Chapter 5

ANALYSIS OF EXTERNAL INPUTS AND VARIABLES

Background of the Analysis

The general findings of this study are described in two parts: Part I (Chapter I) covers the nature of the resources and their extent and the socioeconomic characteristics of the users (external factors) in the Palpa and Phewa watersheds. Since the major focus of the study was on user group structure, function, and performance and their effects and impacts on equity, sustainability, and socioenvironmental soundness, Part II (Chapter VI) deals with an assessment of changes in knowledge, awareness, perceptions, attitudes, skills, and participation (socio-psychological variables) in the target beneficiaries through comparative analysis of the two sites.

Palpa District

Socioeconomic Background of the User Groups

Demography. Table 6 describes the basic demographic, economic, and agriculture-related information of the sampled forest user group (FUG) households. The average family size was 7.0, with a maximum of 8.3 members in Madanpokhara and a minimum of 6.2 in Bharkesh VDC. Males outnumbered females in all the villages. Approximately, 71 per cent of the population belonged to the economically active group (10-60-year age group) and half of the population was illiterate. Only about five per cent of the respondents had college education. The majority of the people were farmers but only 40 per cent were employed all year round in farming activities. The estimated average landholding was 0.87ha/HH, out of which about 0.25ha was irrigated *khet* and 0.55ha was rainfed *pakho*. The average number of livestock units

was 4.25, with a maximum of 6.57 livestock units found in Khum*danda* and a minimum of 2.98 in Shikhar-*danda*. Buffaloes were the most commonly-raised animals (Table 6).

Table 6: Socioeconomic Profile of the Forest User Group Village in Palpa

Attributes	Madan-pokhara	Shikhar-*danda*	Barkesh	Khum-*danda*	Bhairab-sthan	Ramche	Hungi	Total/Ave
FAMILY DETAILS								
Family size	8.29	6.63	6.18	8.50	6.40	6.67	6.67	7.05
-Male	4.57	3.38	3.21	5.40	3.60	3.62	3.50	3.90
-Female	3.71	3.25	2.97	3.10	2.80	3.05	3.17	3.15
<10 years	21.55	25.50	25.49	24.50	26.40	23.57	24.10	24.31
10-60 years	74.15	71.08	71.08	71.30	70.00	72.17	72.50	71.29
>60 years	4.30	3.42	3.43	4.20	3.60	4.29	3.40	4.40
Literacy rate (%)								
-Male	56.90	61.15	38.59	31.82	57.81	50.71	45.00	48.85
-Female	36.50	40.00	27.50	38.40	31.11	29.10	33.30	31.70
College Ed.	14.66	10.38	0.98	0.91	2.50	6.43	2.50	5.48
OCCUPATION (%)								
Farming	47.41	48.11	46.57	50.90	40.60	50.71	45.00	40.27
Off-farming	15.52	7.55	12.25	19.10	25.00	7.86	17.50	14.97
Service	12.93	8.22	1.47	6.50	14.40	7.14	15.00	9.38
Others/unemploy	24.14	36.12	39.71	23.50	20.00	34.29	22.50	35.38
AGRICULTURE								
Land Type:								
- Total (*ropani*)	16.09	20.00	11.06	30.60	11.80	20.81	11.10	17.38
- Irrigated	3.50	5.38	1.36	10.20	2.30	9.79	1.40	4.85
- Non-irrigated	9.60	12.63	7.97	20.40	9.50	10.71	8.00	11.26
- *Kharbari*	3.00	2.19	1.73	-	-	0.31	1.70	1.28
Livestock (LU/HH)								
Total	3.41	2.98	3.47	6.57	3.97	4.53	4.90	4.25
- Cow	0.60	0.55	0.63	1.25	0.56	1.07	0.53	0.74
- Oxen	0.61	0.58	0.75	1.94	0.79	0.97	1.42	1.01
- Buffaloes	1.93	1.69	1.33	2.38	2.00	2.38	2.83	2.08
- Goat	0.27	0.16	0.76	1.00	0.53	0.11	0.12	0.42
- Sheep	0.00	0.00	0.00	0.00	0.09	0.00	0.00	0.00
FORESTRY								
Per capita forest land	0.11	0.06	0.19	0.76	0.26	0.28	0.66	0.28
Year when protection was initiated	1957	1980	1981	1983	1960	1981	1980	

* denotes year when the villagers endogenously initiated protection measures

The average forest land availability per HH was 0.28ha. The maximum (0.76ha) per capita forest land was found in Khum*danda* and the minimum (.11ha) in Madanpokhara.

The estimated per capita fuelwood requirement was over one cubic metre (700kg) per capita per year. The average HH was estimated to require 102kg of green forage per day[1]. On an average each HH in the study area raised 72 trees, two thirds of which were classified as fodder trees (Annex, Table 2). The estimated forest land availability per household was two hectares which is lower than the estimate of three hectares made by Wyatt-Smith (1982). However, the user group household on an average had access to a minimum of two other forests, besides using their private tree resources. Kerosene was used by more than three-fourths of the population surveyed. Biogas was found to be used increasingly by the farmers in Madanpokhara and surrounding VDCs.

The fuelwood situation in the study villages was found to be satisfactory. While the reported requirement is 7.5 tonnes/HH/year, the reported supply is 7.3 tonnes/HH/year. While four villages - Mulgaira, Mahajir, Khum*danda*, and Ramche - reported surplus fuelwood, Shikhar*danda*, Bharkesh, and Hungi were in deficit (Annex, Tables 3 and 4).

Both fruit trees and fuelwood trees were found growing in equal number. Among the fodder trees grown, *Garuga pinnata, Ficus lacor, Ficus semicordata*, and *Artocarpus lakoocha* were the most common. Oranges, lemons, and mangoes were the common fruits and *Castanopsis* sp and *Schima wallichii* the common fuelwood trees.The fodder requirements and supplies have been estimated based on the standard feed requirement reported by Karki (1992) and adjusted to the reported supply by the sampled respondents. Accordingly, there is a daily requirement of 24kg of green fodder per animal unit. However, assuming an 80 per cent digestive factor, the supply is only 20kg/day. Thus, on an average, the estimated fodder deficit found is only 10 per cent, which is better than the national average of a 25 per cent deficit. However, the situations in individual villages are not similar (Annex, Table 5).

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[1] This finding caste doubt on the per capita forest acreage requirement of over 3ha estimated by Wyatt-Smith (1982). In this study, the average forest holding was estimated at 1.96 and 1.28ha in Palpa and Phewa respectively.

Phewa Watershed

The FUGs selected in the Phewa Watershed had an average of 22.5ha of forest area and 114 members made up an average UG. The per capita forest land availability was 0.20ha which was less than that found in Palpa. Based on the information provided in Table 7, brief descriptions on important headings are provided below.

Socioeconomic Background of User Groups

A 10 percent sample survey of the forest user households was carried out using simple random sampling techniques. The sample frame included all the forest users listed in the operational plan. The purpose of the sample survey was to find out the most recent socio-economic information on the members of the concerned forest user groups. The results are summarised in Table 7.

Demography. The upper caste *Brahmin* were dominant in Dopahare village. In Turung village, *Thapa Magar* constituted the major caste. Although females accounted for half of the total population in the two villages, their representation in the user groups as well as in the user committees was low.

Landholdings. Most of the villagers (73.8%) in the user group community had less than 0.75ha of land. A little over 10 per cent of the population had land exceeding 1.35ha. This indicated the subsistence nature of the local agriculture in the area. The average operational landholding was 0.9ha in Dopahare and 0.50ha in Turung village. The total *khet* was much less (33%) than *bari* in both villages.

The cropping intensity was much higher in Turung (218%) than in Dopahare (144%). This was perhaps due to the higher elevations of farmland in the former (1,400-2,000m) compared to the latter (800-1,000m). The average grain yield was 879kg/ha in Dopahare and 1,312kg/ha in Turung. The prevalence of better irrigation facilities, lower elevations, and the existence of more forest area in Turung were the apparent reasons.

Livestock Holdings. Buffaloes were the most commonly-raised livestock in the study area and accounted for 76 per cent of the total livestock units (LUs). There has been a gradual replacement

of cattle by buffaloes in almost all the watershed villages. Cattle are kept only for draught power. Goats and sheep were found in small numbers, but are they among the primary sources of cash income.

Table 7: Socioeconomic Profile of the Forest User Group Village in Phewa Watershed

Attributes	Dopahare	Turung	Total
FAMILY DETAILS			
Family size	6.04	6.80	6.42
-Male	3.24	3.60	3.42
-Female	2.80	3.40	3.10
<10 years	19.50	22.50	21.00
10-60 years	78.24	75.28	76.76
>60 years	2.26	2.28	2.25
Literacy rate(%)	52.80	43.60	47.70
Female literacy%)	.30	12.30	17.30
College Ed.	11.55	07.42	9.49
OCCUPATION (%)			
Farming	42.40	43.34	42.87
Off-farming	18.50	17.55	18.02
Service	13.82	14.52	13.67
Others/unemployed	25.28	24.59	24.44
AGRICULTURE			
Land type:			
- Total (*ropani*)	18.00	11.00	14.50
- Irrigated	6.00	5.00	5.50
- Non-irrigated	12.00	6.00	20.00
- *Kharbari*	1.00	0.00	0.50
Livestock (LU/HH)			
Total	3.38	2.89	3.14
- Cows	0.50	0.35	0.42
- Oxen	1.20	1.08	1.14
- Buffaloes	1.50	1.28	1.39
- Goat	0.15	0.18	0.17
- Sheep	0.03	0.00	0.02
FORESTRY			
Per capita forest land	0.25	0.14	0.19
- Year when protection was initiated	1979	1983	--

* denotes year when the villagers endogenously initiated protection measures

Stall-feeding is the most common method of feeding livestock in the watershed. Over the years, this practice has gradually replaced grazing as more and more scrub and wastelands have been brought under forest plantation. Only supervised grazing is practised in the upper elevations of the watershed.

Fodder Supply. Farmland produced more than 60 per cent of the fodder supply. Turung is currently receiving more forest products than Dopahare, apparently due to the heavier restrictions imposed on the user group forests in the former. The estimated fodder deficit, based on the standard feed requirement of 1,052kg TDN/LU, is about 28 per cent. Dopahare village has higher deficits due to the strict control imposed by the villagers on fodder removal from the forests. The time taken for collecting fodder and fuelwood by the sampled households was higher in Dopahare than in Turung (Table 8). The reasons may be the close proximity of the forests and farms as well as the relatively flat terrain in the latter village.

Fuelwood Supply. On an average 9.38kg. of fuelwood are consumed in an average HH each day. The quantity is slightly higher in Dopahare than in Turung, apparently due to the higher number of livestock units raised in Dopahare. The study area has a net fuelwood deficiency. An average household in Dopahare village reported a shortage of 1.68kg/day or a supply deficit for 0.8 months a year. In Turung the shortage is for only 0.6 months, or there is a shortfall of about 0.36kg/day. Once again the reasons are perhaps due to the higher per capita forest area available in Turung compared to Dopahare (Annex, Table 1).

Major Problems. The major problems of the watershed are: a) cultivation of marginal and sloping land; b) illicit cutting down of trees for fodder, fuelwood, and timber; c) general degradation of land resources; d) severe soil erosion and drying up of the water sources; e) low agricultural produc-tivity; and f) poor animal health. People, especially women, are reported to be spending more and more time fetching water and collecting fuelwood and fodder as well as leaf litter for animal bedding/farmyard manure.

Current Forest Inventory. The forest in Palpa was dominated by *sal* (*Shorea robusta*)-based mixed tree vegetation (68% spp were *sal*), whereas in Pokhara the dominant species was *katus* (*Castanopsis indica*) which accounted for 59 per cent of the total

stand. The average height and DBH of the trees belonging to the sampled FUGs were 7.8m and 11.2cm respectively. The average tree density was 1770/ha and the estimated total standing biomass was 84 tonnes/ha. The individual UGF stock situation is provided in Annex Tables 6 - 8.

Forest User Group Structure and Function

The forest user groups (FUGs) were examined for various attributes, including the year when some elements of an indigenous management system had reportedly begun, source of initiation, and type of system adopted. Tables 7 and 8 describe the findings in detail. All the forest management initiatives have an average history of 20 years or less, although a forest in Phewa did claim to have had some sort of indigenous management dating back 300 years. Almost all the forests have reported experiencing a system breakdown due to conversion of the forest into an open access system and/or liquidation of resources after over-exploitation. The construction of the Pokhara Highway is claimed to have led to a breakdown of indigenous systems in half of the forests studied in Palpa.

Formation of User Groups

In general, FUG formation in Palpa was found to have started through the encouragement of community forestry activities by the then Tinau Watershed Project (TWP), which has now been expanded and renamed the Palpa Development Project (PDP). Due to the target-oriented nature of the community forestry practised by the TWP, efforts were made to bind as many *Panchayat* Protected Forests (PPFs) as possible in some sort of written management plan. The project did manage to establish a number of PPFs, but only a few managed to function as per the plans, due to lack of full tenurial and investment securities. In fact, the ones which functioned successfully were the first few communities which organised themselves into FUGs, and they are functioning well. Tables 8 and 9 provide a brief summary of the FUGs selected for the evaluation. Table 8 describes a resource situation and the type of protection systems in existence. Except for one forest, namely Bharkesh in the Telgha VDC, all the forests have similar biophysical and institutional attributes.

Table 8 provides the institutional characteristics of the selected FUGs. As this information is based on the historical sketching of individual case studies, the authenticity of the information is accepted. For example, the memories of older users were solicited to sketch the spatial and temporal changes in the characteristics of each individual forest. Except for one FUG, all the forests have had some sort of indigenous management. However, the reasons behind forest destruction were found to be varied. Some of the major generalisations are given in the following passages.

Causes and Consequences of Deforestation

Based on the case studies of the UG-managed forests in Palpa and Pokhara, the following cases and their most commonly-known consequences are given: 1) indiscriminate cutting down of trees led to drying up of springs which supplied water to the villagers; 2) wanton destruction of the forests by road contractors gave wrong signals to the people vis-a-vis cutting down trees; 3) charcoal-making at the behest of the government weakened the indigenous control over resources; 4) population growth, due both to natural causes and to migration from the hills to the valleys, accelerated deforestation; and 5) urbanisation and the opening up of fuelwood and timber markets provided additional incentives.

Types of Local Initiative

In most of the cases, the initiative came through an informal group in which a clearly-defined leadership did not exist. However, in some villages an individual leader was found to have initiated forest protection and his socially accepted status and/or leadership quality appeared to have contributed towards effective protection of the forest resources. In one village, the entire village successfully fought a legal battle against an encroacher who had acquired an ownership certificate for forest land through illegal means. However, in other villages the elected community officials were found to have taken the lead in rejuvenating the forests. In one village, one youth club was found to have made an attempt to save the forests.

Social Systems Adopted

Under an indigenous system of management, social institutions are found to be more informal and flexible. Therefore, conforming

Table 8: Summary Descriptions of the User Group Forests in Palpa District and Phewa Watershed

S.No.	Location	Estimated Area (ha)	No of Members	Year Handed Over	Protection System	Operational Plan Exists	Rules	Major spp
1.	Mulgaira Madanpokhara - 6,7,9	8.4	79	2047	Collective watching	yes	Written	*Shorea/Castanopsis Schima wallichii*
2.	Shikhar*danda* Madanpokhara - 5	8.0	140	2046	Collective watching	yes	Written	*Pinuus roxburghii Shorea robusta*
3.	Bharkesh Telgha - 1	62.0	331	2046	Open access	no	Unwritten	*Shorea/Pinus*
4.	Mahajir *Ban* Bhairabsthan - 3	84.0	111	2048	*manapathi* collection	yes	Written	*Pinus roxburghii Quercus* spp
5.	Khum*danda* Chhidipani - 2	35.0	133	2047	Collective watching	yes	Written	*Pinus roxburghii Schima wallichii*
6.	Ramche *Ban* Rampur - 4	60.0	212	2046	Collective/ *ban heralo*	yes	Written	*Shorea/Castanopsis Schima wallichii*
7.	Majuwa Hungi -	35.0	53	2048	Collective/ *ban heralo*	yes	Written	*Shorea/Michelia Schima wallichii*
				PHEWA				
1.	Turung - 7,8	30.0	122	2048	Collective/*ban heralo*	yes	Written	*Schima wallichii Castonopsis* sp
2.	Dopahare - 3	14.0	106	2048	*ban heralo*	yes	Written	*Alnus/Schima*
All Forests Ave.		41.5	151	-	-	-	-	-

Source: Survey Team

to earlier findings on both study sites, the social systems which emerged in response to wide-scale deforestation remained informal until the *Panchayat* Forest Rules were imposed on the villagers by the government and/or projects. The system's key strength lay more in informal discussion and flexibility in day to day operations.

Resource Development Initiatives

Surprisingly, the indigenous approach to resource development in most of the forests studied was not through reforestation. Complete protection from grazing and fuelwood collectors was the most commonly-practised resource development strategy. In fact the reforestation technology, as we know it today, was unknown to the local population until extension materials regarding community forestry and free seedlings' distribution were widely disseminated during the early eighties. This is more so in Palpa than in Phewa because of increased emphasis on community forestry in the former. In Phewa Watershed, the emphasis being on watershed management, conservation-oriented plantations were major strategies. Nevertheless, plantation by the community *per se* was not commonly carried out in Phewa because of subsidised plantations.

Forest Management System

The forest management system developed for most of the FUGs is a mixture of indigenous and traditional systems. While compartmentalisation of the forest and definition of the thinning and harvesting regimes are the contributions of professional foresters, the harvesting schedules, product distribution systems, and enforcement mechanisms for rules are drawn from a pool of indigenous knowledge and practices (Tables 8, 9, and 10). The penalty structure and access rules were also largely borrowed from indigenous management systems as the UG members were confident of their success. Forest protection was the most critical aspect of user group Forestry, and it was found that the rules and provisions adopted were those which had been in practice before and that the villagers were confident of success.

Hiring a guard through common funds (cash or grains, locally called the *manapathi* system) was the usual system of protection

Table 9: Attributes of Selected Forest User Groups in the Palpa and Phewa Study Areas

Name of FUG	Years Under Indig. Mgmt.	Causes/Result of Deforestation	Mgmt. Initiative by and Who Particp.	Social System Adopted	Committee or Op. Plan First	Major Activities Undertaken So Far
PALPA DISTRICT						
Mulgaira	37 Years	Open access spring dried	Individual social fencing	Informal Group	Operational Plan	Reforestation around Spring
Shikhar	30 Years	Open access, denuded slopes	Group *heralo*	Formal Group	Protection Committee	Reforestation with pines
Bharkesh	Irregular Attempts	Open access, mass cutting	Group social fencing	Informal	Operational Plan imposed	None
Mahajir	35 years	Cadastral survey encroachment	Group l egal actions	Informal	Operational Plan	Reforestation in gaps
Khum-*danda*	10 years	Highway construction/ charcoal-making	Group *heralo*	Formal	Committee came first	Reforestation was carried out in in 1986/87
Ramche	23 years	*Birta* Abolition Land Reforms Act	Group *heralo*	Formal	Committee came first	Only protection has been accepted
Hungi	12 years	Fuelwood cutting after highway	Group	Formal	Committee	Only protection has been assigned.
PHEWA WATERSHED						
Turung	13 years	Open access, nationa-lisation, cadastral survey	Group and Individual	Informal *heralo*	Committee School Mgmt.	Only protection through fencing
Dopahare	10 years	Open access, grazing, conversion	Govt./Group	Informal	Committee	All the area was reforested

Source: Survey Team

Table 10: Forest Management Rules, Rights, and Sanctions in the Selected Forest User Groups in Palpa and Phewa

User Group Name	Unit and No of Mgmt.	Harvesting Period/Dur.	Penalty Amount	Access to Fodder Coll.	Access to Leaf Litter	Access to Grazing	Protection System
PALPA DISTRICT							
Mulgaira	Compartment (6)	Jan./Feb.	Rs 50	Regulated	Regulated fencing	Not allowed	Social
Shikhar*danda*	Compartment (5)	February	Rs 50	Regulated	Regulated guards	Allowed	Volunteer
Bharkesh	None	Not defined	None	Open access	Open access	Uncontrolled	None
Mahajir	Compartment (5)	January	Rs 50	Open to members only	Allowed to members only	Regulated fencing	Social
Khum*danda*	Compartment (4)	January	Rs 50	Regulated	Regulated guarding	Restricted	Rotational
Ramche	Compartment (5)	Jan./Feb.	Rs 50	Restricted	Regulated	Restricted	*heralo*
Hungi	Compartment (3)	February	Rs 25	Restricted	Restricted	Not allowed	*heralo*
PHEWA WATERSHED							
Turung	Compartment	Feb./March	Variable	Regulated	Regulated	Not allowed	*heralo*
Dopahare	Compartment	Jan./Feb.	Variable	Not allowed	Not allowed	Not allowed	*heralo*

Source: Survey Team

used. However, in two forests, there were no guards hired, and protection was carried out through 'social fencing', i.e., each and every user had the responsibility for restraining himself/herself and for bringing violators to book.

Animal Grazing and Product Removals

The FUG management committee is very sensitive to the basic needs of the users which in most cases consist of fuelwood, tree fodder, leaf litter, and grasses. The UGF rules and regulations were therefore found to be well defined.

The user members were also well informed and knowledgeable about these rules. Typical rules did not permit grazing in the forests; fuelwood cutting was strictly regulated with well-defined timing and procedures; and tree fodder collection was also restricted. The rules were found to be flexible as well as liberal regarding collection of leaf litter and fresh herbage, which are used both as fodder and bedding materials and are converted into compost.

Harvesting and Benefit Sharing

Harvesting includes the annual operation of applying management prescriptions such as thinning, singling, and selective logging. These are the most important, sensitive, and far-reaching operations and both the FUGs and the DFO were found to be concerned about their proper execution. Since the forests being managed generally consisted of relatively young stock, the most commonly-practised operation was thinning and singling. In one of the forests - Mahajir Salleri - the team did find selective logging operations in progress but, in the team's judgement, this was also carried out outside the scope of the approved management plan. In fact the concerned Ranger and the DFO did not know of this operation and the Chairman of the UG was visibly embarrassed to admit this. However, it is a truism that any such and all operations are carried out based on the judgement and the decision of the executive committee. In product distribution aspects, all the FUGs were found to have an elaborate arrangement. The most commonly practised system was collecting the products, submitting them to a pool, and randomly distributing them to all the members participating in the operation. The system was fair and equitable in that a number of collectors were allowed from each HH in proportion to the size of

HH, and only those who actually participated were eligible for a share.

Hypotheses Tested

Working hypotheses were set up to examine specific variables which could be monitored over a certain period of user group functioning. Some of the hypotheses were descriptive and others were quantitative. The testing of the hypotheses was carried out using appropriate statistical tools, such as the X^2 and t tests, especially in quantitative hypotheses.

Hypothesis # 1. The bulk of the basic needs of the people, such as fuelwood, fodder, leaf litter, and timber, are fulfilled from sources other than UG-managed forests.

Based on the survey of sample users, 71 per cent and 68 per cent of the total supply of fuelwood and fodder in Palpa and 68 per cent and 60 per cent in Phewa respectively were met through on-farm sources. The fulfillment ratios of the private sources were significantly different ($p=0.05$) to the ratio from public sources. It was therefore determined that the majority of farmers in Palpa and Phewa obtained their basic goods from private sources. In Mulgaira village, the members were found to have switched from fuelwood to biogas, and a few members had already waived their rights to harvest fuelwood from the UG forest. It is therefore concluded that given the proper motivation and incentives, people can meet their basic needs from private sources, at least on a short-term basis.

Hypothesis # 2. Continuous use and overexploitation (fodder, fuel and litter collection, indiscriminate burning, uncontrolled grazing, illegal felling, and timber theft) are not the principal agents in the degradation of forests in the mid-hills.

Out of the 139 households surveyed, 87 households reported that the main causes of forest exploitation were population pressure (97 reported so), poor performance of the DOF staff (76), construction of roads (56), growing fuelwood markets in the urban centres (45), and lack of clear-cut management authority among the local people (34). Illegal use of the forest for non-timber products scored only 32. It was claimed that lack of control by the

DFOs and abuse of rules by the politically and economically powerful in society led to forest degradation. It was, therefore, concluded that traditionally-recognised forest uses such as fodder and fuelwood collection were not the principal causes of forest degradation in the study area. A closer analysis of the resources indicated that the perception of local people regarding the causes of deforestation were different than those of 'outsiders'. The reason for this situation is perhaps due to their increased involvement in and understanding of their forest system. For example, although population expansion was blamed as the leading cause of deforestation, this was invariably associated with the authoritarian and alienating attitudes of rangers and malpractices by land surveyers and other government staff whose conflicting dictums had undermined their traditional respect for the forest.

Hypothesis # 3. There is no difference in the attitudes of people from different ethnic groups towards the role of the forest.

The sample respondents were grouped into four broad ethnic groups and were questionned about their knowledge, awareness, perceptions, and attitudes towards different forest activities. The X^2 test conducted indicated that the response did not differ significantly (P=0.01) along ethnic lines. It was therefore concluded that the attitude of the people regarding the role of the forest was similar across social groupings.

Hypothesis # 4. Locally planned, implemented, and managed reforestation projects are more cost effective and sustainable than outside managed plantation projects.

Local people were found to be quite interested in reforestation work, provided they were properly motivated. One of the key factors that was found to induce local participation was the prior guarantee of tree ownership. Formation of user groups prior to the plantation work was an appropriate institutional mechanism to ensure popular support. Four reforested areas reportedly planted through people's participation (planning, implementing, and managing) were examined against the standard norms of the traditional plantation methods. The survival count of the four patches was 70 per cent, which is also higher than the national average (60%) reported for CF projects. Using the cost estimates

made by the respective DFOs, it was found that the participatory plantation cost was Rs 1,490/ha compared to Rs 14,159/ha for a plantation established by contractors. The two mean amounts were significantly (p=0.01) different from each other and, therefore, it was concluded that reforestation work could be planned and implemented by the local people in a more cost-effective manner provided an appropriate institution was created beforehand.

Hypothesis # 5. Degraded land is suitable for broadleaf-based multiple use forestry (silvipasture, horti-pasture, etc) practices.

This hypothesis attempts to refute an often repeated statement that the degraded sites were suitable only for conifers and other hardy species. Over 90 per cent of the degraded land in the study area reforested by the community was planted with multipurpose trees and grasses. Despite hostile biophysical conditions, especially poor soil profiles and steep slopes, these lands had a history of maintaining deciduous forest cover. Since most of the UG-managed forests had also gone through different stages of degradation and rehabilitation, leading to the current state of sustainable forest management, it was concluded that technically most of the degraded land was suitable for implementing broadleaf-based multi-storey forestry practices. On questioning whether reforestation work would lead to the development of multiple forestry, about 83 per cent replied in the affirmative. The chi-square test conducted showed that community reforestation work was closely related (p=0.05) to multiple use forestry.

Hypothesis # 6. Forest management strategies built upon indigenous management techniques lead to sustainable forestry.

All the successful FUGs in the study area had a history of an indigenous forest management system in one or other form. The very concept of user group management was based on indigenous technical knowledge and skills. Since it has been realised by the government, in its policy statements, that the management of community forest land is not possible without day to day participation by the community, it is concluded that forest management plans which have incorporated indigenous knowledge and skills have greater chances of succeeding. Out of nine FUGs

examined in the case studies, one FUG each - Telgha in Palpa and Dopahare in Phewa did not have any history of indigenous management, i.e., 80 per cent of the FUGs which were successful had an indigenous association. As the success factor was significantly ($p=0.05$) correlated to the indigenous element, the hypothesis was not rejected.

Hypothesis # 7. Improved resource condition (indicated by tree density and standing biomass volume) is indicative of effective forest user group management.

Forest areas with over 70 per cent crown cover, rapidly regenerating trees, existence of forest litter, rejuvenating springs, presence of wildlife, and increased soil fertility and reduced sediment yield generally indicated good forest management. These attributes of course are associated with management indicators such as the presence of an effective FUG structure, an equitable distribution system, community-managed reforestation schemes, and absence of fencing. In almost all the FUGs in which these factors were found to be positive, superior management of user group forests was noticed. Out of the nine FUGs studied, seven had a strong association of these variables. The biometric variables (growth and yield) were significantly correlated to the group attributes such as enforcement of rules and fair distribution of forest products.

Hypothesis # 8. Forest user groups are more effective where successful parallel institutions exist to manage other natural resources.

Forest user groups were found to be more effective in the presence of parallel systems of organisation (e.g., irrigation user groups, livestock user groups, etc). It was noted that FUGs that had included certain pre-existing and contemporary technical solutions in the management plans were having less disputes and more effective protection than groups which ignored the exisiting knowledge and skills. A case in point is Mulgaira FUG. The villagers here have a well organised user group in a several natural resources' sector. On the other hand, in Dopahare area, the FUG was not found to be successful due to ignorance of the functioning and structre of sister user groups. As there was a strong association between the existence of user groups in other sectors and successful FUGs, the hypothsis was not rejected.

Hypothesis # 9. Management plans must be understandable by, and appropriate to, the local community, for effective management.

A typical management plan follows a standard format with the general rules and technical prescriptions being written with the aid of the Ranger. Those FUGs that were closely involved in writing the OPs were having no or few complaints regarding the lack of knowledge of the provisions of the plan. In such FUGs, compliance to rules was high. However, in those FUGs which had been simply handed over through imposed OPs, the members were largely unaware of the rules and did not understand the UGF concepts, procedures, and practices. This hypothesis was examined by testing the knowledge and awareness of the members regarding the key provisions of the operational plan. It was found that out of 109 respondents in Palpa, 91 (83%) had knowledge of harvesting time, penalty amounts, and major tree species as provided for in the OP. However, in Phewa only 16 out of 30 (53%) had knowledge of the same items. It was therefore concluded that members of the successful FUGs were heavily involved in the preparation of operational plans as well as having a thorough knowledge of them.