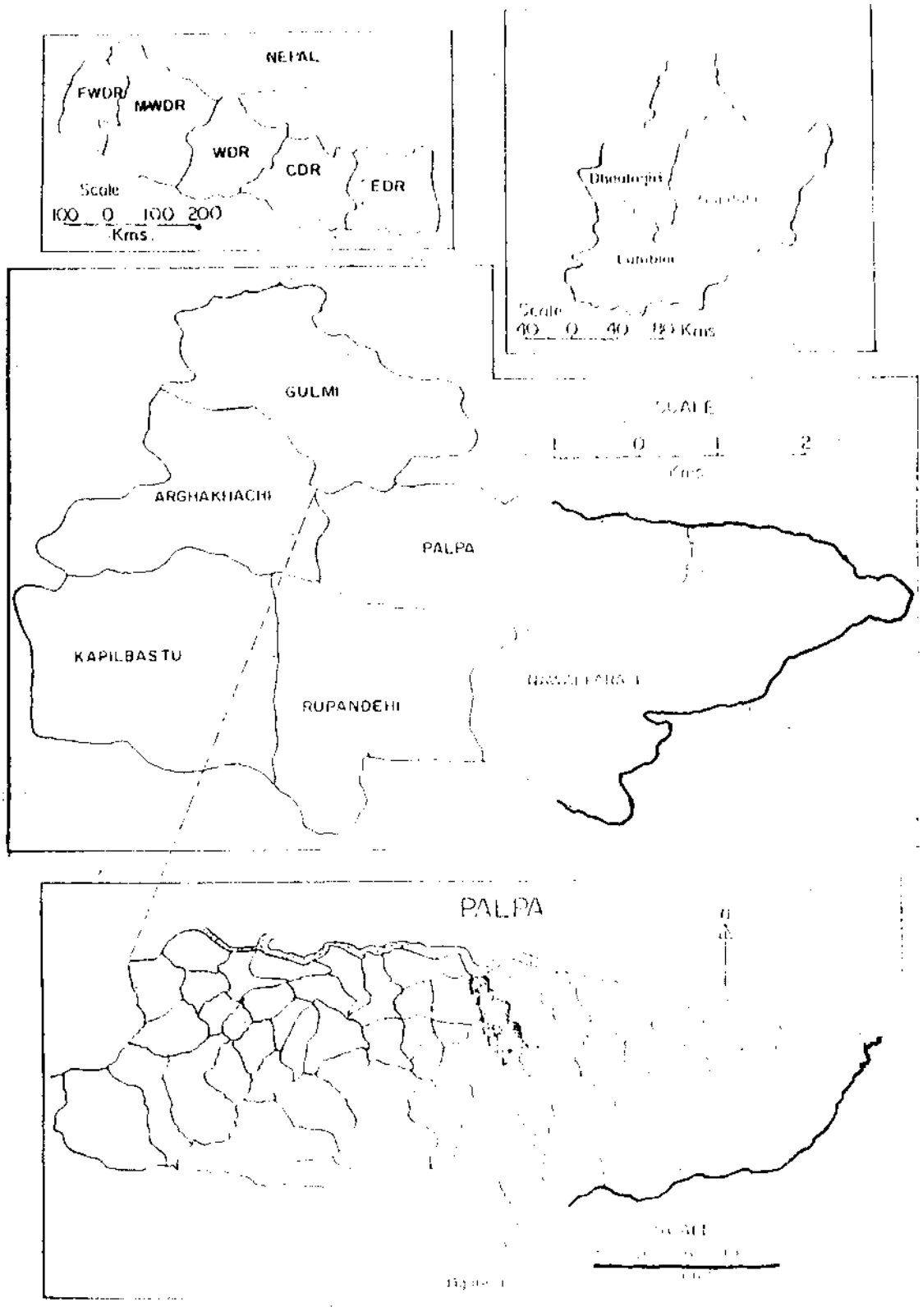
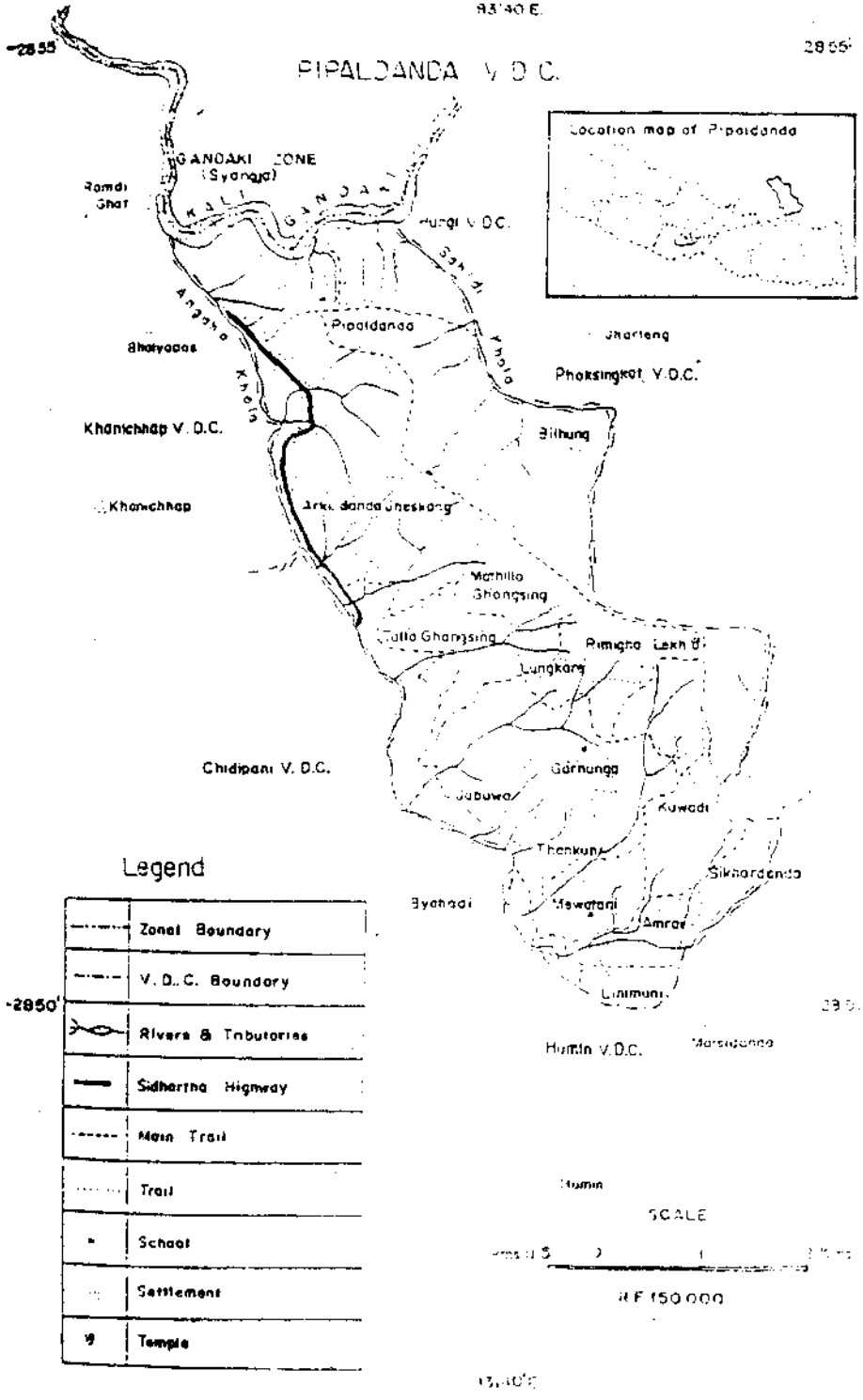
LOCATION OF PALPA DISTRICT




83°40'E
28°55'
PIPALDANDA V.D.C.
Location map of Pipaldanda
GANDAKI ZONE
(Syangja)
KALI GANDAKI
Ramdi Ghat
Hungi V.D.C.
Sano Kh.
Angsa Khola
Pipaldanda
Bhatyaudas
Phalo
Phoksingkot V.D.C.
Khanichhap V.D.C.
Bilthung
Khanichhap
Machilla Ghangsing
Tallo Ghangsing
Pimgha Lekh
Lungkang
Chidipani V.D.C.
Garnunga
Jabuwa
Kuwadi
Thenkun
Sikhardanda
Byahadi
Mewatani
Amrae
Linimuni
Humla V.D.C.
Marsidanda
Legend
Zonal Boundary
V.D.C. Boundary
Rivers & Tributaries
Sidhartha Highway
Main Trail
Trail
School
Settlement
Temple
SCALE
RF 150,000
28°50'

kms in its Northern border through a narrow steep sided valley. However, the most important rivers in the VDC are Angahakhola and Sahidikhola which are the main tributaries flowing approximately parallel to each other to meet Kaligandaki river at the northern border. These streams have so many tributaries which get plenty of water during the rainy season but get dry in winter. The climatic condition of the study area is of the monsoonal type, with variation in temperature due to great altitudinal differences. Summer is hot at low land areas and warm at upland part but at higher parts winters are cool everywhere. Due to altitude, at the higher parts frost occurs in winter. During summer season lowland areas become as hot as Terai. Accordingly vegetation also varies with altitude, slope, aspect, soil and microclimatic variation. Vegetations are *khayar (Acacia catechu), jamun (Eugenea jambolana)* etc at lower parts to *laligurans (Rhodogendron arboreum)*, etc. at higher parts. Soils in the VDC are mainly fertile loam at the valley floors while they range from sandy to gravelly at places depending on the slope and aspects on the one the hand and the parent material on the other.

Population

There were only 303 households in 1933 but the number of households reached 992 in 1991 increasing by 201 percent within 60 years. There were 4399 people in 1971 and it reached 5644 in 1991. The growth rate of population 1.68 percent for the decade between 1971 to 1981 and it decreased in the next decade to only 0.8 p.c. per annum. The density of population was 25 persons per sq km in 1971 and it reached 280 persons in 1983. Though the population growth rate is not so high the density of population is very high in the study area. The distribution and density have varied with its location. The population pressure on natural resources like forest and agricultural land is also high. The out-migration of the people is more than in-migration which has helped in reducing the population pressure in the study area. In addition to this, mobility of the people has its effect on the awareness of innovation techniques of the local people and additional income of the farmer.

Methodology

This study is mainly based on field survey. Most of the data are primary in nature. Some relevant informations were collected also from the available secondary sources the unit of inquiry was at the household level. The total number of the samples was 160 households out of 992 households. This study was undertaken at the ward level and the number of sample households was arrived at through random sampling technique. Heads of the already selected households were interviewed. In addition some groups were purposely selected to conduct group interview. The study area had been observed very carefully and thoroughly to collect quantitative and qualitative informaton. Abney's level was used to find out the degree of the slopes. Aerial photos, toposheets and various maps had been used for analysis and pesentation.

Natural Resources and Man

As a back-bone of agricultural economy the farmers are directly related with natural resources in the study area. Traditional sytem of subistence farming has further increased the direct dependency on them. Resources for the people are available from private as well as common lands both of which fulfill their basic needs. There is a discernible complex interation between forest, grazing land, cropping land, livestock and population in Pipaldanda.

Land Utilization

Sixty years ago the population pressure was very low and most of the areas were covered by dense forest and only a few suitable parts of the land were under cultivation. In

ENVIRONMENTAL CONSERVATION SYSTEM

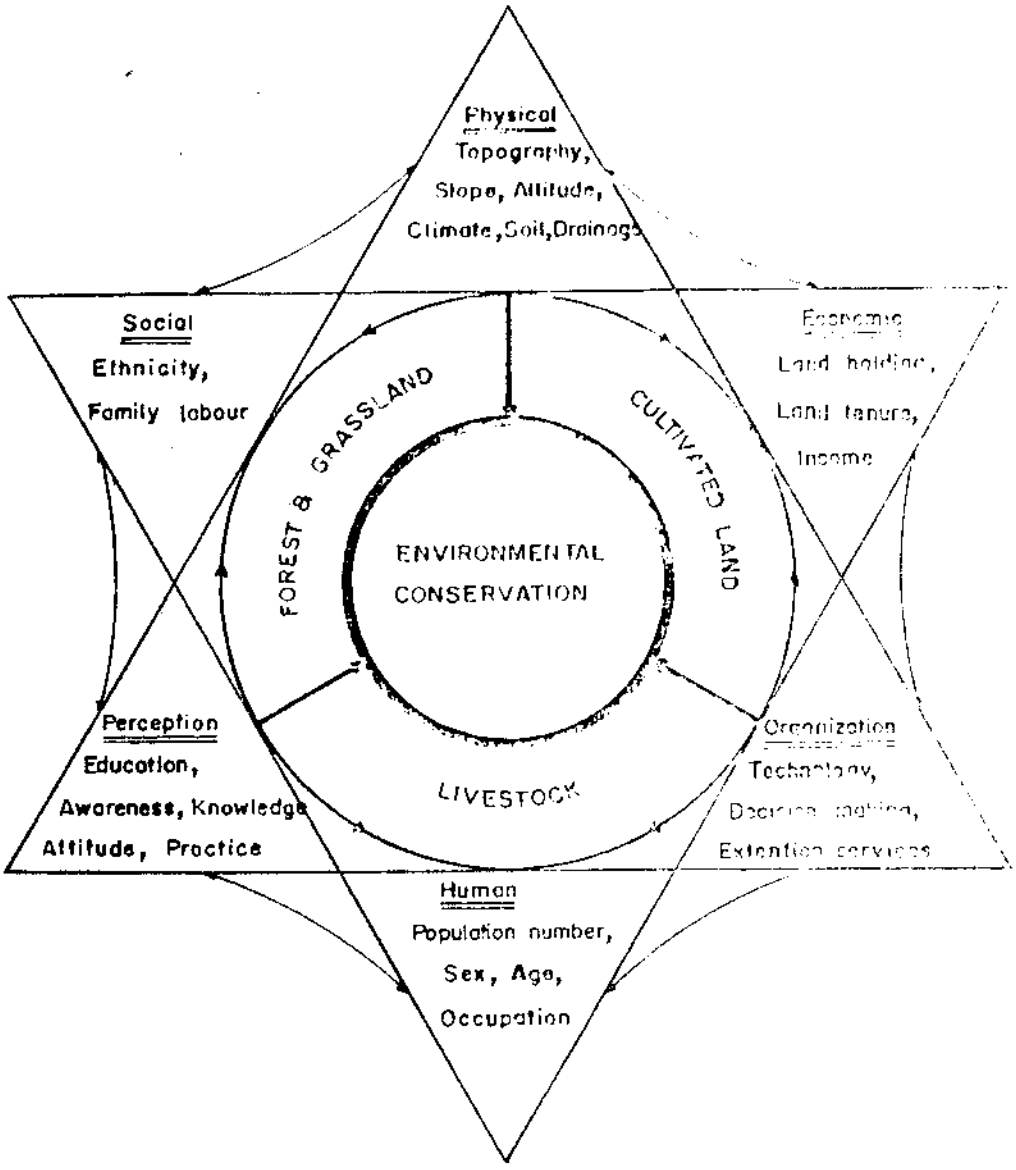


Figure: A

1972 the cultivated land increased and covered 45.84 percent of the total area of the VDC; forest and shrubland covered 42.42 percent. The cultivated land was further increased in 1993 and covered more than half of the total area. The extension of cultivated land within 1978 to 1993 is more than between 1972 and 1978 because of the damage of more and more paddy fields by flood in 1977 and people needed more land for growing crops. Deforestation process was very fast in six years between 1972 to 1978 and this rate slightly decreased during 1978 to 1993 due to the recent conservation practices at lower hill area. Over-exploitation of forest resources has caused heavy deforestation process and it has increased more and more the area of bare land mostly at upper hill area. Bare land has slightly decreased in 1993 by the encroachment by cultivated land and afforestation of forest and conservation practices. The extension of grassland is in increasing trend to supply grasses as an alternate to solve the problem raised by the lack of the fodder from public forest land. It had covered only 3.75 percent of total area in 1972 but it has reached 7.67 percent of total land in 1993. The built up area is also extending. The area of landslide was more in 1972 due to the construction of Siddhartha High way and has been gradually naturally controlled after a long time so that in 1978 it has decreased to a considerable extent.

Table No 1
Landuse in percentage of total area.

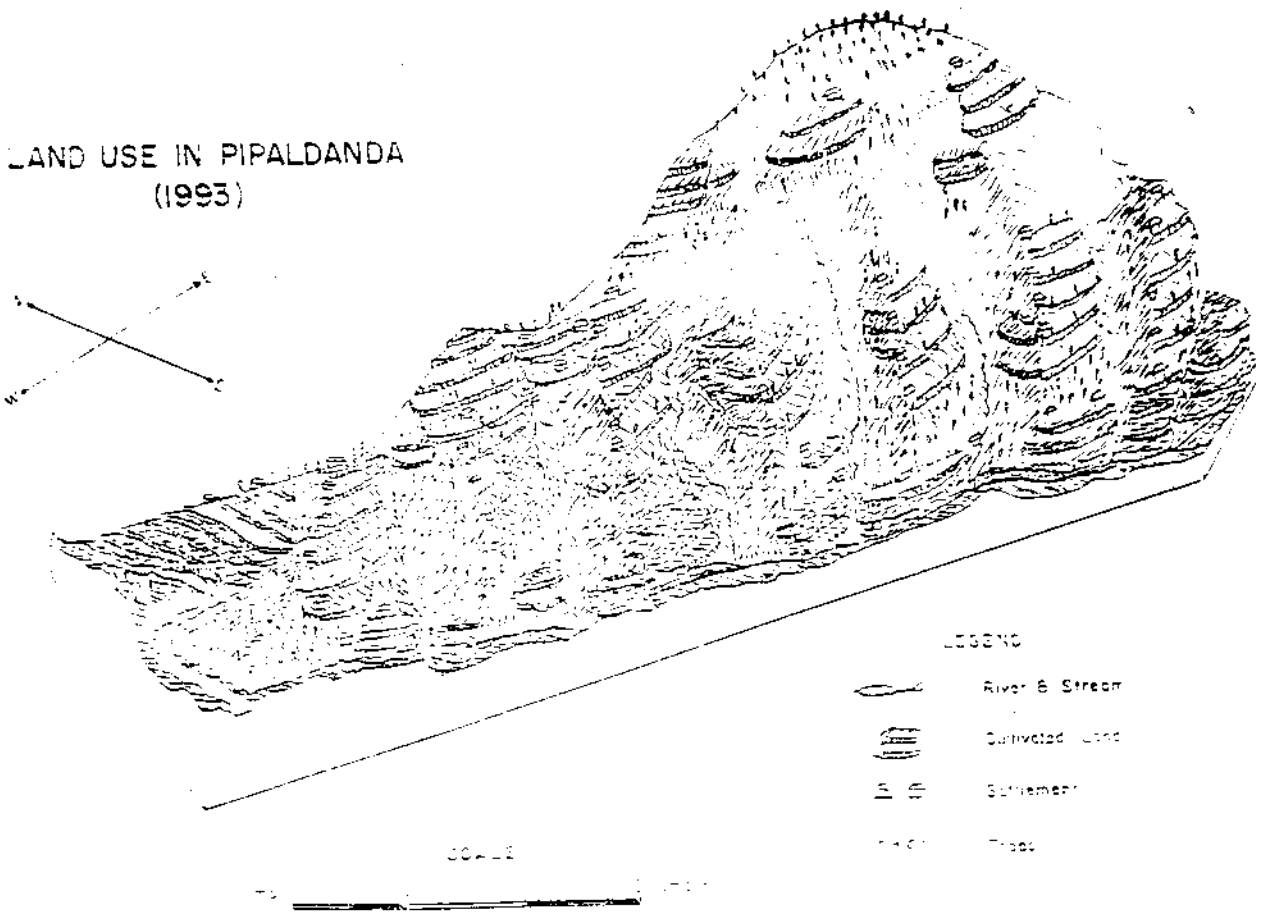
Land	1972	1978	1993
Cultivated land	45.24	46.31	50.13
Forest and shrub	42.42	25.28	22.05
Grassland	3.75	6.33	7.67
Built up Area	2.87	3.71	5.16
Landslide	2.46	1.91	2.38
Waterbody	1.32	1.32	1.32
Bareland	1.16	11.78	8.96
Sand	0.18	3.36	2.33
Total	100.00	100.00	100.00

Source:- Aerial photo and field survey 1993.

It has further increased in 1993 because of the occurrence of more and more landslides at upper parts caused by direct and indirect impact of deforestation, extension of cultivated land at steeply sloping parts at the gradient of more the 30^0 and irrigation channel construction. In 1978 sandy area has increased because of occurrence of heavy flood in 1977 and damage of more and more paddy fields has been gradually changing into sandy area.

Use of Forest Resources.

To examine the relationship between population and amount of forest product consumption, coefficient of correlations had been calculated. The value in 1963 is 0.94 and in 1993 it is 0.91. It shows that there is a high positive correlation between the number of population and the extent of forest product consumption in the study area. The probable error (P.E.) of the above correlation value in 1963 in 0.026 and in 1993 is 0.0386, both of which are less than 6 value. The range of correlation value at the interval of thirty years shows the decreasing rate of correlation which have been even represented by regression line. The slope of regression line of correlation beween the number of population and amount of forest product consumption in 1963 is steeper than in 1993. From the regression equations it has been seen that in 1963, for every 100 persons there was a need of 6099 quintals of additional forest produce but in1993 the need has been found to be 5000 quintals of additional forest produce. Farmers are trying to meet their requirement of


LAND USE IN PIPALDANDA
(1993)
LEGEND
River & Stream

forest production from their private land rather than depending on public forest. In 1993 people used to get the 75 percent of their total requirement from private land but its population had reached 94 percent in1993. The highest amount of forest product is used for fodder and litter. The second is for fuelwood and the rest for building materials. Other minor products consist of leaves, herbs, game animals and root products which are very limited in amount, these days.

Use of Water Resources

Water is an indispensable source for man. Hill farmers need their water resources for domestic purposes, to run mills and irrigate their lands. Most of the parts in the study area have piped safe drinking water facility, serving nine percent of total population have piped drinking water facility and 19 percent get their drinking water from springs. The springs serve mostly isolated households from the main settlement. At lower parts or the places there is the possibility of irrigation facility. The total cultivated land in the study area is 1027.61 hectares i.e. 50.13 percent of total land out of which 257.87 hectares i.e. 25.09 percent of total cultivated land are irrigated by channels which divert the water to the agricultural fields from the local streams.

Environmental Problems

Natural environment of the study area is deteriorating at an alarming rate. Land degradation problems, such as soil erosion, landslide and floods are occurring frequently due to its fragile geology, sensitive hill ecosystem and copious monsoon rain. Human activities like deforestation, improper landuse, unscientific farming practices and development infrastuctures have further aggravated the problems. Crop production has declined with deterioration in soil fertility and agricultural productivity. Soil erosion, sedimentation and landside are the frequently occurring processes on the landscape which create hazardous environment. It is clear that the physical factors like fragile geology, steep hillside and high intensity of rainfall are mainly responsible for causing land degradation but it has been further aggravated by the high population pressure on environment. The natural resources are at such a large scale that it has led to environmental problems as mentioned below.

1. Land Use Changes:-

To meet the needs of the increasing population more and more agricultural land is needed resulting in the encroachment of marginal and very steeply sloping side. At most places landuse of the hill for agriculture appears to be unfeasible. Problems of ecological imbalance are to be found at places particularly along the slopes with gradient more than 30^0 the heavy extention of bare land at the steep hill side has also caused serious problems of soil erosion.

2. Deforestation:-

Deforestation has caused the depletion of forest resource and shrub lands at the unrestricted common land. The villagers have to spend more time in the collection of fodder, fuelwood, litter and building materials. The same labour could have been used at other productive work and they have to reduce the number of cattle which has led to the decrease in additional income from livestock and manure supply for the cultivated land.

3. Soil Erosion:-

The most serious problems of soil erosion are to be seen at the newly extended cultivated land. These areas have a heavy loss of soil and slumping has occurred at a number of places. Steeply sloping cultivated lands are suffering from soil erosion regularly. More soil erosions occur in steeply sloping rainfed cultivated plots. Overgrazing on forest, bare lands and on cultivated land during dry season has accelerated soil erosion, to a great extet.

4. Landslide:-

Although more and more landslides appear at the steep slopes from the observation it seems that more and more small and medium sized landslides are seen at the unirrigated terraces, newly extended cultivated land, overgrazed areas where some sort of construction works are being carried out. They have not been included in the land use map since their magtnitude in quite small. The more and more landslides at the cultivated land have damaged more and more cropping fields in every summer rainy season. Landslides damage not only crops but also cultivated fields. Some of them have become so completely damaged that they become unsuitable for any further improvement and in some cases it becomes more expensive and labour consuming for bringing them back to cultivation.

5. Decrease in Soil Produtivity:–

In the study area out of the total sampled households, 14 households (46.25%) have experienced decreasing rate of soil productivity at the steeply sloping cultivated land. Respondents have reported that they were continually supplying manure every planting time on their cultivated land but the productivity is decreasing from season to season. The decreasing productivity is serious at the steeply sloping rainfed dry farmland at the brown soil area.

6. Flooding:-

The effects of disastrous flood are mostly confined to the lower plain areas just as the effect of soil erosion and landslide is prominent at hilly areas above them. The valley floors are mostly affected by frequent flood in the stream in the rainy season. Before 1977 the frequent flood in the stream occurred in channels which were narrow and trees were lining the side of the streams. All of the flat stream valley floor areas had been used for paddy cultivation. In 1977 the disastrous flood swept away thousands of ropanis of paddy field and caused landslide at most of the hillside of the stream bank areas. At present in every rainy season not only at the stream bank but also at several small tributaries occasional floods cause heavy damage to the cultivated land along the river and slumping of bankside by lateral cutting during summer rainy season is a frequent occurrence. If proper care is not taken in time the expanding gully erosion would be wider and at last may cause heavy loss of land along with severe and widespread erosion.

7. Depletion of Water Resource:-

It has been reported that sixteen springs are declining in volume gradually during the last six decades. In addition to this, decrease in stream water level during the winter season is attributed to the deforestation at the upper parts of the VDC. Besides, the decrease in stream waters is also due to piping of water for drinking and a greater infiltration and subsurface flow due to the heavy deposition of porous sandy materials on the river bed areas by frequent flood. The abundance of water resources has been adversely affected at almost all parts of the study areas but the extent of depletion varies from place to place. Comparatively speaking the hilly parts are less affected.

8. Others:-

Other problems are declining number of wildlife, unscientific use of fertiliser which has caused adverse effect on crop production, crop damage by monkey and parrots and fragmentation of small size land holding at distant places.

Local Resource Management

People in the Hill region of Nepal live in traditionally different ways and their cultural customs and activities indicate in fact ways to adjust themselves to envitonmental condition and to live within the potentials and limitations offered and set by natural environment rather than making major modification to it. It was to the advantage of these people that

quite recently much disruption did not take place since they knew that their livelihood depended upon continued maintenance of the system, and they were very careful.

Landuse Management

The potentiality of land and its use pattern vary with the various controlling factors in the hilly areas. Local variations on climate, soil and terrain are the main controlling factors which, in turn, depend on the local variation in attitude, slope gradient and slope aspects. On the basis of these controlling factors local people make their decision regarding land use management with their long experience and knowledge of local variations. The chi-square values 439.09 in 1972 and 432.43 in 1993 show that there is a strong numerical correlation between landuse and altitude with most intensive uses for cultivation at lower hill region. The landuse pattern is highly affected by the degree of steepness of the slope. The chi-square values which are 168.9 in 1972 and 196.07 in 1993 prove that there is a strong quantitative numerical correlation between slope gradient and landuse; similarly the chi-square values 57.64 in 1972 and 47.73 in 1993 show the statistical relationship between aspect and landuse. From these observations and analyses it can be concluded that altitude, slope steepnees and aspect are the physical properties that villagers recognise and so they make an attempt to capitalise them on their management of rural land use zoning.

Agricultural Land Management

The cultivated land in the study area can be divided mainly into two types : irrigated *khet* land and rainfed *bari* land. The slope management by terracing of plots are most important. There is a more intensive use for agricultural land at the lowest gradient of slope. Irrigated *khet* lands are properly managed by terracing.

1. Terracing :-

Terrace slopes of rainfed *bari* lands are not properly managed. In the study area the terracees have been made at 43^0 slopes. The average slope of terracing rainfed *bari* land is 13.29^0 and at the average slope gradient 25.45. The result (r=0.59) suggests that a weak relationship exists and indicates that farmers do not manage the dry upland terraces as rigidly as the parent shope.

2. Vegetation at *kanlo*:-

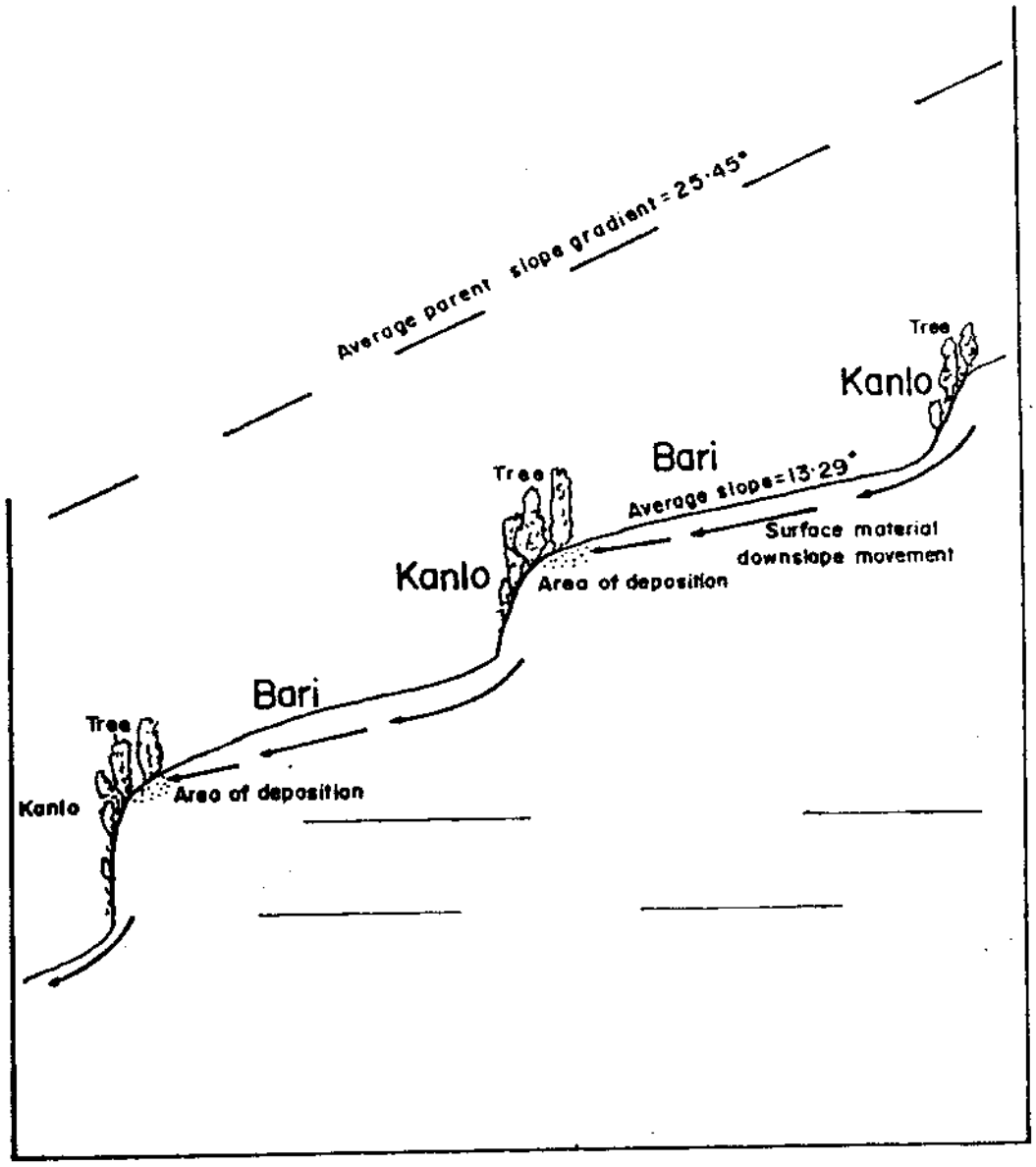
Farmers break the slope by planting vegetation barrier between cultivated fields. The vegetated *kanloes* serve as sources of plant meterials for fodders, fuelwood and building materials. Old cultivated plots have more vegetation at *kanlo* than new ones. Irrigated cultivated lands have less trees at *kanlo* than rainfed areas.

At the upland dry farm areas the north facing slope has 8.18 trees per *kanlo* but south facing slope has 12.6 trees per *kanlo*. It is because of this that most of the settlements are located at the south facing slope and due to proximinty to the settlements they have properly managed tree planting and the North facing slope consists of comparatively new extension of cultivated land. So the degree of effort in the management of tree conservation is less there. The South facing slope has 81.87% fodder tree while the North facing slope has only 45.77% . This is also caused by the conservation, fodder trees at the nearer parts of southfacing slope. The chi- square value (137.08) indicates that there is strong numerical correlation between slope aspect and distribution of fodder and non-fodder trees. Similarly upper hill has 1.9 trees per *kanlo* and 13.8 trees at lower hill because the newly extended cultivated land at upper parts do not have many trees at *kanlo*.

3. Cropping Pattern:-

Farmers in the study area have assorted varieties of crops with emphasis on cereal

UPLAND DRY FARM TERRACING IN PIPALDANDA



Source. Field Survey, 1993

crops. Upon the onset of the monsoon, farmers cultivate paddy in their *khet* from June onward, followed by wheat cultivation owing to the lack of good irrigation facility in the winter season. Some portions of *khet* land remain fallow for six months following the paddy harvest in November, while some other *khet* lands are used for maize production after wheat and before paddy. Upon the onset of the monsoon, farmers cultivate maize in their dry *bari* land. inter-cropping or growing two crops simultaneously in one plot, though not necessarily sown simultaneously, is another indicator of farmers' efficiency in the management of land resources. Cultivating maize and millet, or maize and ginger, or maize, *siltung beans* and pumpkin at the same place at the same time is quite general in the most of the rainfed *bari*. All of these crops are harvested from August to December. Most of these rainfed cultivated lands are allowed to remain fallow until summer rain.

4. Manuring and Mulching:-

Farmers in all settlements use manuring particularly for the production of cereal crops, maize and wheat. Farmers do not apply manure in millet and paddy cultivation, although these are the major cereal crops. They believe that manure applied to maize would be sufficient for a second crop of millet and paddy too. Equally important is that farmers do not have the amount of manure required to fertilize millet and paddy as well. All respondents in all setllements, regardless of their socio- economic status reported that they did not leave crop stalks in their fields since these residues were needed for feeding their livestock. The removal of crop stalks deprive soil of the nutrients and expose them to accelerated erosion. The important point to be noted, however, is that the crop stalks as fodder reduce the farmers' dependency on forest and protect them from rapid degradaion and depletion.

Private Tree and Grassland Management

Farmers have the practice of planting trees in marginal lands and grass land as well as in the lands which are situated by the sides of the rivers, or surrounding the homestead and along the farm path and major trails. Farmers do not grow trees if they have small landholdings due to the lack of sufficient land for cultivation. In the study area 11.25 percent of the households do have not this type of private land used for private tree and grassland management. Every farmer has 0.66 ropani of land for this type of land in the study area. They retain private tenureship of the tree and grasses and have the right to control and harvest these trees and grasses. Other families are not allowed to share the products without their prior permission .

Public Forest Management

Partly owing to the growing awareness of the deteriorating environmental condition people have shown their interest and taken initiative in publice forest management. Villagers have organized forest committees which have formulated and put into practice rules and regulations. The local villagers are allowed to cut their required amount of timber for which it is mandatory to seek formal permission from the village forest committee. In addtion to the conservation of old forest, tree plantation and preservation has also been done at the bare parts. At the upper parts of the VDC however this awareness has just recently been seen because in this part even now they do not have as many problems as the lower area. There is a nursery for the seedlings for the local plantation. The local villagers have collectively conributed to the establishmat of this nursery.

Alternatives for Fuelwood

A very limited number of households have used alternative sources and adopted measures to reduce the pressure on fuelwood consumption. The major alternative resources

of fuelwood are biogas, improved *chulo* and kerosene stove. These are used by 2.5 percent of household and are limited only to those places situated at the settlements of lower parts. Most of the farmers of the upper settlements do not have much scarcity of fuelwood as compared to the lower ones. So, these alternative methods have been used only by those people. In addition to these causes they have not known how these can reduce the pressure on fuelwood consumption and they are traditionally using their open wide fire place with *odans* which are suitable to prepare meal for a large family to get heat at fire place in cold winter season and to distill local alcohol, locally called *raksy*.

Landslide Control

The local people have indigenous knowledge about the need of preventing landslides. They adopt the measure of planting trees. They decide the selection of various local trees according to sites. At valuable places which have suffered from landslide recently, and at the middle *kanlo* of *bari* land they quickly plant the branches of *dabdabe* (*Garuga pinnata Roxb.*) and also construct the retaining walls. At the marginal parts, grassland area and steeply sloping parts they usually plant long rooted trees. At these *kanlo* of irrigated *khet* land and wide flat *bari* land trees are not planted with retaining walls. When the cultivated land is perceived most likely to fall apart, the farmers generally decide to change that *khet* into *bari* and bari into grassland or abandon altogether. Although people do not think that it is their responsibility to control landslide on common land, at some parts by the side of the main trail and steeply sloping sliding areas which are thought to be vulnerable and risky to the people they try to control by palnting trees and constructing retaining walls .

Flood and Soil Erosion Control

Every household has a small run off diversion channel to protect their property. Mostly in residental areas and cultivated plots generally diversion channels join this trail cum main drain. Therefore, main drain provides a course for run off diversion for the community as a whole. The main drain can be several hundred metres long ending in a small stream or a safe place. The beneficiary households involve themselves in taking necessary measures on the slope at the lower terracees. When the channel breaks the wall the structure is quickly fixed with stone, clay and shrubs and trees, which are quickly planted. Thorny and fodder trees are usually planted at the side of main drain. To protect their farmland from stream flood farmers construct walls which are lined with trees at the sides of the stream and streamlets. Check dams are also constructed to protect their land and fix the course of stream when and where it is needed. This part of the work is quite expensive and most of the households are not quite capable of protecting their land from stream flood.

Water Resource Management

Most of the people in the study area agree that there is a close relation between forest clearance and depletion of water resources. The traditional culture of the villagers is to protect trees at the water spring areas which are to be kept quite neat and clean as well. People are not supposed to throw filth nor they are allowed to cut trees around the spring. They even sacrifice poultry, goat, pig and buffalo to please the water deities, in the springs or sources of water.

Conclusion

The high population pressure followed by the consequent heavy exploitation of resources has led to the crises of environmental deterioration in the study area. A proper management of trees, grasses, cultivated land, cropping pattern and some construction work in every village has proved that they have rich indigenious knowledge of local resource management. Although local villagers have rich perception of environmental deterioration

and conservation measures because of various limitations and capabilities they have been rendered incapable of resource management to a great extent and in a satisfactory manner; however, local farmers have been traditionally practising local resource management and are also adopting some innovative techniques nowadays. The improvement and extension of those traditions coupled with recently adopted techniques would be very sound measures for local resource management on a sustainable basis in the study area.

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