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VOLUME II (C)

RESOURCE CONSERVATION AND UTILIZATION
PROJECT
PROJECT NUMBER 367-0132

VOLUME II (C) . . . . . APPENDICES Ia-Ic

APPENDIX Ia - LIVESTOCK PRODUCTION

APPENDIX Ib - RANGE MANAGEMENT AND ANIMAL HUSBANDRY COMPONENT

APPENDIX Ic - RANGE AND PASTURE PRODUCTION

APPENDIX Ia

LIVESTOCK PRODUCTION

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TABLE OF CONTENTS

Chapter	Page
Introduction	1
Livestock population	2
Animal husbandry ownership pattern	3
Breakdown of different types of livestock and poultry bird into adult, youngstock (percentage)	5
Breakdown of different types of livestock and poultry bird into adult, youngstock with sexwise (head) of Makawanput, Gorkha, Myagdi & Mustang	7
Animal Husbandry System	9
Breeds and performance	12
Livestock Production	15
Estimated breakdown of livestock production in the existing year	20 20
Disease situation	21
Prevailing price list of livestock and poultry bird and their products	22
Description of government offices residing in the project area	24
Livestock Development Proposed Programme	28
Summary of livestock development proposed programme of the project area	41
Summary of livestock development proposed programme of Kulekhani Catchment Area (Makawanpur district)	43
Summary of livestock development proposed programme of Daraudi Catchment Area (Gorkha district)	45
Summary of livestock development proposed programme of Upper Kaligandaki Catchment Area (Myagdi district)	47
Summary of livestock development proposed programme of Upper Kaligandaki Catchment Area (Mustang district)	49
Budget	51
Capital Cost	54
Benefit from livestock component	75
Cost for livestock component	76

Tables of livestock benefit and cost

Table No.		Page
1.	Total benefit and cost (summary form)	80
2.	Total benefit from different types of livestock projects	81
3.	Total cost of rearing of animals in the project area	82
4.	Total cost of rearing of animals in the project area	83
5.	Total requirement of fodder for animals	84
6.	Cost of rearing of animal or poultry bird (per head per year)	85
7.	Quantity of concentrate feed given (per head per year)	87
8.	Cattle and buffalo herd and sheep, goat, and poultry flock development composition	88
9.	Breakdown of livestock and poultry bird into adult and young sexwise	89
10.	Impact of project in livestock development	90
11.	Prevailing price list of livestock products	92

APPENDIX

Appendix no.	Table no.	Particular	Page
1	1	Total livestock and poultry birds of different panchayats in Kulekhani Catchment Area	94
1	2A & 2B	Total no. of livestock population and poultry birds of different panchayats of Daruandi Catchment Area (Gorkha district)	95 & 96
1	3	Total no. of livestock population & poultry birds of different panchayat of Upper Kali-gandaki Catchment Area (Myagdi district)	97
1	4	Total no. of livestock and poultry birds of different panchayats of Upper Kali-gandaki Catchment Area (Mustang District)	98
2	1	Milk production (Buffalo, Cattle & Nak/Chauri)	99
2	2	Ghee production (Buffalo, Cattle & Nak/Chauri)	100
2	3	Meat production (Buffalo & Goat)	101
2	4	Meat production (Poultry & Sheep)	102
2	5	Egg and wood production	103
2	6	Hides and skin production	104
2	7	Farm yard manure (Buffalo)	105
2	8	Farm yard manure (Cattle)	106
2	9	Farm yard manure (Sheep, goat & poultry)	107
3	1	Total cost of required number of vaccination & drenching in the project area	108

Appendix no.	Table no.	Particular	Page
4		Phasing of livestock development center and sub-center (location, year of implementation)	109
		a. Kulekhani Catchment Area (Makawanpur)	109
		b. Daraundi Catchment Area (Gorkha)	110
		c. Upper Kali Gandaki Catchment Area (Myagdi)	112
		d. Upper Kali Gandaki Catchment Area (Mustang)	113
5	1	Recommended staffing pattern of livestock development centers	114
5	2	Recommended staffing pattern of livestock development sub-center	117
5	3	Total required number of manpower for livestock and pasture development	119
5	4	Total number of manpower in different offices at present in the project area	120
5	5	Incremental staff of livestock and pasture development	121
6		Training	
	1	Preparation cost of incremental JTA in project area	122
	2	Preparation cost of VAA in the project area	123
	3	Total cost involved in training (inservice)	124
	4	Refresher course training	125
	5	Farmer's day	126
	6	Total cost involved in training	127
	7	Farmer's training	128
	8	VAA training	129
7		Norms for buildings	130

RCUP

LIVESTOCK PRODUCTION

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RCUP
LIVESTOCK SECTOR

INTRODUCTION

Livestock keeping is an integral part of agriculture farming in the project area and has become one of the main sources of income for rural hill people. Especially in Mustang district, livestock rearing has played a vital role since in addition to income, livestock provide the main source of food. Indeed, animal husbandry is an indispensable element of the RCUP.

A typical rural hill farm family of 5-6 members in the project area keeps one or two heads of buffalo, one to three heads of cattle, a few sheep and goats and some poultry birds. Inhabitants of the northern part of Jomsom and Mustang districts, also rear yak/nak and chauries. These animals provide a means of transportation and also are used for ploughing, milking, etc. Beside these animals, horses and mules are found in Myagdi and Mustang and are used for exporting and importing of wool, churpi (a kind of compact cheese), rice, salt, and daily used goods and materials.

In general, buffalo are kept for milk production and cattle for ploughing. In addition, animal dung is the principle source of fertilizer without which crop production would be sharply curtailed. Sheep and goats are reared mainly for meat and wool production and are utilized for transportation. Pig raising is infrequent; only lower castes raise them. Poultry keeping is very popular.

At present, there are 51,000 buffalo, 128,800 cattle, and 145,000 sheep and goats in the project area. This area covers 512,662 sq. kms. and contains 214,484 people and 41,636 households. An average farm household with 1.23 hectares of cultivated land keeps 3 livestock units.

Presently only 50-60 percent of total animal food requirement is available, resulting in lowered livestock productivity. Overgrazing leading to erosion is very common everywhere, and leads to a continuous depletion of natural resources. Animals live on paddy, millet, wheat, maize crop residues and fodder leaves in winter and on green grasses, weeds from the farmstead, forest and pasture in summer. There is a perpetual food scarcity, especially during winter.

FMD, R.P., H.S., the major diseases of large animals (cattle, buffalo), liverfluke, and other ecto and endoparasitic diseases are common in small animals (sheep and goat). For poultry, ranikhet and fowl pox are frequent.

All animals in the area are local breeds. Because of different factors of livestock illness, animal production is very low. Shortage of feed, poor genetic stock, lack of animal health care and a crucial factor, ineffective extension activities, are the major constraints to livestock improvement.

Findings and conclusions. In view of the present situation, the Detailed Feasibility Study Team has proposed a number of programmes.

The introduction of a few improved breeds of livestock and poultry will significantly improve livestock production. By the end of the fifteenth year of the project, milk production will be increased by 140.9 percent, meat production by 58.8 percent, egg production by 124.4 percent and wool production by 81.0 percent. There is no chance of increment of hides/skin in second and third five year, as the livestock mortality rate will be decreased. FYM production is expected to be increased by 64.2 percent and draft power benefit by 8.7 percent in the fifteenth year.

Finally, this Livestock and Pasture Development component helps to uplift the quality of life among rural hill people. Concurrently, the heavy pressure on forest/pasture land will be significantly reduced through better land use practices.

LIVESTOCK POPULATION

A current livestock census is not available. However, team estimates the total livestock population (excluding poultry and domestic birds) as follows:

(a)	Makawanpur	--	45,640
(b)	Gorka	--	194,500
(c)	Myagdi	--	62,650
(d)	Mustang	--	30,020
			332,810

L.U. = Livestock unit. 1 adult buff = 1 L.U.

1 cow/oxen = 0.7 L.U., 1 sheep/goat = 0.1 L.U., 1 buff calf = 0.3 L.U.

1 cattle calf = 0.23 L.U., 1 horse-mule = 0.8 L.U., 1 donkey = 0.5 L.U.

1 chouri/yak = 0.8 L.U.

Gorkha District (Daraundi catchment area) holds the highest number of livestock, i.e., 58.44 percent, followed by Myagdi district (upper Kali Gandaki catchment area) with 18.82 percent; Makawanpur District (Lukekhani catchment area) with 13.72 percent; and Mustang District (upper Kali Gandaki catchment area) comes at last with only 9.02 percent. See Table 1 below and also Appendix 1, page 1 to 5, for the panchayatwise livestock population.

Total number of livestock and poultry birds in different catchment area* districtwise:

Table 1

(in heads)

District Animal	Makawanpur	Gorkha	Myagdi	Mustang	Project Area
Buffalo	5,400	29,500	16,100	20	51,020
Cattle	17,400	81,900	24,200	5,300	128,800
Sheep	40	6,600	7,100	1,800	15,540
Goat	22,800	75,300	15,000	17,200	130,300
Yak & Nak	--	--	--	2,000	2,000
Chauri	--	--	--	1,400	1,400
Horse/Mule	--	--	200	2,300	2,500
Pig	--	1,200	50	--	1,250
Poultry	27,100	127,900	64,400	8,700	228,100

ANIMAL HUSBANDRY OWNERSHIP PATTERN

An average farm family of six members rears one to two heads of buffalo, 2-3 heads of cattle, 3-6 sheep and goats, and a few poultry birds. Yak/nak are only raised in Mustang. Here holdings vary from 2-20 heads. Some people also keep horses and mules, mainly for transportation. In this way Mustang district holds the highest number of livestock per household, i.e., an average of 10 animals per household. But this is largely because of the greater

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* There are three catchment areas in the whole project area:

1. Kulekhani catchment area: it comes under Makawanpur district, whose commanding area are seven panchayats only.
2. Daraundi catchment area: it lies in Gorhka district and it covers only 29 panchayats.
3. Upper Kali Gandaki catchment area: it covers two districts: Myagdi district -- commanding area are 14; Mustang -- 16 panchayats.

goat population in Mustang, which is more than five head per household. Average number of livestock per household in Myagdi, Gorkha and Makawanpur is 8.3, 7.8 and 7.2, respectively (excluding poultry). The breakdown by animal is shown in Tables 2 and 3.

Average numbers of livestock and poultry birds per household in the project area districtwise:

Table 2 (in head)

Animal District	Makawanpur	Gorkha	Myagdi	Mustang
Buffalo	0.84	1.19	2.14	--
Cattle	2.73	3.30	3.23	1.78
Sheep	0.06	0.26	0.95	0.60
Goat	3.58	3.04	2.00	5.79
Yak & Nak	--	--	--	0.67
Chauri	--	--	--	0.47
Horse/Mule	--	--	0.03	0.77
Pig	--	0.05	0.01	--
Poultry	4.25	5.15	8.60	2.93

R C U P

PROJECT AREA

Breakdown of different types of livestock and poultry bird into adult, youngstock.

Table - 3 (in percentage)

District	Makawanpur						Gorkha						Myagdi						Mustang					
Animal	Adult		Young-stock		Lac. animal		Adult		Young-stock		Lac. animal		Adult		Young-stock		Lac. animal		Adult		Young-stock		Lac. animal	
	M	F	M	F	M*	**	M	F	M	F	*	**	M	F	M	F	*	**	M	F	M	F	*	**
uffalo	3	51	18	28	45	--	2	53	15	30	45	--	4	60	14	22	45	--	--	--	--	--	--	--
Cattle	30	31	21	18	40	--	41	37	11	11	40	--	37	33	13	17	40	--	12	58	10	20	40	--
Sheep	--	--	--	--	--	--	10	56	14	20	--	--	16	60	13	11	--	--	18	48	18	16	--	--
Goat	10	50	22	18	--	--	9	52	22	17	--	--	6	62	13	19	--	--	33	34	14	19	--	--
Yak/Nak	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4	66	8	22	40	na
Chauri	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	70	13	9	8	40	na
Horse/Mule	--	--	--	--	--	--	--	--	--	--	--	--	40	30	16	14	--	--	36	30	18	16	--	--
Pig	--	--	--	--	--	--	8	72	10	10	--	--	8	72	10	10	--	--	--	--	--	--	--	--
Poultry	9	42	23	26	--	--	23	25	28	34	--	--	16	34	25	25	--	--	18	50	16	16	--	--

* Out of total adult animal

M = Male, F = Female

There is little difference in herd and flock composition between one district and another. At the same time the proportion of milking female livestock (buffalo, cow, nak, chauri) to total female livestock is similar in each district (45 percent for buffalo, 40 percent for cattle and 40 percent for nak and chauri). The one exception is the chauri, for which 13 percent are adult female and 70 percent are adult male. This is because of the greater value of male chauri, which are exploited for many purposes.

Breakdown of different types of livestock and poultry birds into adult and youngstock with sexwise:

Table - 4A (in heads)

District / Animal	Makawanpur					Gorkha				
	Adult		Youngstock			Adult		Youngstock		
	M	F	M	F	Total	M	F	M	F	Total
Buffalo	162	2,754	972	1,512	5,400	590	15,635	4,425	8,850	29,500
Cattle	5,220	5,394	3,654	3,132	17,400	33,579	30,303	9,009	9,009	81,900
Sheep	4	20	9	7	40	660	3,696	924	1,320	6,600
Goat	2,280	11,400	5,016	4,104	22,800	6,777	39,156	16,566	12,801	75,300
Pig	--	--	--	--	--	96	864	120	120	1,200
Poultry	2,439	11,382	6,233	7,046	27,100	16,627	31,975	35,812	43,486	127,900

M = Male

F = Female

On the basis of table number - 3 the total number of animals and poultry birds with sexwise is calculated for different districts.

R C U P

Breakdown of different types of livestock and poultry birds into adult, youngstock with sexwise:

Table - 4B (in heads)

District / Animal	Myagdi					Mustang				
	Adult		Youngstock			Adult		Youngstock		
	M	F	M	F	Total	M	F	M	F	Total
Buffalo	644	9,660	2,254	3,542	16,100	--	--	--	--	20
Cattle	8,954	7,986	3,146	4,114	24,200	636	3,074	530	1,060	5,300
Sheep	1,136	4,260	923	781	7,100	684	504	324	288	1,800
Goat	900	9,300	1,950	2,850	15,000	5,676	5,848	2,408	3,268	17,200
Yak/Nak	--	--	--	--	--	80	1,320	160	440	2,000
Chauri	--	--	--	--	--	980	182	126	112	1,400
Horses/Mules	80	60	32	28	200	828	690	414	368	2,300
Pig	4	36	5	5	50	--	--	--	--	--
Poultry	10,304	21,896	16,100	16,100	64,400	1,566	4,350	1,392	1,392	8,700

M = Male

F = Female

ANIMAL HUSBANDRY SYSTEM

Buffalo. Buffaloes are of high economic value to farmers. They are reared mainly for milk production and farm yard manure. The number of improved buffaloes is negligible. Buffaloes are always stall fed for the whole year with green grass, salt, and concentrated feed, especially during lactation. Fertile female buffaloes and female calves receive better care than male buffaloes, since these are only valued for meat (and this only among some castes) and for manure. In general, the more acreage of cropland one has, the more buffaloes one owns. Some households own up to 10 buffaloes. Buffalo keeping is more concentrated along the roadside and in bazaar towns primarily because of the marketing opportunity. Approximately 44 percent of the farm households in Daruandi keep buffaloes. Kulekhani buffaloes are raised in about 49 percent of the households.

Cattle. Cattle are widely found from the lower to the upper altitudes (up to 2500 meters). Cattle are important for religious reasons, and there is hardly a farm household that does not have one or two cattle; 70 percent of the households in Daraundi and 84 percent of the households of the Kulekhani catchment keep cattle. Farmers rely on cattle mainly for bullock power and farm yard manure but not for milk. As there is no alternate means of ploughing in hilly regions, cattle are a necessity. Cattle are not well nourished; many are in a state of semi-starvation. In summer they are grazed on pasture land, forest, and cropfields; in winter they are grazed in the forest. There is no stall feeding, as farmers cannot afford to do so. A small amount of concentrated feed, khole, is usually fed to milking cows for the first 3 to 4 months of calving and to bullocks at the time of ploughing.

Sheep/Goat. Sheep are often reared in high altitudes and are rare at lower altitudes. Sheep are reared mainly for meat in lower areas and for wool and meat at higher altitudes, i.e., in northern Jomsom or Mustang District and in Barpak Panchayat of Gorkha District. There are different patterns of rearing sheep in higher and lower altitudes. Sheep are nomadic in higher altitudes, whereas the sheep at lower altitudes are reared by settled farmers and are daily grazed. Ghee from surplus milk is sometimes made but it is negligible in quantity. Farmers keep flocks of 2-4 to 20-25 sheep. Regarding the sheep of higher altitudes, they are brought down to areas below 1000 meters in winter (from September/October to January/February) and graze in forest, pas-

ture, and even in crop fields. Then they are taken up to the snowline for grazing when winter recedes (after February/March). At higher altitudes, mixed animal husbandry (goat with sheep) is common, but at lower altitudes. In higher altitudes farmers also utilize their sheep and goats for transportation and for wool, whereas in lower altitudes, sheep and goat keeping is done purely for meat.

Yak/Nak and Chauri. Yak/Nak are mainly concentrated in the hills, i.e., above 3000 meters in Myagdi and Mustang Districts. However, very few farmers keep yak/nak due to the lack of feed. So-called large farmers keep 2-20 head of yak/nak. Yak are reared for breeding purpose and also utilized for ploughing. They are also one of the main sources of transportation. Nak are reared mainly for milk production. They remain in alpine pastureland until and unless there is heavy snow fall since they cannot adapt to a very warm climate. Yaks are never kept in sheds, except for breeding purposes. Nak and calves remain in sheds more or less all the time, and as a result they are better cared for. They are fed concentrated feed [1/] 2-3 days prior to calving and up to 5-10 days after calving. In fact, Yak/Nak rarely die of disease, but sometimes farmers lose much of their herds simply because of heavy snowfalls that deprive the animals of grass.

Chauri is the cross breed of Yak/Nak and the lulu cattle. It is also adapted to high altitudes, i.e., above 2500 meters. Male Chauri are called Jhopa and female are called Jomo. There are anywhere from 5-30 chauri per household. Jhopa are utilized for ploughing and Jomo for milk production. Chauri are also one of the main sources of transportation and are thus important for high altitude dwellers. They can come down up to 1000 meters. Especially in winter, farmers bring their chauri to Pokhara where the animals are loaded with basic commodities, rice, salt, cloth and other daily need goods for their return to Myagdi and Mustang. They are also utilized to transport fire wood from the forest. Chauri remain at the barn more or less all the time and thereby they get more care than Yak/Nak. They are occasionally fed concentrated feed and salt. In summer they graze in alpine

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1/ Khole (Uwa, i.e., naked barley flour is boiled with water).

Pattern of Breeding (Yak/Nak x Hilly cattle)

Type - I

(1) Yak x Lulu cattle female

F_1 - Chauri - { Male - Jhopa - Sterile
Female - Jomo - Fertile

(2) Yak x Jomo

F_2 - { Male - Toltu - Fertile (but dies after 4-5 yrs. because of lack of nourishment)
Female - Tolmu - Fertile (" " " " " " ")

(3) Yak x Tolmu

F_3 - (Lulu cattle)

Type - II

(1) Nak x Hilly cattle (bull)

F_1 - Chauri - { Male (Jhopa) - stout body, resistence to disease
Female (Jomo) - produce more milk

(This type is more productive than Type I)

(2) Jomo x Lulu cattle (bull)

F_2 - { Male - Toltu
Female - Tolmu

In the F_2 generation, both males and females die early because of lack of nourishment. Farmers also do not take great care to keep the animals alive, because they are less productive than other animals.

pasture and as the cold starts, they come down and live off crop residue, grass, etc. Some farmers also make hay for winter feed.

Poultry. Poultry keeping is becoming more popular in the project area. Until recently, only lower castes raised poultry. But these days, brahmins and Chhetris are also starting to show an interest in poultry. There is no commercial poultry farm and present farmers are showing a tremendous interest in this idea since the costs would be minimal and the income would be high.

Presently more than 60 percent of farm families are keeping poultry. One small poultry farm with the capacity of 100 birds was also found in the Kulekhani catchment area. Farmers do not give any concentrated feed to poultry. Only at the time of harvesting of crops do poultry birds receive grain. The birds also feed themselves by moving around the kitchen and courtyard.

BREEDS AND PERFORMANCE

There are no exotic breeds of animal in the project area except for one or two bulls and some rams distributed by the District Agriculture Development Office (DADO) and the Sheep and Goat Development Centre (in Mustang). The characteristics and the performance of local breeds of animal are described below.

1. Buffalo

a. Lahure. This is a cross-breed (improved) buffalo concentrated in the Kulekhani catchment area. The body is massive in size, black in color, and horns short and curved. It produces 1200 to 1800 litres of milk per lactation, i.e., 4 to 6 litres per day with 300 days of lactation. The calving interval is 18 months. The fat percentage of the milk is 7. Lahure mature after years. It is brought up from Jitpur near Birgunj.

b. Parkote (Pahadia). This is a local buffalo, also called Lime. In fact, there is no one word for "local buffalo," but rather all types are distinguished by separate names. Parkote is widely found in the project area. It is poor in performance, with a low fertility rate. The body is small. The brow is black in color, with horns short to medium. The live weight is 200 to 250 kg. when matured, which occurs at the age of 3.5 years. A female first calves at the average age of 4.5 years. It is

estimated that the productive life is 8-10 years, giving birth to 5-6 calves. A female gives birth in every 18-24 months. Parkote milk production is poor. It is estimated that a female prduces 500-800 litres of milk per lactation (300 days) with the fat content 7 percent. Usually a bull starts to give service at the age of 3 to 4 years, and its productive life is 4 years. It can breed up to 7 to 8 years.

2. Cattle

a. Hilly cattle (Pahadi gai). This is an indigenous breed, small to medium in size and black or brown to dirty white in color. Females produce 160 to 220 litres of milk per lactation, for an average of 240 days. The milk is 4 percent fat. It is assumed that the female's productive life is 6 to 9 years with a calving interval of 18 to 24 months. Thus the animal will have 4 to 6 lactations in her entire life. A cow matures at 4 years and gives first calf at the average age of 5 years. Hilly cattle are widely found in the project area. A bull matures at the age of 3 to 4 and can give service up to 7 to 8 years. Its productive life is assumed to be 3-4 years.

b. Lulu cattle. Lulu cattle generally live at higher altitudes, i.e., mainly in Mustang District and in scattered areas of Myagdi District. The lulu is medium in size, brown to black in color. Its average milk yield is 0.8 litres per day with 7 percent fat content. The lactation period is 240 days and the calving interval is 12-24 months. The lulu female first calves at the age of 4-5 years and will produce 3-6 calves in her entire life.

3. Sheep

a. Kage. The Kage is small in size with a white body and black head. The body is compact, the neck and ear long. The live weight of an adult male is 20-25 kgs and 15-20 kgs for an adult female. Kage sheep mature at 1-2 years and the female gives birth to 1-3 lambs at one time. Because of the adoptation of faulty breeding season, the mortality rate of lambs is high. Kage sheep are confined to lower altitudes of hilly regions. It is reared mainly for meat production, as its wool quality is course and used mainly to make rope and radi (very poor quality carpet). Furthermore, wool production is very low (300-400 gm. per year). Shearing is done twice a year.

b. Baruwal. Baruwal is mainly concentrated at higher altitudes at

Barpak, Simjung Panchayat of Gorkha and also cool regions of Myagdi andn Mustang Districts. The body is compact and both larger and taller than kage sheep. The live weight of an adult male and female are 25-30 kg and 20-25 kg, respectively. Baruwal sheep live in large flocks of 100-500 head. They mature late, at 1.5-2 years. A female gives birth every year and can produce 4-6 lambs in her life time. The wool of Baruwal is better in quality and quantity than that of Kage, i.e., 0.5-1.0 kg per year. The main breeding season is September/October and lambing season is February/March. Lambing is single. Ghee is made from surplus milk.

c. Bhyanglung. This is a Tibetan breed of sheep. It is mainly found in the northern part of Jomsom and in Kagbeni of Mustang District. It is large in size, white to brown in color. The wool is of fine quality. Ghee is made from Bhyanglung milk but only in small quantities.

4. Goat

a. Hilly goat. This type of goat is abundantly found all over the mid hills from 800-2000 meters altitude. It is medium in size and white brown to dirty white to black in color. It matures early, from 6-12 months. Kidding percentage is 70-80, but mortality is high at 30-35 percent. One female goat can produce 5-6 kids in her entire life with 12 month intervals between births. Kidding is single to twin. The average live weight of matured male goats is 25-30 kg.

b. Sinal goat. The Sinal goat is mostly confined to high altitudes and found mixed with flock of Baruwal sheep. It is also found in the mid hills, but this is not common. It has a medium body size with different coloring. It matures late, after one year. In general, the female gives 3 births every two years with 5-6 births in the female's life time. The live weight of a matured goat is 20-30 kg.

c. Chyangra. This is a Tibetan breed and thus is confined to high altitudes, from 2000-4000 meters. Generally Chyangra are seen in Myagdi and Mustang Districts (from the northern part of Kagbeni panchayat to the Tibetan border). For these districts, it is a very important animal that is used for transportation. Chyangra are smaller than the hilly goat, and the body is more compact. Leg and head are small. A pair of small horns occur in both male and female. Its hair is long and falls down to the knee. The hair is coarse and is used to make rope, a rough type of carpet, bags, etc. Very short and soft hair is also found underneath the

long hair. This very short, soft hair is called Pashmina and is used to make mufflers, caps, coats, etc., which are very expensive and valuable. The Chyangra also matures late, from 1.5 - 2.5 years. Kidding season occurs from June to August with single births. The kidding percentage is 80. Chyangra is a good milk producer with yields of 100-200 ml/day with 90 days of lactation. Milking is done once a day, and ghee is also made from surplus milk. The market price of the ghee is Rs. 40/kg.

5. Yak/Nak. The yak/nak is referred to as a snow loving animal, as it lives above 3000 meters. The male is called yak and the female is nak. The body is massive and bears a pair of long horns. The front legs look shorter than the posterior legs. The tail of the nak is used in religious rituals and is very costly (50-200 Rs). It is a good pack animal. Yak are also utilized for ploughing and nak for milk production. On an average, the nak produces one litre of milk per day with 7 percent fat content for 90-120 days. The nak matures at 4-5 years and gives birth at 5-6 years. 75 percent of the nak produce a calf every 24 months a the remaining 25 percent give birth every 12-18 months. A Nak produces 5-6 calves in her lifetime. Ghee and churpi (hard and compact cheese) is made from surplus milk.

6. Chauri. This is a cross-breed of yak/nak with lulu cattle. It is smaller than yak/nak and bigger than the lulu. The body is stout and brown to black in color. It is also a good pack animal and a main source of transportation. It matures at 4-5 years. The female produces milk, about one litre per day with 7 percent fat content for 90 to 120 days. Ghee and Churpi is made from surplus milk.

7. Poultry. There is no exotic breed of poultry in the project area. All are local and have poor productivity. One laying bird lays eggs two or three times a year at the rate of 10-15 eggs per time, and produces 30-40 eggs per year. The live weight of a mature bird is slightly more than a kg.

LIVESTOCK PRODUCTION

1. Milk Production. Of buffalo, 55 percent of the animals are adult female and 45 percent of these are lactating (milking). On an average, one buffalo cow produces 2.2 litres of milk per day for 300 days (lactation days) with a calving interval of 20 months. Regarding cattle, 40 percent are adult female and of these, 40 percent are lactating. The average milk yield is 0.8 litres

per head per day for 240 days, or 192 litres per lactation with a calving interval of 20 months. Among the nak, 66 percent of the animals are adult female and of these, 40 percent are milking. For chauri, 13 percent are adult female and of these, 40 percent are milking. Both nak and chauri produce a litre of milk per day for 90 days (lactation period) with an average of 90 litres of milk per lactation and a calving interval of 24 months. Our estimate reveals that Gorkha District produces the largest quantity of milk in the entire project area (7335 thousand litres). Then follows Myagdi, Makawanpur, and Mustang. Thus the per capita milk production comes to 57.5 litres in the project area.

Milk production		(000 litres)
Makawanpur		1,416.0
Gorkha		7,335.0
Myagdi		3,372.0
Mustang		220.0
	Total:	12,343.0

For further detail, see Appendix 2, Table 1, page 1.

2. Ghee production. It is assumed that milk producerrs themselves consume 10 percent of the raw milk and the remaining 90 percent is sold as raw milk or as ghee. But in general, maximum quantum of produced milk is being tried to utilize for ghee making. Thus total project area produces 667.4 tons of ghee. (See Appendix 2, Table 2, page 2.)

Ghee production		Tons
Makawanpur		74.78
Gorkha		394.18
Myagdi		192.37
Mustang		6.07
	Total:	667.40

3. Meat production. In the project area buffalo, sheep, goat and poultry are used for meat. 57.3 percent of this meat is produced in Gorkha District alone. Meat is one of the main sources of protein in the project area. At

present in the project area, there are 2.5 kg of meat per head per year.

For religious reasons, cattle are no where legally slaughtered in Nepal. Whatever number of cattle are illegally slaughtered are all adult males. In general, young stocks are not used for meat.

It is estimated that one adult buffalo produces an average of 80 kg of edible meat. 15 kg, 14 kg and 0.8 edible meat is estimated per head in case of goat, sheep and poultry birds, respectively. Only in the case of poultry are both males and females used for meat production. Some people in the project area also consume pork, but the numbers have not been calculated. (For details, see Appendix 2, Table 3 and 4, pages 3 and 4.)

Edible meat. For buffalo, hide, bones and other unedible materials are excluded. But in case of goat, sheep and poultry, all skin, intestines and blood are also consumed.

Meat production		Tons
Makawanpur		72.2
Gorkha		307.7
Myagdi		121.7
Mustang		39.3
	Total:	540.9

4. Egg production. It is estimated that 38 percent of the poultry are laying birds. Because of poor nutrition and lack of other health care, productivity is very low. One bird lays eggs 2-4 times a year at the rate 10-15 eggs per time. Thus, it is estimated that one laying bird produces only 30 eggs per year on an average. Most all of the eggs are consumed at home. Gorkha District alone produces 56.1 percent of the total egg production, i.e., 1,458,100 eggs. Then come Myagdi, Makawanpur and Mustang Districts. In the project area there are 12 eggs per head per year.

Egg production		(000 No.)
Makawanpur		308.9
Gorkha		1458.1
Myagdi		734.1
Mustang		99.2
	Total:	2600.3

For further details, see Appendix 2, Table 5, page 5.

5. Wool production. Because of poor genetic stock and poor health care, sheep have low productivity of both meat and wool. This is especially true of the Kage breed. Their wool production is only 300 gm. on an average per head per year, whereas with the Baruwal breed, production is 700 gm per head per year. On the average, 550 gm/head/year for one adult sheep is estimated. In general, shearing is done twice a year with adult sheep (lambs are excluded). Myagdi District produces substantially more wool than Gorkha. (See Appendix 2, Table 5, page 5.)

Wool production	(Tons)
Makawanpur	--
Gorkha	2.5
Myagdi	2.7
Mustang	0.6
Total:	5.8

6. Hides and skins. In general, skins of sheep and goat are consumed. Only the hides of buffalo and cattle are used to make shoes, bags, knife cases, etc. There is no commercial factory for these goods. Some lower castes (especially sarki) collect hides and skins from dead animals. It is assumed that there is a 15 percent and a 12 percent mortality rate (including all adult and young animals) respectively for cattle and buffalo. It is not possible to collect hides and skins from every animal that dies since some animals die in places beyond man's reach. From this, a 5 percent loss in hides is a reasonable estimate. (See also Appendix 2, Table 6, page 6.)

Hides and skins	(Pieces)
Makawanpur	3,096
Gorkha	15,034
Myagdi	5,284
Mustang	755
Total:	24,169

7. Farm yard manure (FYM) production. FYM plays a vital role in the agricultural production system, especially in the hilly regions. Chemical fertilizer is more or less unknown to farmers. Thus, livestock rearing is an

integral part of farming. It is estimated that one adult buffalo produces 6000 kg FYM per year and young stock of buffalo produce 2000 kg/head/year. Adult cattle are estimated to produce 3000 kg of FYM per head; calves, 2000 kg per head. For sheep and goats, it is 150 kg and for poultry, 10 kg.

FYM production		(Tons)
Makawanpur		72,676.0
Gorkha		359,252.0
Myagdi		137,485.0
Mustang		16,309.0
	Total:	585,722.0

(For further details, see Appendix 2, Table 7, 8 and 9, pages 7, 8 and 9.)

Table 6

Estimated Breakdown of Livestock Production
In the Existing Year

Product	Makawanpur	Gorkha	Myagdi	Mustang	Grand Total
Meat 30% H	21.66	92.3	36.5	11.79	182.27
(M. Tons) 70% M	50.54	215.4	85.2	27.51	378.63
Milk 10% H	141.6	733.5	337.2	22.0	1234.3
(in '000 lts) 90% M	1274.4	6601.5	3034.8	198.0	11108.7
Ghee 10% H	7.48	39.42	19.24	.61	66.74
(in ton) 90% M	67.30	354.76	173.13	5.46	600.66
Egg 90% H	278.01	1312.29	660.69	89.28	2340.27
(in '000) 10% M	30.89	145.81	73.41	9.92	260.03
Hides and skins 25% H	620.0	2918.0	862.0	189.0	4589.0
(Pieces) 75% M	1860.0	8753.0	2586.0	566.0	13765.0
Wool 50% H	--	1.25	1.35	0.3	2.9
(Ton) 50% M	--	1.25	1.35	0.3	2.9
FYM 100% H	72676.0	359252.0	137485.0	16309.0	585722.0

H = Home consumption; M = Marketed.

In fact, some amount of any livestock product produced in a farmstead is consumed at home and some is marketed. The consumption rate of different products is varied. Our survey estimates that 30 percent of total meat production is consumed at home and the remaining 70 percent is marketed in the form of edible meat or as live animal. For milk and ghee, home consumption is 10% and 90 is marketed; for eggs, these percentages are just the reverse. Regarding hides and skins, 25 percent are utilized by local people, especially by Sarkis and 75 percent is marketed to the terai or India. Wool is particularly marketed in Mustang, as there is a small carpet factory there. In addition, local people themselves weave carpets, sweaters, mufflers, socks, etc. It is rare that even 50 percent of the wool is marketed outside the project area. All produced FYM is used in each individual's field, as seen in the above table.

DISEASE SITUATION

Because of poor animal health care, there is a tremendous loss in livestock production and reproduction. At present, there are no good veterinary facilities in the project area. Some of the more common diseases are summarized below:

1. Foot and mouth disease (FMD). Generally buffalo, cattle, yak/nak and chauri are susceptible to this disease. In foot and mouth disease swelling of the feet and mouth occurs and puss forms. These symptoms are accompanied by high fever, which reduces milk production.

2. Hemmorrhagic Septicaemia (HS). Buffaloes are more affected by this disease than other animals. It results in high mortality and loss in animal production.

3. Rinder pest (RP). Outbreaks of RP are epidemic. It occurs from time to time in the project area.

4. Liverfluke. Outbreaks of liverfluke are common everywhere in the project area. It is particularly dangerous for small animals (sheep and goats). 30-40 percent of sheep and goat mortality is due to liverfluke.

Beside these diseases, Mastitis, six months disease, ranikhet and fowl pox are common. Also, ectoparasite substantilly reduce animal production.

Toxic plants. There are some poisonous plants in the area which kill animals from time to time. These plants are particularly dangerous when new leaves are sprouting.

Marketing Facility. There is no organized or dependable marketing facilities in the project area. Except for the few town bazaars, there are hat bazaars every week, fortnight and month in the village, where the people come with agriculture commodities including livestock products (milk, ghee, curd, eggs, wool, hides, etc.). Here, buying and selling take place through bargaining. In general, cash is the medium of exchange, but in-kind exchanges also occur. Live cattle, buffalo, sheep, goat, pig and poultry birds are purchased and sold frequently in all of these informal markets. Some panchayats also organize markets.

Apart from those markets, there are regular markets in town bazaars every week. There is no well maintained record of buying and selling of livestock and livestock products at these markets. It is also difficult to estimate the numbers of live animals and amounts of livestock products that move from

one village to another. There are also some outlet/inlet markets or centers from where animals and animal products do move in and out of the project area.

Prevailing marketing centers catchment areawise:

1. Kulekhani
   a. Bhimphedi
   b. Hetauda
2. Daraundi
   a. Gorkha bazar
   b. Majuwa Khairenitar
3. Upper Kaligandaki
   a. Myagdi
      i. Beni
      ii. Pokhara
      iii. Baglung
   b. Mustang
      i. Jomsom
      ii. Pokhara

The Survey team visited all these markets or centers to develop a prevailing price list. There is a substantial difference in the price of commodities from one catchment area to the other. The prevailing price of list of Kulekhani and Daraundi is more or less the same, and the price list of Myagdi and Mustang is also similar. The prevailing price list of the project area was prepared to show an average for the entire project area. (See table below.)

Prevailing Price List of Livestock and Poultry Bird and Their Products

			Rs/animal
Buffalo	below 1 yr. male	--	120.0
	below 1 yr. female	--	140.0
	1 to 2 yr. male	--	200.0
	1 to 2 yr. female	--	175.0
	2 to 3 yr. male	--	280.0
	2 to 3 yr. female	--	310.0
	Above 3 yrs. male	--	600.0
	Above 3 yrs. female	--	1000.0

			Rs/animal
Cattle	Below 1 yr. male	--	100.0
	Below 1 yr. female	--	100.0
	1 to 2 yr. male	--	200.0
	1 to 2 yr. female	--	200.0
	2 to 3 yrs. male	--	325.0
	2 to 3 yrs. female	--	300.0
	Above 3 yrs. male	--	475.0
	Above 3 yrs. female	--	400.0
Yak/Chauri	Below 1 yr. male	--	160.0
	Below 1 yr. female	--	160.0
	1 to 2 yr. male	--	300.0
	1 to 2 yr. female	--	280.0
	2 to 3 yrs. male	--	600.0
	2 to 3 yrs. female	--	500.0
	Above 3 yrs. male	--	1000.0
	Above 3 yrs. female	--	800.0
Sheep	Below 1 yr. male	--	150.0
	Below 1 yr. female	--	100.0
	Above 1 yr. male	--	275.0
	Above 1 yr. female	--	250.0
Goat	Below 1 yr. male	--	80.0
	Below 1 yr. female	--	80.0
	Above 1 yr. male	--	200.0
	Above 1 yr. female	--	180.0
Poultry birds	Below 1 yr.	--	20.0
	Above 1 yr.	--	30.0

Prevailing Price List of Livestock Products

				Rs
Milk	per litre		--	3.00
Ghee	per Kg.		--	35.00
Curd	per litre		--	3.00
Churpi	per Kg.		--	7.00
Meat	Mutton - Kg	a. Goat	--	16.0
		b. Sheep	--	13.0
	Buff - Kg		--	10.0
	Pork - Kg		--	10.0
	Chicken - Kg		--	20.0
	Fish - Kg		--	16.0
	Egg - One		--	0.75
	Wool - Kg	a. Kage	--	15.0
		b. Baruwal	--	25.0
	FYM - 25 Kg		--	1.0

DESCRIPTION OF GOVERNMENT OFFICES RESIDING IN THE PROJECT AREA

1. Kulekhani Catchment Area (Makawanpur District)

a. Chitlan sheep development farm. The main objective of this farm is to improve the local unproductive kage sheep through cross breeding and improved feeding. Cross-breeding is being carried out with Rambullet and Merino rams. At this farm there are a few Rambullets and 3-4 merino rams.

Sheeps		
No. of breeding male	--	8
No. of breeding female	--	131
No. of hoggets	--	64
No. of lambs	--	93
No. of Kage	--	117
No. of crossed sheep	--	113
Total	--	230

Cross-breed sheep with 25 to 50% exotic blood of Rambullets and Merino will be distributed to the farmers on the recommendation of the District Agriculture Development Office. Rams or ewes with 25 to 50% exotic blood have shown satisfactory results at the farmer's level. It gains more weight and shows a substantial increment of wool production. This farm also conducts research and trials on fodder plants and green grasses. It has introduced cocksfoot, Paspalum, Dinanath, Desmodium and Rye grass. Cocksfoot and paspalum have had particularly good results. Hay is also made from these grasses. This farm is poorly staffed, and therefore extension work is negligible.

Existing manpower	Rank	No.
Asst. Livestock Development Officer	G-III/T	1
Junior Technician (JT)	NG- I/T	1
JTA	NG- II/T	1
Asst. Clerk cum Typist (Kharidar)	NG- II/T	1
Field Assistant		1
Peon		1
Mukhia	NG-III/A	1

2. Daraundi Catchment Area (Gorkha District)

Coordinate Sheep and Goat Programme. This program was established in 1977/78. Its main objective is to improve sheep and goats of Gorkha district by providing animal health care, breeding and training in livestock management, feeds and feeding, etc. At first, attention was given to Sirdibash and Barpak panchayats of Gorkha District, but now the program is expanding to cover other panchayates also. At present, the program focus is on animal health and training, which are seen as prerequisites to a breeding programme.

Regular training is being conducted twice a year, once in February/March and later in September/October. This training concerns:

Pasture improvement
Breeding
First aid
Management
Feeds and fodder

This training is given to selected farmers, especially to shepherds. The training period is of 3 days. 52 shepherds have already received this training.

Existing manpower	Rank	No.
Asst. Livestock Development Officer	G-III/T	1
Junior Technician (JT)	NG- I/T	1
Field man		2
Flock master	NG- IV/T	1

3. Upper Kali Gandaki Catchment Area (Mustang)

a. Sheep and Goat Development Center Marpha. Improvement of genetic potential and animal production of sheep and goats is the primary focus of this center. Concurrently it conducts research and trials on its own land and farmers' land to improve feed and feeding practices. There are three Polworth rams used for breeding, particularly in Lete Panchayat, where there is one sub-center. The center also gives attention to animal health and offers first aid treatment for animals. Dipping and drenching are also done. Finally, the center is carrying out pasture trials in different panchayats of Mustang District.

Farmers cultivate grass in their own land with the help of JTA's and the facilities provided by the Center. Trials being run in farmers' land ranges from 0.5 to 19 ropanies. For these trials the center provides free distribution of seed, fertilizer, insecticides and technical assistance.

For extension programs, there are eight sub-centers. There sub-centers also treat animals with first aid.

Location of panchayat sub-center	Manpower (no.)	Remarks
Lete	One - JT One - Fieldman One - Peon	Stock of veterinary medicine
Tukuche	One - Fieldman	First aid medicine
Jomsom	One - JTA	First aid medicine

Location of panchayat sub-center	Manpower (no.)	Remarks
Kagbeni	One - Fieldman	First aid medicine
Muktinath	One - Stockman *	First aid medicine
Chusang	One - Fieldman	First aid medicine
Cherang	One - Fieldman	All veterinary medicine
Mustang	One - Fieldman **	First aid

Existing manpower of center	Rank	No.
Asst. Livestock Development Officer (Pasture Development Officer)	G-III/T	1
Junior Technician (JT)	NG- I/T	1

* Deputed from Veterinary Hospital

** Not working at present.

ii. Veterinary Hospital, Jomsom, Mustang. This hospital is working to control different diseases. It offers vaccinations and parasitic control measures. It also provides castration services.

Existing manpower	Rank	No.
Veterinary doctor	G- II/T	-
Lab assistant	NG- I/T	1
Stock supervisor	NG-III/T	2
Stockman	NG-III/T	3
Asst. Accountant	NG- II/T	2
Clerk	NG-III/T	1
Peon		2

Apart from the above government offices, there is one Veterinary unit in Beni, Myagdi District, which is supervised by the DADO in Beni. This unit has only been recently established, and is poorly staffed and equipped. However, to a greater or lesser extent, there are staff and equipment problems with all farms and centers in the project area.

LIVESTOCK DEVELOPMENT PROPOSED PROGRAMME

Lines of Improvement on Priority Basis

Feeds and Feeding
Animal Health
Genetic Improvement
Extension service and research
Training
Credit

1. Feeds and Feeding. The optimum production potential of livestock, both native and crossbreeds, cannot be realized without improving the existing feeding resources. At present the proportion of available feed to required feed ranges from 50-60 percent in the catchment areas. Pasture land/forest grazing is so intensive that the vegetation is not able to regenerate. Overgrazing is leading to erosion and to a continuous depletion of natural resources. Farmers lop the fodder leaves from the forest. Forage cultivation is not practiced. In the rainy season, farmers collect green grasses and weeds growing on the walls of terraces or from places beyond the animal's reach. There is a scarcity of animal feed during winter and animals remain in a condition of semi-starvation. The nutritional requirements of animals is seldom met. To overcome these problems, feeding resources improvement should receive first priority in the proposed livestock development programme. (See detail in feeding resources development programme.)

2. Animal Health. The lack of adequate veterinary facility has been one of the major constraint to livestock production. Considerable growth in animal production can be achieved through providing animal health services. Ruminant livestock, especially sheep and goats, are heavily infested with ect and endoparasites. Foot and mouth and H.S. diseases are frequent in large animals. Consequently, the following activities will be carried out in the livestock development programme.

a. Drenching against endoparasites. This programme will be carried out at least twice a year for small and large animals. Nomadic sheep and goats will be drenched once when they come down to the mid-hills from alpine pastures, i.e., in September/October and later on their return to

alpine pastures from the mid hills, i.e., of animal throughout the project year. See summary sheet of programme, pages 57-60.

b. Dipping/Spraying/Dusting against Ectoparasite. These activities are exclusively for small animals, i.e., sheep and goats. The type of control measure used will depend on the climate, as follows:

i. Dipping in BHC -- for tropical and sub-tropical area
ii. Spraying -- preferred for sub-tropical area
iii. Dusting -- preferred for temperate area

This programme also will be carried out twice a year, i.e., once in pre-monsoon (February/March) and next in post-monsoon (September-October).

c. Vaccination. This programme will be launched only for HS and RP and for as many animals as possible (i.e., 30-35 percent of the total animals within first five years). However, this vaccination programme will be executed only for large animals. (See Appendix 3, Table 1.)

d. Installation of Dipping Tanks. In view of the heavy loss in animal production due to ectoparasites (mange, ticks, lice, etc.), a dipping programme will be launched. This will be particularly effective in lower altitudes or in warm climatic areas. Altogether 48 dipping tanks will be installed within the first five years, (6 in Kulekhani, 27 in Daraundi, 15 in Upper Kali Gandaki, 14 in Myagdi and one in Lete, Mustang). Except for the Mustang District, there will be roughly one dipping tank in each panchayat. In cooler regions, dipping is not good for the animal according to the Agriculture Department, and our own survey confirmed that livestock owners do not want to have their animals dipped. Thus, spraying or dusting programmes will be launched in these regions. This programme will be undertaken throughout the project year. (See summary sheet of proposed programme, pages 52-60.)

e. Installation of Water Trough. Unhygienic water is the main source of endoparasitic illnesses; of these, liverfluke dominates over all other parasites. But, animals drink even muddy water due to the lack of other available water. To overcome this problem, 400 water troughs will be constructed in the project area within the first five years, 50 in Kulekhani, 150 in Daraundi, and 200 in Upper Kali Gandaki (100 in Myagdi and 100 in Mustang District).

3. Genetic Improvement. The quickest way to upgrade livestock production is to improve the genetic stock. Cross breeding will be intensified as food availability increases. The project will provide good exotic breeds of buffalo bull/ram/buck from outside the country. This breeding programme will be executed under the supervision of the livestock development center and sub-centers. (See summary sheet of programme, pages 52-60.)

a. Distribution and establishment of bull/ram/buck station

Buffalo bull. The project will establish an improved buffalo bull (murrha) station in each livestock development sub-center and at the farmer's level.

Some 60 improved murrha will be purchased within the country or imported from India within the first five years. Approximately 15 bulls will be stationed, one in each sub-center, excluding the sub-centers of upper Kaligandaki, Mustang District. About 45 bull stations will be set up in farmers' barns and 15 bull stations will be established at the sub-centers. Money allocated for each bull includes transportation, essential utensils, and first aid. In addition, a separate cost of Rs. 1000/- for each bull shed is allotted. Maintenance costs of the bull stations will be borne by the project, at least for the first five years, and services will be provided to the farmers free of cost. A maintenance of Rs. 200/ bull/month [1/] will be provided to the farmers. Also, an incentive of up to Rs. 500/- per year will be awarded to the farmer who can arrange the servicing of the largest number of breeding females within each sub-center.

The project will motivate farmers to purchase the crossbreed buffalo bull/cow, which will arrive during the second five years. Concurrently the project will resume purchase and distribution of improved stock of bulls. The project will also encourage an intensive breeding programme, especially in lower altitudes, which have the most potential for livestock development.

Cattle. No exotic breeds of cattle will be imported. It is clear that farmers rear cattle mainly for draft power and manure. For breeding

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1/ Rs. 6.66/day/bull -- Rs. 4.00 for cone. feed and Rs. 2.66 for green fodder and other care.

purposes, some 200 improved bulls (50 to 75% Jersey cross) will be purchased from farmers in the Kathmandu Valley and distributed in the project area within the first five years. Money allocated for each bull includes the cost of the construction of bull sheds, transportation, first aid, etc. Bull stations will be established at the farmer's level and the farmers will be provided with maintenance cost, at least for the first five years, at the rate of Rs. 180/month/bull [2/]. In addition, an incentive of up to Rs. 500 will be awarded to the farmer who can arrange the servicing of the largest number of breeding female within the sub-center. Lulu cattle in Mustang District will be improved through cross breeding with Jersey cross bulls. But this programme will be confined to a few panchayats only.

Sheep. To upgrade Baruwal sheep mainly for wool production, some 40 improved rams (preferably Merino D'Arles, mountain breed) will be imported from the USA in the second year. These will be stationed in the vicinity of the Livestock Development Centers or sub-centers. A lump sum amount will be given for this breeding programme, which will be executed under the supervision of the sub-centers. All imported rams will initially be stationed at the Livestock Development Center, Chitlang, for two to three months and will then be distributed to the different sites of the project area. Groups of eight rams will be stationed at the Livestock Development Center, Chitlang, L.D. Center (Mustang) and sub-centers at Barpak, Taku (Gorkha District), Darmija (Myagdi). Ram sheds of Rs. 20,000 will be provided for every eight rams. Maintenance cost will be provided by the project for the first and second five years. The offspring of cross-rams will be purchased by the project at the rate of Rs. 1000/0 per ram and will be distributed to the selected farmers along with materials for management, sheds, etc. Maintenance or rearing cost will be borne by the project at the rate of Rs. 150/ram/month [3/] at least for

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2/ Rs. 600/bull/day, i.e., Rs. 4.00 for cone. feed and rest for green fodder and other care.

3/ Rs. 5.0/day/animal for cone. feed and other care.
the first five years and servicing will be free of charge. An incentive of Rs. 300 will also be awarded to the farmers who can arrange the servicing of the largest number of breeding ewes within the sub-center.

In addition to this Chitlang Livestock Development Center, Makawanpur will provide at least 10 rams (Rambullet or merino x kage cross) every year.

Method of breeding programme. Nearly 100 native breeding ewes will be identified, collected and made a flock along with 4-5 improved rams at the time of breeding season. The flock will be reared by the sub-centers for up to 2 months and then the breeding ewes and rams will be given back to the owners.

For Bhyanglung (Tibetan breed), cross-breeding is not possible at present.

Goat. (a) Hilly goat. Because of the easy rearing of goats and the increasing demand for goat meat, farmers in the project area are enthusiastic about goat farming, especially in the plains and mid hills. Some 20 Jamunapari goats (10 male and 10 female) will be imported from India in the second year. These will be stationed at the Central Goat Farm, Bandipur, for cross breeding and the offspring will be available for the third year. The cross male goats will be distributed along with materials for management, sheds, etc. to the selected farmers in the project area for upgrading the native flock. Farmers will be provided a maintenance rearing cost of Rs. 150/month/male goat [4/] at least for the first five years and servicing will be free of cost. Maintenance cost for the Jamunapari goat will be provided for second five years also. Rs. 300/- will also be awarded as an incentive to the farmer who can arrange the servicing of the largest number of breeding females. The project will motivate farmers to purchase the cross breed males and females. In this way 90 cross male goats will be distributed in the first five years. But these second and third five year figures are tentative and will depend on the adoption rate and the interest of farmers.

(b) Mountain goat (Chyangra). No cross breeding will be carried out.

4/ Rs. 5.0/day/animal for cone. feed and other care.

Poultry. Poultry is an integral part of livestock rearing and generates more income to the farmers with low labor investment. Farmers have shown an interest in poultry keeping. 20,000 improved 6-8 week-old poultry birds and cockrels will be distributed to the farmers at a 50 percent subsidy rate (Rs. 10/-bird, with actual costs of Rs. 20) in the entire project area within the first five years. This distribution programme will be continued for the next second and third five years. (See summary sheet of programme, pages 52-62.)

b. Selection and breeding. Selection of better herd sires among locally available animals will be carried out. Exchanging sires between panchayats will eliminate inbreeding problems. The project will try to replace the bull every 3 years to further control in-breeding. In addition, the bulls (offsprings of cross-breeds) will not be allowed to stay at one place for a long period.

Castration programme. 105 Burdizo castrators will be distributed to the farmers at the rate of Rs. 190.0 castrator (the actual cost is Rs. 253.0); thus the project will subsidize the castrators at 75% during farmers' training within the first five years. The best bull will be selected for breeding and only the less productive ones will be castrated. Distribution of the Burdizo castrator will continue throughout the entire project.

Condition of buffalo bull/cattle bull/ram/buck raising at farmer's level. Preferably VAA's will be chosen for bull/buck/ram rearing. However, if a VAA is unsuitable, another progressive and interested farmer will be selected as an alternative. However selected, the bull/ram/buck raiser will have to fulfill the following conditions:

Experience of raising livestock.

Knowledge of the fundamentals of livestock management.

Own provision of enough feed for animals.

Household size not less than five members.

Interest in keeping bull/buck/ram.

Number of service provided to the animal should be recorded or registered in detail.

This record should be submitted to the sub-center every month.

Awareness of inbreeding problems.

Close contact with JTA stationed in his own panchayat and sub-center is to be kept up.

After selection, the bull/ram/buck raiser should carry out the following activities: If a VAA or farmer cannot maintain the above conditions, he may be taken out of the programme and a chance given to another farmer.

4. Extension Service and Research

Establishment of Livestock Development Centers and Sub-Centers. To diffuse new ideas to the farmer's level, extension work can play a vital role. Also, this is the only medium which provides a two-way communication channel for the farmers. To develop the most effective programme, the project plans four Livestock Development Centers and 21 sub-centers in the project area.

In every catchment or district area, there will be one Livestock Development Center. Besides these, there will be three sub-centers in Kulekhani Catchment (Makawanpur District), eight in Daraundi (Gorkha District), and 10 sub-centers in Upper Kali Gandaki (5 in Myagdi and 5 in Mustang District). The area served by each sub-center will be from one to five panchayats. (See Appendix 5, pages 1-5.)

Except for the Livestock Development Center in Beni (Myagdi District), all centers will be independent of the District Agriculture Development Office (DADO) unless a Gazetted - II Officer is in charge. In every center there will be one Livestock Development Officer (G.II/T), who will be the center in-charge; and one Pasture Development Officer (G.III/T). There will be two Livestock Development Officers in the first five years and two will be allocated in the second five years. Regarding the sub-centers, a senior JT will be the in-charge and there will be one JTA in each served panchayat. (See Appendix 5, Table 1-5.)

There will be disease diagnostic facilities in each center. Adaptive studies on livestock productivity, breeds, performances, adaptability of exotic breeds and their offspring will be carried out by the center. Such studies will form the basis for further development of the programme. In addition, the Jomsom Veterinary Hospital (Mustang) will be provided with surgical equipment and drugs in every first, second and third five year period.

Farmers will be provided with shearing scissors and hoof cutters at a 75 percent subsidy rate. In this way 235 shearing scissors at the rate of Rs. 120.0/scissors (the actual cost is Rs. 160.0) and 260 hoof cutters at the

rate of Rs. 230.0/cutter (actual cost Rs. 306.0) will be distributed in the first five years. A total of 825 scissors and 850 hoof cutters will be distributed during the whole project.

Functions of Livestock Development Centers

a. To effectively and intensively execute the programme in the common area.

b. To instruct and guide the sub-centers in different aspects, i.e., from technical to administrative work.

c. To conduct supervision of sub-centers and visits to the farmers' level.

d. To allocate the number of improved buffalo/cattle/bull/ram/buck and also poultry to different sub-centers for breeding purposes.

e. To conduct trials and studies on breeding, nutrition and livestock management.

f. To conduct training (inservice, refresher courses) for JT's, JTA's, and Stockmen organized either in the center or outside.

g. To select the most progressive and interested farmers for training as Village Agriculture Assistants (VAA's). First this selection will be made in the first 5 years on the recommendation of the sub-centers.

Functions of Livestock Development Sub-centers

a. To effectively carry out various livestock and feeding improvement programmes as directed by the LDC.

b. To distribute improved males for upgrading local stock. Improved bulls/ram/buck will be distributed to progressive farmers in the Bull Station Programme and the performance of such distributed animals will be recorded by the sub-centers. The sub-centers themselves will have bull stations. Bulls will be exchanged every third year to check inbreeding.

c. To conduct the mass vaccination/drenching/dipping and other primary health service activities.

d. To disseminate improved livestock production technology to farmers, initiate and persuade farmers to castrate their unproductive bulls, and to make use of crossbred bulls for upgrading their native stock.

e. To educate farmers about better land use, e.g., improvement of feeding resources through the introduction of forage crops in cropping

sequence; pasture production on marginal and sub-marginal land; building of terrace risers and bunds, etc. The centers will also select farmers for the seed production program and demonstrate improved feeding and management systems to farmers.

f. To maintain regular contact with VAA's and farmers; to observe the farmers' problems of livestock keeping and try to solve these at the farmers' level; to communicate health problems for immediate action to the LDC; to conduct herd registration of cross breeds.

g. To collect native species of grasses and legumes for identification and identify sites for pasture improvement and range management.

h. To study breeding performance, livestock productivity and feeding resources and communicate results to LDC.

i. To organize a breeders' association at the village and sub-center levels.

j. To organize farmers' training and VAA refresher training and to organize livestock show/fairs at the sub-centers.

5. Training. The project plans to organize different types of training every year, either within or outside the project area. The Department of Agriculture can help to allocate manpower for this training, especially at the officer level as there is shortage of non-officers. The project will provide financial support for the training. Altogether 98 Junior level technicians will be trained during the first five years of the project.

Types of Training

JTA preparation -- in the first five years.
VAA preparation -- in the first five years.
Inservice Training to JT, JTA and Stockman.
Farmer's training
VAA training
Higher degrees leading to M.Sc. Ph.D. level.
Observation tour.

a. JTA preparation -- in the first five years. The Project will recruit the best SLC graduates with a background in vocational agricultura and they will be awarded a scholarship of Rs. 250 per month during training. Training will last three months, and will be arranged with the Institute of Agriculture and Animal Science, Rampur. Selected students will have to commit themselves to work as JTA's for at least five years. (See Appendix 6, Table 1.)

b. VAA (Village Agriculture Assistant) preparation -- in the first five years. One VAA could not possibly perform all of the duties for the agronomy, horticulture and livestock components of the project. However, RCUP feels that it would be useful to have specialized VAA's for an intensive livestock programme. For this, the project will select the most progressive farmers (one from each ward) who will be given training in the sub-centers. Consequently there will be 63 VAA's in Makawanpur District, 261 in Gorkha District, 126 in Myagdi District and 144 in Mustang District and the total number of VAA's in the whole project area will be 594 during the first five years. These VAA's will be payed Rs. 150/- per month. Their main job will be to contact farmers and to disseminate information about modern livestock farming, including management, feeds and feeding, and breeding. Every VAA will contact 40-50 farmers in a month. (See Appendix 6, Table 2.)

c. Inservice Training to JT's, JTA's and Stockmen.

15 days training course. This training will be organized by the Pokhara Livestock Farm and GADP, Khairenitar. Training will be given in Livestock and veterinary medicine. Training will last 15 days and will be given once a year for every year of the project. (See Appendix 6, Table 3, page 1.)

Refresher Training Course. Training period will be organized by the Livestock Development Center. It will be offered for seven days, once a year for every year of the project. (See Appendix 6, Table 5, pages 2 and 4.)

d. Farmer's Training -- Farmers. Ten of the most progressive farmers will be selected from each sub-center and will be given training for 3 days. Training will be three times a year and organized by the sub-centers. This training also will be continued for the entire project. (See Appendix 6, Table 4.)

Farmer's day. Farmer's day will be organized once in a year in every sub-center. It will last one day and will consist of a livestock show, visual aid education programme, leaflet distribution, etc. (See Appendix 6, Table 3, pages 3 and 4.)

Establishment of livestock breeder's association. For any programme for upgrading livestock it is essential to have the full participation of farmers. Thus, a Livestock Breeder's Association will be established, preferably one in each panchayat, under the direction of the sub-centers. This will be an association of the most progressive farmers. The farmers who have raised bulls/rams/bucks from the livestock development center and sub-center will

also be members and will oversee the livestock improvement activities of their villages. Meetings of associations will be held every three months and JTA's will assist the associations in their respective villages.

Farmers themselves will discuss their activities and achievements that have resulted from the livestock programme. It is important to have the breeding programme operate through the farmer's own efforts. The breeders' associations can help to stimulate this kind of local involvement and initiative. For example, if farmers decide that their community needs a bull/ram/buck for breeding, the association can send a request to the sub-center or center. The association will also take the responsibility for the marketing of animals and animal products. In addition, the association will organize a "cross-breed contest" and the winner will be awarded with some monetary incentive offered by sub-centers. This type of cross-breed contest will be held every six months.

In short, the main focus of the livestock breeder's association will be to make the farmers aware of and concerned with livestock development. This will not be an easy job and will take time. However, evidence from other countries suggests that this type of local farmers' organization can be very successful.

e. Refresher Training Course -- VAA. This training will be organized in the Livestock Development sub-centers. The training period will last 5 days twice in a year. This training will continue throughout the project. (See Appendix 6, Table 5.)

f. Ph.D. and M.S. degree course training. It is also essential to train high level manpower for the project, as each Livestock Development Center is carrying out research and trial activities for livestock improvement. The project plans to train one Ph.D. and four M.S. degree level candidates in animal and pastural science. Training will be held abroad, preferably in the USA. Training of Ph.D. candidates will occur in the fourth year and the M.S. degree training will occur in the first, second, third and fourth year of the first five years. The cost of this training will be borne by project, but it had not been included in the livestock develoment component. (See in the summary sheet of proposed programme, pages 57 to 61.)

g. Observation tour. An observation tour abroad of 4-6 months will be provided for eight livestock and assistant livestock officers. (See summary sheet of proposed programme.) The cost of this programme will be borne by

project, but this has not been included in livestock development component.

6. Credit. Lack of capital prevents many farmers from adopting modern livestock inputs and practices. Accordingly, the project will provide loans to the farmers for purchasing improved or locally available selected buffaloes and also for adopting better management practices.

The project will provide credit for 200 she-buffaloes at the rate of Rs. 3000/- animal, which should include the costs of management as well. For better utilization of crop residue, the project will provide loans to farmers for purchasing chaff cutters (manually operated), especially in buffalo rearing areas. 50, 100, and 50 chaff cutters will be allocated for Makawanpur, Gorkha and Myagdi Districts, respectively. This distribution programme will be continued for the second and third five years, depending upon the interest and adoption rate of farmers.

Provision of credit for poultry keeping on the periphery of town bazaars or along the road side will be emphasized. Thochok Panchayat of Makawanpur District (where there is already a small poultry farm of 100 birds) is a very feasible area for poultry keeping. Similarly, farmers of Taranagar Panchayat of Gorkha District are interested in poultry and this panchayat is also near to a bazaar and to the Narayanghat-Gorkha Highway. Moreover, there has been an increasing demand for eggs in this area. The project will allocate credit for four commercial poultry keeping farms. Each poultry farm should have the capacity of at least 200 birds. Credit will be allocated at Rs. 10,000/- for each farm and the total allocation will be Rs. 40,000/- (See summary sheet of proposed programme, pages 52 to 61.)

This field survey revealed that farmers are also interested in cream separators. Farmers are familiar with this as there is one cream separator in Palungtar Panchayat of Gorkha District. There will be a credit facility for 16 cream separators in the whole project area -- three in Makawanpur, six in Gorkha, four in Myagdi and three in Mustang District in the first five years. The cream separators will be manually operated with a small capacity of 165 liters/hour.

Credit for purchasing buffalo cows (selected good breeds), cream separators, and poultry farms in miniscale will be provided through ADB/N and credit for chaff cutter through the cooperatives.

Credit Repayment System. Credit provision will be made only for medium term loans, with the length of the term depending upon the nature of activity. The term of repayment is as follows:

	Duration of repayment period
Purchasing buffalo cow	3 yrs
Chaff cutter	3 yrs
Cream separator	5 yrs
Poultry farm in miniscale	5 yrs

For repayment, a one-year grace period is provided for all activities. Hence, the repayment begins from the second year of disbursement. In this way, repayment will be completed within four years in three year installments in case of buffalo cows or chaff cutters, and in four year installments for cream separators and miniscale poultry farms. Repayment will be made in equal installments for each year. Also, 100% repayment is assumed for medium term loans.

In the second five years, disbursement of loans will be made in equal amounts for all years, i.e., from the sixth to the tenth year. But in the case of the third five year period, loan disbursement will be made only for the eleventh and twelvth year, since the project will last only fifteen years. Also, a grace period will be eliminated for the third five years.

The project will provide Rs. 1,455,000.0 in the first five years and Rs. 4,525,000.0 in the total fifteen years. The project actually needs only Rs. 884,000.0 for the first five years for credit provision, assuming that in the next 2-5 years the loans are repaid.

RCUP

LIVESTOCK DEVELOPMENT -- PROPOSED PROGRAMME

Proposed Programme	Unit	Year 1	Year 2	Year 3	Year 4	Year 5	1st 5 yr Total	2nd 5 yr Total	3rd 5 yr Total	Grand Total
A. Genetic improvement										
1. Distribution of improved animals and poultry birds										
a. Improved buffalo bull	No.	-	12	12	16	20	60	60	60	180
b. Improved cattle bull	"	-	14	53	44	89	200	200	200	600
c. Improved goat (male)	"	-	20	-	-	-	20	-	-	20
i. Jamunapari (male 10, female 10)										
ii. Cross breed goat (male)	"	-	-	20	40	30	90	210	300	600
d: Ram										
i. Exotic breed (merino D'Arles)	"	-	40	-	-	-	40	-	-	40
ii. Cross ram	"	-	10	20	10	10	50	50	50	150
iii. Kage cross	"	-	10	10	10	10	40	40	40	120
e. Improved poultry (fowl)	"	-	2,500	4,500	5,500	7,500	20,000	20,000	20,000	60,000
2. Castration of unproductive cattle males	"	-	50	400	1,000	1,000	2,450	3,000	3,000	8,450
B. Animal Health										
1. Vaccination - a. H.S. (i) Buffalo	"	-	5,000	6,000	7,000	10,000	28,000	24,000	25,000	77,000
(ii) Cattle	"	-	7,000	8,000	18,000	27,000	60,000	58,500	60,000	178,500
b. R.P. (i) Buffalo	"	-	3,500	6,500	12,500	17,500	40,000	48,000	50,000	138,000
(ii) Cattle	"	-	6,500	14,700	24,800	34,000	80,000	30,000	55,000	165,000
2. Drenching - a. Sheep/goat	"	-	12,000	23,500	40,000	61,000	136,500	157,000	170,000	463,500
b. Cattle/buffalo	"	-	13,000	27,000	47,000	59,000	146,000	148,000	164,000	458,000
3. Dipping/Dusting/Spraying of Sheep/goat	"	-	12,000	25,000	50,000	70,000	157,000	160,000	170,000	487,000
4. Dipping Tank Installation	"	8	9	10	12	9	48	-	-	48
5. Livestock First Aid Kit	"	67	112	133	156	126	594	594	594	1,782

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Proposed programme	Unit	Year 1	Year 2	Year 3	Year 4	Year 5	1st 5 yr Total	2nd 5 yr Total	3rd 5 yr Total	Grand Total
C. Management										
1. Water trough installation	No.	73	89	88	92	58	400	-	-	400
2. Distribution of equipment										
a. Shearing scissors	"	-	20	50	70	95	235	260	330	825
b. Hoof cutter	"	-	40	50	70	100	260	260	330	850
c. Burdizo castrator	"	-	5	10	45	45	105	120	200	425
3. Credit provision										
a. Purchasing of selected buffalo cow	"	-	50	100	150	100	400	400	400	1,200
b. Chaff cutter	"	-	-	45	50	60	155	180	200	535
c. Cream separator	"	-	4	4	4	4	16	20	20	56
d. Poultry farm in miniscale	"	-	-	-	-	2	2	4	5	11
D. Extension and Research										
1. Establishment of L.D. Center	"	4	-	-	-	-	4	-	-	4
2. Establishment of sub-center	"	4	5	5	5	2	21	-	-	21
3. Construction (Building)										
a. L.D. Center Office	"	Design &	4	-	-	-	4	-	-	4
b. L.D. Sub-center cum quarter	"	Estimate	4	5	5	7	21	-	-	21
c. Quarter -- type A	"	"	4	-	-	-	4	-	-	4
d. Quarter -- type B	"	"	8	-	-	-	8	-	-	8
e. Exotic breed ram shed	"	"	3	2	-	-	5	-	-	5
4. Livestock production studies	"	1	1	4	4	4	14	20	20	54
E. Training										
1. VAA preparation	"	67	112	133	156	126	594	-	-	594
2. VAA training	"	67	179	312	468	594	1,620	2,970	2,970	7,560
3. Farmer's training	"	40	90	140	190	210	670	1,050	1,050	2,770
4. JTA preparation	"	15	15	17	18	-	65	-	-	65
5. Inservice training (JT, JTA, Stockmen)	"	17	37	65	92	114	325	1,625	1,625	3,575
6. M.S. Degree course in A.H.[1]	"	1	1	1	1	-	4	-	-	4
7. Ph.D. Degree course in A.H.	"	-	-	-	1	-	1	-	-	1
8. Observation tour for (Livestock Dev. Officer and Asst. Liv. Dev. Officer)	"	-	2	2	2	2	8	-	-	8

[1] Animal Husbandry.

RCUP

LIVESTOCK DEVELOPMENT -- PROPOSED PROGRAMME

KULEKHANI CATCHMENT AREA

(MAKAWANPUR DISTRICT)

Proposed Programme	Unit	Year 1	Year 2	Year 3	Year 4	Year 5	1st 5 yr Total	2nd 5 yr Total	3rd 5 yr Total	Grand Total
A. Genetic improvement										
1. Distribution of improved animals and poultry birds										
a. Improved buffalo bull	No.	-	3	2	1	-	6	6	6	18
b. Improved cattle bull	"	-	5	6	6	-	17	17	17	51
c. Improved goat										
i. Jammapari (male 40, female 10)	"	-	-	-	-	-	-	-	-	-
ii. Cross breed goat (male)	"	-	-	5	10	7	22	50	75	147
d. Ram										
i. Exotic breed (merino D'Arles)	"	-	10	-	-	-	10	0	0	10
ii. Cross ram	"	-	-	-	-	-	-	-	-	-
iii. Kage cross	"	-	4	-	4	-	8	8	8	
e. Improved poultry (fowl)	"	-	500	1,000	1,000	1,500	4,000	4,000	4,000	12,000
2. Castration of unproductive cattle males	"	-	10	70	150	150	380	500	700	1,580
B. Animal Health										
1. Vaccination - a. H.S. (i) Buffalo	"	-	500	500	1,000	1,000	3,000	2,000	2,000	7,000
(ii) Cattle	"	-	1,000	1,000	2,500	4,000	8,500	8,000	8,500	25,000
b. R.P. (i) Buffalo	"	-	500	1,000	1,500	2,000	5,000	5,000	5,000	15,000
(ii) Cattle	"	-	1,000	2,000	3,000	5,000	11,000	3,000	5,000	19,000
2. Drenching - a. Sheep/goat	"	-	2,000	3,050	6,500	10,000	21,150	24,200	26,200	71,550
b. Cattle/buffalo	"	-	2,000	4,500	7,000	6,000	19,500	19,654	21,778	60,932
3. Dipping/Dusting/Spraying of Sheep/goat	"	-	2,000	4,000	8,000	11,000	25,000	25,000	27,000	77,000
4. Dipping Tank Installation	"	3	1	2	-	-	6	-	-	6
5. Livestock First Aid Kit	"	11	26	21	5	-	63	63	63	189

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Proposed programme	Unit	Year 1	Year 2	Year 3	Year 4	Year 5	1st 5 yr Total	2nd 5 yr Total	3rd 5 yr Total	Grand Total
C. Management										
1. Water trough installation	No.	10	20	20	-	-	50	50	-	50
2. Distribution of equipment										
a. Shearing scissors	"	-	-	-	-	5	5	6	8	19
b. Hoof cutter	"	-	10	10	10	20	50	50	65	165
c. Burdizo castrator	"	-	-	-	5	5	10	12	20	42
3. Credit provision										
a. Purchasing of selected buffalo cow	"	-	10	20	25	20	75	75	75	225
b. Chaff cutter	"	-	-	10	10	10	30	35	39	104
c. Cream separator	"	-	1	1	-	1	3	3	3	9
d. Poultry farm in miniscale	"	-	-	-	-	1	1	1	1	3
D. Extension and Research										
1. Establishment of L.D. Center	"	1	-	-	-	-	1	-	-	1
2. Establishment of sub-center	"	1	1	1	-	-	3	-	-	3
3. Construction (Building)										
a. L.D. Center Office	"	-	1	-	-	-	1	-	-	1
b. L.D. Sub-center cum quarter	"	-	1	1	1	-	3	-	-	3
c. Quarter -- type A	"	-	1	-	-	-	1	-	-	1
d. Quarter -- type B	"	-	2	-	-	-	2	-	-	2
e. Exotic breed ram shed	"	-	-	1	-	-	1	-	-	1
4. Livestock production studies	"	1	1	1	1	1	5	5	5	15
E. Training										
1. VAA preparation	"	11	26	21	5	-	63	-	-	63
2. VAA training	"	11	37	58	63	63	232	315	315	862
3. Farmer's training	"	10	20	30	30	30	120	188	188	496
4. JTA preparation	"	3	4	9	-	-	16	-	-	16
5. Inservice training (JT, JTA, Stockmen)	"	5	8	11	11	11	46	230	230	506
6. M.S. Degree course in A.H.	"	-	-	1	-	-	1	-	-	1
7. Observation tour for (Livestock Dev. Officer and Asst. Liv. Dev. Officer)	"	-	1	-	1	2	-	-	-	2

RCUP

LIVESTOCK DEVELOPMENT -- PROPOSED PROGRAMME

DARAUNDI CATCHMENT AREA

(GORKHA DISTRICT)

Proposed Programme	Unit	Year 1	Year 2	Year 3	Year 4	Year 5	1st 5 yr Total	2nd 5 yr Total	3rd 5 yr Total	Grand Total
A. Genetic improvement										
1. Distribution of improved animals and poultry birds										
a. Improved buffalo bull	No.	-	4	5	10	15	34	34	34	102
b. Improved cattle bull	"	-	5	31	32	52	120	120	120	360
c. Improved goat (male)										
i. Jammapari (male 10, female 10)	"	-	-	-	-	-	-	-	-	-
ii. Cross breed goat (male)	"	-	-	10	20	15	45	110	150	305
d. Ram										
i. Exotic breed (merino D'Arles)	"	-	12	-	-	-	12	-	-	12
ii. Cross breed ram	"	-	-	5	5	-	10	10	10	30
iii. Kage cross	"	-	4	4	4	4	16	16	16	48
e. Improved poultry (fowl)	"	-	1,000	2,000	3,000	4,000	10,000	10,000	10,000	30,000
2. Castration of unproductive cattle males	"	-	20	200	600	600	1,420	1,500	1,980	4,900
B. Animal Health										
1. Vaccination - a. H.S. (i) Buffalo	"	-	3,000	3,500	4,000	6,000	16,500	14,000	15,000	45,500
(ii) Cattle	"	-	4,000	4,500	11,000	16,000	35,500	35,000	35,500	106,000
b. R.P. (i) Buffalo	"	-	2,000	3,500	6,500	10,000	22,000	27,000	28,000	77,000
(ii) Cattle	"	-	4,000	8,700	16,000	22,000	50,700	20,000	40,000	110,700
2. Drenching - a. Sheep/goat	"	-	6,400	14,000	21,500	34,500	76,400	88,300	95,630	260,330
b. Cattle/buffalo	"	-	7,500	16,000	27,500	39,500	89,500	90,868	100,695	281,063
3. Dipping/Dusting/Spraying of Sheep/goat	"	-	6,000	14,000	28,000	40,000	88,000	91,000	96,000	275,000
4. Dipping Tank Installation	"	2	5	6	9	5	27	-	-	27
5. Livestock First Aid Kit	"	12	28	63	90	68	261	261	261	783

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Proposed programme	Unit	Year 1	Year 2	Year 3	Year 4	Year 5	1st 5 yr Total	2nd 5 yr Total	3rd 5 yr Total	Grand Total
C. Management										
1. Water trough installation	No.	10	30	35	45	30	150	-	-	150
2. Distribution of equipment										
a. Shearing scissors	"	-	10	20	30	40	100	111	141	352
b. Hoof cutter	"	-	10	20	30	40	100	100	125	325
c. Burdizo castrator	"	-	3	10	20	20	53	60	100	213
3. Credit provision										
a. Purchasing of selected buffalo cow	"	-	25	40	70	40	175	175	175	525
b. Chaff cutter	"	-	-	20	20	20	60	70	78	208
c. Cream separator	"	-	2	1	2	1	6	8	8	22
d. Poultry farm in miniscale	"	-	-	-	-	1	1	2	2	5
D. Extension and Research										
1. Establishment of L.D. Center	"	1	-	-	-	-	1	-	-	1
2. Establishment of sub-center	"	1	2	2	2	1	8	-	-	8
3. Construction (Building)										
a. L.D. Center Office	"	-	1	-	-	-	1	-	-	1
b. L.D. Sub-center cum quarter	"	-	1	2	2	3	8	-	-	8
c. Quarter -- type A	"	-	1	-	-	-	1	-	-	1
d. Quarter -- type B	"	-	2	-	-	-	2	-	-	2
e. Exotic breed ram shed	"	-	1	1	-	-	2	-	-	2
4. Livestock production studies	"	-	-	1	1	1	3	5	5	13
E. Training										
1. VAA preparation	"	12	28	63	90	68	261	-	-	261
2. VAA training	"	12	40	103	193	261	609	1,305	1,305	3,219
3. Farmer's training	"	10	30	50	70	90	250	392	392	1,034
4. JTA preparation	"	4	3	-	12	-	19	-	-	19
5. Inservice training (JT, JTA, Stockmen)	"	4	12	22	37	45	120	600	600	1,320
6. M.S. Degree course in A.H.	"	1	-	-	-	-	1	-	-	1
7. Observation tour for (Livestock Dev. Officer and Asst. Liv. Dev. Officer)	"	-	-	1	-	1	2	-	-	2

RCUP

LIVESTOCK DEVELOPMENT -- PROPOSED PROGRAMME

UPPER KALI GANDAKI CATCHMENT AREA

(MAYGDI DISTRICT)

Proposed Programme	Unit	Year 1	Year 2	Year 3	Year 4	Year 5	1st 5 yr Total	2nd 5 yr Total	3rd 5 yr Total	Grand Total
A. Genetic improvement										
1. Distribution of improved animals and poultry birds										
a. Improved buffalo bull	No.	-	5	5	5	5	20	20	20	60
b. Improved cattle bull	"	-	4	3	6	37	50	50	50	150
c. Improved goat (male)										
i. Jammapari (male 10, female 10)	"	-	-	-	-	-	-	-	-	-
ii. Cross breed goat (male)"	-	-	-	5	10	8	23	50	75	148
d. Ram										
i. Exotic breed (Merino D'Arles)	"	-	10	-	-	-	10	-	-	10
ii. Cross ram	"	-	5	10	5	5	25	25	25	75
iii. Kage cross	"	-	4	4	4	4	16	16	16	48
e. Improved poultry (fowl)	"	-	500	1,000	1,000	1,500	4,000	4,000	4,000	12,000
2. Castration of unproductive cattle males	"	-	10	80	200	200	490	600	810	1,900
B. Animal Health										
1. Vaccination - a. H.S. (i) Buffalo	"	-	1,500	2,000	2,000	3,000	8,500	8,000	8,000	24,500
(ii) Cattle	"	-	1,500	1,500	3,000	5,000	11,000	10,500	11,000	32,500
b. R.P. (i) Buffalo	"	-	1,000	2,000	4,500	5,500	13,000	16,000	17,000	46,000
(ii) Cattle	"	-	1,000	3,000	3,000	5,000	12,000	5,000	8,000	25,000
2. Drenching - a. Sheep/goat	"	-	1,400	3,200	6,000	9,500	20,000	23,100	25,000	68,200
b. Cattle/buffalo	"	-	3,000	5,500	10,500	12,500	32,500	32,845	36,393	101,738
3. Dipping/Dusting/Spraying of Sheep/goat	"	-	2,000	4,000	8,000	11,000	25,000	25,000	27,000	77,000
4. Dipping Tank Installation	"	3	2	2	3	4	14	-	-	14
5. Livestock First Aid Kit	"	15	23	17	23	48	126	126	126	378

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Proposed programme	Unit	Year 1	Year 2	Year 3	Year 4	Year 5	1st 5 yr Total	2nd 5 yr Total	3rd 5 yr Total	Grand Total
C. Management										
1. Water trough installation	No.	21	15	15	21	28	100	-	-	100
2. Distribution of equipment										
a. Shearing scissors	"	-	10	20	30	40	100	110	141	351
b. Hoof cutter	"	-	10	10	20	20	60	60	75	195
c. Burdizo castrator	"	-	2	-	10	10	22	24	40	86
3. Credit provision										
a. Purchasing of selected buffalo cow	"	-	15	30	45	30	120	120	120	360
b. Chaff cutter	"	-	-	10	10	20	40	46	51	137
c. Cream separator	"	-	1	1	1	1	4	6	6	16
d. Poultry farm in miniscale	"	-	-	-	-	-	-	1	2	3
D. Extension and Research										
1. Establishment of L.D. Center	"	1	-	-	-	-	1	-	-	1
2. Establishment of sub-center	"	1	1	1	1	1	5	-	-	5
3. Construction (Building)										
a. L.D. Center Office	"	-	1	-	-	-	1	-	-	1
b. L.D. Sub-center cum quarter	"	-	1	1	1	2	5	-	-	5
c. Quarter -- type A	"	-	1	-	-	-	1	-	-	1
d. Quarter -- type B	"	-	2	-	-	-	2	-	-	2
e. Exotic breed ram shed	"	-	1	-	-	-	1	-	-	1
4. Livestock production studies	"	-	-	1	1	1	3	5	5	13
E. Training										
1. VAA preparation	"	15	23	17	23	48	126	-	-	
2. VAA training	"	15	38	55	78	126	312	630	630	1,572
3. Farmer's training	"	10	20	30	40	50	150	235	235	620
4. JTA preparation	"	4	2	2	6	-	14	-	-	14
5. Inservice training (JT, JTA, Stockmen)	"	4	10	16	22	29	81	405	810	891
6. M.S. Degree course in A.H.	"	-	1	-	-	-	1	-	-	1
7. Observation tour for (Livestock Dev. Officer and Asst. Liv. Dev. Officer)	"	-	-	1	-	1	2	-	-	2

RCUP

LIVESTOCK DEVELOPMENT -- PROPOSED PROGRAMME

UPPER KALI GANDAKI CATCHMENT AREA

(MUSTANG DISTRICT)

Proposed Programme	Unit	Year 1	Year 2	Year 3	Year 4	Year 5	1st 5 yr Total	2nd 5 yr Total	3rd 5 yr Total	Grand Total
A. Genetic improvement										
1. Distribution of improved animals and poultry birds										
a. Improved buffalo bull	No.	-	-	-	-	-	-	-	-	-
b. Improved cattle bull	"	-	-	13	-	-	13	13	13	39
c. Improved goat (male)										
i. Jamunapari (male 10, female 10)	"	-	-	-	-	-	-	-	-	-
ii. Cross breed goat (male)	"	-	-	-	-	-	-	-	-	-
d. Ram										
i. Exotic breed (Merino D'Arles)	"	-	8	-	-	-	8	-	-	8
ii. Cross ram	"	-	5	5	-	5	15	15	15	45
iii. Kage cross	"	-	-	-	-	-	-	-	-	-
e. Improved poultry (fowl)	"	-	500	500	500	500	2,000	2,000	2,000	6,000
2. Castration of unproductive cattle males	"	-	10	50	50	50	160	400	500	1,060
B. Animal Health										
1. Vaccination - a. H.S. (i) Buffalo	"	-	-	-	-	-	-	-	-	-
(ii) Cattle	"	-	500	1,000	1,500	2,000	5,000	5,000	5,000	15,000
b. R.P. (i) Buffalo	"	-	-	-	-	-	-	-	-	-
(ii) Cattle	"	-	500	1,000	2,800	2,000	6,300	2,000	2,000	10,300
2. Drenching - a. Sheep/goat	"	-	2,200	3,250	6,000	7,000	18,850	21,400	23,170	63,420
b. Cattle/buffalo	"	-	500	1,000	2,000	1,000	4,500	4,633	5,134	14,267
3. Dipping/Dusting/Spraying of Sheep/goat	"	-	2,000	3,000	6,000	8,000	19,000	19,000	20,000	58,000
4. Dipping Tank Installation	"	-	1	-	-	-	1	-	-	1
5. Livestock First Aid Kit	"	29	35	32	38	10	144	144	144	432

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Proposed programme	Unit	Year 1	Year 2	Year 3	Year 4	Year 5	1st 5 yr Total	2nd 5 yr Total	3rd 5 yr Total	Grand Total
C. Management										
1. Water trough installation	No.	32	24	18	26	-	100	-	-	100
2. Distribution of equipment										
a. Shearing scissors	"	-	-	10	10	10	30	33	40	103
b. Hoof cutter	"	-	10	10	10	20	50	50	65	165
c. Burdizo castrator	"	-	-	-	10	10	20	24	40	84
3. Credit provision										
a. Purchasing of selected buffalo cow	"	-	-	10	10	10	30	30	30	90
b. Chaff cutter	"	-	-	5	10	10	25	30	31	86
c. Cream separator	"	-	-	1	1	1	3	3	3	9
d. Poultry farm in miniscale	"	-	-	-	-	-	-	-	-	-
D. Extension and Research										
1. Establishment of L.D. Center	"	1	-	-	-	-	1	-	-	1
2. Establishment of sub-center	"	1	1	1	1	1	5	-	-	5
3. Construction (Building)										
a. L.D. Center Office	"	-	1	-	-	-	1	-	-	1
b. L.D. Sub-center cum quarter	"	-	1	1	1	2	5	-	-	5
c. Quarter -- type A	"	-	1	-	-	-	1	-	-	1
d. Quarter -- type B	"	-	2	-	-	-	2	-	-	2
e. Exotic breed ram shed	"	-	1	-	-	-	1	-	-	1
4. Livestock production studies	"	-	-	1	1	1	3	5	5	13
E. Training										
1. VAA preparation	"	29	35	32	38	10	144	-	-	144
2. VAA training	"	29	64	96	134	144	467	720	720	1,907
3. Farmer's training	"	10	20	30	40	50	150	235	235	620
4. JTA preparation	"	4	6	6	-	-	16	-	-	16
5. Inservice training (JT, JTA, Stockmen)	"	4	7	16	22	29	78	390	390	858
6. M.S. Degree course in A.H.	"	-	-	-	1	-	1	-	-	1
7. Observation tour for (Livestock Dev. Officer and Asst. Liv. Dev. Officer)	"	-	1	-	1	-	2	-	-	2

BUDGET

Budget component is divided into two categories: (a) capital cost, (b) operating cost. Credit also incorporated in capital cost. Hence, the capital cost is Rs. 97,48,000/- including credit in the first five years and and Rs. 15,629,000/- in the whole 15 years. Also, there are Rs. 14,192,800/- and Rs. 42,029,000/- in the first five years and the whole project years, i.e., 15 years, in case of operating cost. Therefore, total project costs are Rs. 23,940,800/- and 57,658,000/- in the first five years and total project (15 years). See summary sheet of project costs, pages 63 and 64.

Besides this, this project cost is also calculated catchment area wise. See pages 70 to 85.

CAPITAL COST

1. Includes Livestock Development Center Office building, quarters and Sub-center office building, Fencing, Dipping tank, Water trough, and Bull/Ram station shed.

2. Livestock Development Center -- 2 Ropani
   @ Rs. 5,000/ropani
   Livestock Development Sub-center -- 2 Ropani
   @ Rs. 3,000/ropani
3. Vehicle -- wheel -- @Rs. 100,800/-
4. It includes center and sub-center both.
5. Equipment for center and sub-center and also it includes the distribution of (a) Shearing Scissors, (b) Burdizo Castrator, (c) Hoof Cutter to the farmers, (d) Livestock first aid kit.
6. It also includes the procurement of 20 Jamunapari goat (10 male and 10 female) at the rate of Rs. 3,000/- per head.
9. It includes only drugs, i.e., Rs. 30,000/- and surgical equipment -- Rs. 50,000/- .

RCUP

LIVESTOCK DEVELOPMENT COST ESTIMATE

Capital Cost

('000 NR)

Capital Cost	Year 1	Year 2	Year 3	Year 4	Year 5	1st 5 yr	2nd 5 yr	3rd 5 yr	Grand Total
1. Construction	135.0	2309.0	705.0	680.0	876.0	5605.0	-	1395.0	7000.0
2. Land	54.0	30.0	30.0	30.0	12.0	156.0	-	-	156.0
3. Vehicle	201.0	-	-	-	-	201.0	-	-	201.0
4. Furniture	52.0	15.0	15.0	15.0	6.0	103.0	-	42.0	145.0
5. Equipment	193.0	59.0	69.0	85.0	73.0	479.0	230.0	434.0	1143.0
6. Procurement of buffalo, cattle bull/ram/buck and doe	-	712.0	359.0	382.0	567.0	2020.0	1600.0	1690.0	5310.0
7. Procurement of 6-8 week old poultry birds	-	25.0	45.0	55.0	75.0	200.0	190.0	190.0	580.0
8. Purchasing of Horse	20.0	-	-	-	-	20.0	-	10.0	30.0
9. Strengthening of Jomsom Veterinary Hospital	80.0	-	-	-	-	80.0	50.0	50.0	180.0
TOTAL CAPITAL COST	735.0	4050.0	1223.0	1247.0	1609.0	8864.0	2070.0	3811.0	14745.0
Credit Provision (buffalo cow, chaff cutter, cream separator, poultry farm in mini scale)	-	170.0	311.0	347.0	56.0	884.0	-	-	884.0

RCUP

LIVESTOCK DEVELOPMENT COST ESTIMATE

Operating Cost
('000 NR)

	Operating Cost	Year 1	Year 2	Year 3	Year 4	Year 5	1st 5 yr	2nd 5 yr	3rd 5 yr	Grand Total
1.	Staff	393.0	1012.4	1532.1	2126.7	2607.4	7671.6	8438.8	[illegible]	2 393.1
2.	Training	52.0	100.8	163.0	210.5	188.7	715.0	786.0	865.0	2,366.0
3.	Building and other maintenance	-	6.8	167.3	202.6	236.6	613.3	722.8	865.1	2,201.2
4.	Rent (House)	34.0	46.0	12.0	12.0	16.8	120.8	-	-	120.8
5.	Research and experiment	-	-	40.0	40.0	40.0	120.0	200.0	200.0	520.0
6.	Bull/buck/ram rearing cost	-	194.0	437.0	687.8	1018.0	2336.8	600.0	-	2936.8
7.	Vaccination and drenching	-	123.2	250.4	440.7	608.5	1422.8	1490.8	1630.0	4,543.6
8.	Fuel and maintenance (vehicle)	20.0	34.0	34.0	34.0	34.0	156.0	172.0	189.0	517.0
9.	Stationary	28.0	38.0	48.0	58.0	62.0	234.0	257.0	283.0	774.0
10.	Drugs	56.0	86.0	116.0	[illegible]	158.0	562.0	618.0	680.0	1,860.0
11.	Kerosine oil	18.0	25.5	33.0	40.5	43.5	160.5	177.0	194.0	531.5
12.	Ration (horse)	16.0	16.0	16.0	16.0	16.0	80.0	88.0	97.0	265.0
	Total Operating Cost	617.0	1682.7	2848.8	4014.8	5029.5	14192.8	13550.4	14285.4	42,029.0
	Total Capital Cost	735.0	4050.0	1223.0	1247.0	1609.0	8864.0	2070.0	3811.0	14,745.0
	Total Credit	-	170.0	311.0	347.0	56.0	884.0	-	-	884.0
	GRAND TOTAL (Project cost)	1352.0	5902.7	4382.8	5608.8	6694.5	23940.8	15620.4	18096.8	57,658.0

RCUP

LIVESTOCK DEVELOPMENT FOREIGN EXCHANGE ESTIMATE

Capital Cost

('000 NR)

Capital Cost	% of foreign exchange	Year 1	Year 2	Year 3	Year 4	Year 5	1st 5 yr	2nd 5 yr	3rd 5 yr	Grand Total
1. Construction	20.0	27.0	641.8	141.0	136.0	175.2	1121.0	-	279.0	1400.0
2. Land	0.0	-	-	-	-	-	-	-	-	-
3. Vehicle	100.0	201.0	-	-	-	-	201.0	-	-	201.0
4. Furniture	10.0	5.2	1.5	1.5	1.5	0.6	10.3	-	4.2	14.5
5. Equipment	90.0	173.7	53.1	62.1	76.5	65.7	431.1	207.0	390.6	1028.7
6. Procurement of buffalo, cattle bull/ram/buck and doe	40.0	-	284.8	143.6	152.8	226.8	808.0	640.0	676.0	2124.0
7. Procurement of 6-8 week old poultry birds	0.0	-	-	-	-	-	-	-	-	-
8. Purchasing of Horse	0.0	-	-	-	-	-	-	-	-	-
9. Strengthening of Jomsom Veterinary Hospital	90.0	72.0	-	-	-	-	72.0	45.0	45.0	162.0
TOTAL CAPITAL COST		478.9	981.2	348.2	366.8	468.3	2643.4	892.0	1394.8	4930.2

RCUP

LIVESTOCK DEVELOPMENT FOREIGN EXCHANGE ESTIMATE

Operating Cost

('000 NR)

	Operating Cost	% of foreign exchange	Year 1	Year 2	Year 3	Year 4	Year 5	1st 5 yr	2nd 5 yr	3rd 5 yr	Grand Total
1.	Staff	0.0	-	-	-	-	-	-	-	-	-
2.	Training	0.0	-	-	-	-	-	-	-	-	-
3.	Building and other maintenance	0.0	-	-	-	-	-	-	-	-	-
4.	Rent (House)	0.0	-	-	-	-	-	-	-	-	-
5.	Research and experiment	0.0	-	-	-	-	-	-	-	-	-
6.	Bull/buck/ram rearing cost	0.0	-	-	-	-	-	-	-	-	-
7.	Vaccination and drenching	80.0	-	98.56	200.32	352.56	486.8	1138.24	1192.64	1304.0	3634.88
8.	Fuel and maintenance (vehicle)	82.0	16.4	27.88	27.88	27.88	27.88	127.92	141.04	154.98	423.94
9.	Stationary	80.8	22.4	30.4	38.4	46.4	49.6	187.2	205.6	226.4	619.2
10.	Drugs	80.0	44.8	88.8	92.8	116.8	126.4	469.6	494.4	544.0	1508.0
11.	Kerosine oil	0.0	-	-	-	-	-	-	-	-	-
12.	Ration (horse)	0.0	-	-	-	-	-	-	-	-	-
	Total Operating Cost		83.6	245.64	359.4	543.64	690.68	1922.96	2033.68	2229.38	6168.02
	Total Capital Cost		478.9	981.2	348.2	366.8	468.3	2643.4	892.0	1394.8	4930.2

OPERATING COSTS

1. It includes salary, project allowance, Remote area allowance, Field allowance, Rice allowance, Provident fund, and respective grade of all additional staff and project allowance of all existing manpower. There is also an incremental of $10 in every second and third five year of the first and second five years.
2. JTA preparation and in-service training of JT, JTA, Stockman, farmer's training, and farmer's day and VAA preparation cost. There is an incremental cost of 10% in every second and third five year.
3. Building and other construction maintenance cost is 5%, which includes Livestock Development Center, Sub-Centers, quarters, fencing, water trough, and bull station (at sub-center), etc.
4. House rent.
5. For any type of research work for livestock development.
6. Includes buffalo and cattle bull/ram/buck maintenance cost. The maintenance cost of Jamunapari goat at the rate of Rs. 1800/head/year is also given for first and second five years.
8. Fuel and maintenance cost of vehicle, and there is an incremental of 10% cost is included in second and third five year.
9. Stationary cost plus an increment of 10% in second and third five year.
10. There is an increment of 10% in second and third five year.
11. Kerosine oil given to Center and Sub-Center and a 10% incremental cost in second and third five year.
12. Ration for horse and 10% incremental cost in second and third five year.

R C U P

Kulekhani Catchment Area
Makawanpur District

Total Livestock Development Cost Estimate
Capital Cost
('000NR)

Makawanpur Capital Cost	Unit Cost		Year - 1 Unit	Cost	Year - 2 Unit	Cost	Year - 3 Unit	Cost	Year - 4 Unit	Cost	Year - 5 Unit	Cost	TOTAL Unit	Cost	2nd 5 Year	3rd 5 Year	Grand Total
A. Genetic Improvement																	
1. Distribution of improved animals & poultry birds																	
a) Improved buffalo bull	1	6.5	-	-	3	19.5	2	13.0	1	6.5	-	-		39.0	39.0	39.0	117.0
b) Cattle bull(Jersey cross)	1	4.5	-	-	5	22.5	6	27.0	6	27.0	-	-		76.5	76.5	76.5	229.5
c) Improved Ram																	
i) Ram (exotic breed)	1	12.75	-	-	10	127.5	-	-	-	-	-	-		127.5	-	-	127.5
ii) Cross ram	1	1.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
iii) Kage cross	1	0.5	-	-	4	2.0	-	-	4	2	-	-	-	4.0	4.0	4.0	12.0
d) Improved (cross) male goat	1	1.0	-	-	-	-	5	5.0	10	10.0	7	7.0	22	22.0	50.0	75.0	147.0
Sub-Total						171.5		45.0		45.5		7.0		269.0	169.5	194.5	633.0
e) Poultry (improved fowl)	1	0.01	-	-	500	5	1000	10.0	1000	10.0	1500	15.0	4000	40.0	40.0	40.0	120.0
Sub-Total-1						176.5		55.0		55.0		22.0		309.0	209.5	234.5	753.0
2. Equipments																	
a) Burdizo castrator	1	0.19							5	0.95	5	0.95	10	1.9	2.28	3.8	7.98
b) Shearing scissor	1	0.12									5	0.6	5	0.6	.72	0.96	2.28
c) Hoof cutter	1	0.23			10	2.3	10	2.3	10	2.3	20	4.6	50	11.5	11.5	14.95	37.95
d) Livestock first aid box	1	0.2	11	2.2	26	5.2	21	4.2	5	1.0	-		63	12.6	12.6	12.6	37.8
Sub-Total-2				2.2		7.5		6.5		4.25		6.15		26.6	27.1	32.31	86.01
B. L. D. Centre																	
a) Land	1	10.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
b) Construction	1	466.75	-	-	1	466.75	-	-	-	-	-	-	1	466.75	-	200.0	666.75
c) Equipments	1	40.0	1	40.0	-	-	-	-	-	-	-	-	1	40.0	-	45.0	85.0
d) Furniture	1	10.0	1	10.0	-	-	-	-	-	-	-	-	1	10.0	-	10.4	20.4
e) Horse	1	5.0	1	5.0	-	-	-	-	-	-	-	-	1	5.0	-	-	
f) Vehicle - 4 wheel	1	100.8	1	100.8	-	-	-	-	-	-	-	-	1	100.8	-	-	100.8
Sub-Total-3				155.8		466.75								622.55		255.4	877.95

Makwanpur Capital cost	Unit	Cost	Year - 1 Unit	Cost	Year - 2 Unit	Cost	Year - 3 Unit	Cost	Year - 4 Unit	Cost	Year - 5 Unit	Cost	TOTAL Unit	Cost	2nd 5 Year	3rd 5 Year	Grand Total
C. L. D. Sub-Centre																	
a) Land	1	6.0	1	6.0	1	6.0	1	6.0	-	-	-	-	3	18.0	-	-	18.0
b) Construction																	
i) Office building cum quarter	1	72.0	1	-	1	72.0	1	72.0	1	72.0	-	-	3	216.0	-	-	216.0
ii) Ram Shed	1	20.0			1	20.0	-	-	-	-	-	-	1	20.0	-	-	20.0
iii) Fencing	1	2.5	1		1	2.5	1	2.5	1	2.5	-	-	3	7.5	-	-	7.5
iv) Diping tank	1	5.0	3	15.0	1	5.0	2	10.0	-	-	-	-	6	30.0	-	-	30.0
v) Water trough	1	1.25	10	12.5	20	25.0	20	25.0	-	-	-	-	50	62.5	-	-	62.5
vi) Bull station	1	1.0	1	1.0	1	1.0	1	1.0	-	-	-	-	3	3.0	-	-	3.0
Sub-Total-4				28.5		125.5		110.5		74.5	-	-		339.0	-	-	339.0
c) Equipment	1	5.0	1	5.0	1	5.0	1	5.0	-	-	-	-	3	15.0	-	-	15.0
d) Furniture	1	3.0	1	3.0	1	3.0	1	3.0	-	-	-	-	3	9.0	-	-	9.0
Sub-Total-5				8.0		8.0		8.0						24.0			24.0
Total				200.5		790.25		186.0		134.25		28.25		1339.15	236.6	522.21	2097.0

R C U P
Kulekhani Catchment Area
Makwanpur District
Total Livestock Development Cost Estimate
Operating Cost
('000 NR)

Makawanpur *Operating Cost*	Unit Cost		Year - 1 Unit Cost		Year - 2 Unit Cost		Year - 3 Unit Cost		Year - 4 Unit Cost		Year - 5 Unit Cost		TOTAL Unit Cost		2nd 5 Year	3rd 5 Year	Grand Total
A. Staff																	
a) L.D. Centre				58.8		95.5		97.4		99.6		101.4		452.7	497.97	547.76	1498.43
b) L.D. Sub-centre				39.2		136.7		188.0		198.9		200.5		763.3	839.6	923.6	2526.5
Sub-total - 1				98.0		232.2		285.4		298.5		301.9		1216.0	1337.57	1471.36	4024.93
B. Training				10.8		21.8		30.6		30.3		31.1		124.6	137.1	150.8	412.5
C. Building & other maintenance (5% annually)																	
a) L.D. Centre	1	23.3	--	--				23.3		23.3		23.3		69.9	77.0	96.0	242.9
b) L.D. Sub-centre						1.4		7.7		13.2		16.9		39.2	44.1	47.1	130.7
Sub-total -2						1.4		31.0		36.0		40.2		109.1	121.1	143.4	373.6
C. Operation of Office																	
a) L.D. Centre																	
Research/experiment	1	10.0					1	10.0	1	10.0	1	10.0	3	30.0	50.0	50.0	130.0
Stationary	1	5.0	1	5.0	1	5.0	1	5.0	1	5.0	1	5.0	5	25.0	27.0	30.5	83.0
Drugs	1	8.0	1	8.0	1	8.0	1	8.0	1	8.0	1	8.0	5	40.0	44.0	48.0	132.0
Kerosine oil	1	3.0	1	3.0	1	3.0	1	3.0	1	3.0	1	3.0	5	15.0	16.5	18.5	50.0
Horse ration	1	4.0	1	4.0	1	4.0	1	4.0	1	4.0	1	4.0	5	20.0	22.0	24.2	66.2
Vehicle fuel & maint.	1		1	10.0		17.0		17.0		17.0		17.0		78.0	85.8	94.4	258.2
Sub-total - 3				30.0		37.0		47.0		47.0		47.0		208.0	245.8	265.6	719.4
b) L.D. Sub-centre(rent house)																	
Buffalo bull maint. at farmer's level	1	2.4	--	--	1	2.4	2	4.8	3	7.2	3	7.2	9	21.6			
" " *sub-centre*	1	2.4			2	4.8	3	7.2	3	7.2	3	7.2	11	26.4			
Cattle bull maint. at farmer's level	1	2.16			5	10.8	11	23.8	17	36.7	17	36.7	50	108.0			
Ram maintenance at farmer's level	1	1.8			14	25.2	14	25.2	18	32.4	18	32.4	64	115.2	120.0		
Male goat " "	1	1.8					5	9.0	15	27.0	22	39.6	42	75.6			
						43.2		70.0		110.5		123.1		346.8	120.0		

R C U P

Kulekhani Catchment Area

	Makawanpur	Unit	Cost	Year - 1 Unit	Year - 1 Cost	Year - 2 Unit	Year - 2 Cost	Year - 3 Unit	Year - 3 Cost	Year - 4 Unit	Year - 4 Cost	Year - 5 Unit	Year - 5 Cost	TOTAL Unit	TOTAL Cost	2nd 5 Year	3rd 5 Year	Grand Total
	Rent (house)	1	2.4	1	2.4		4.8		2.4		2.4				12.0			12.0
	Stationary	1	2.0	1	2.0	2	4.0	3	6.0	3	6.0	3	6.0	12	24.0	26.4	29.04	79.44
	Drugs	1	6.0	2	6.0	2	12.0	3	18.0	3	18.0	12	18.0	12	72.0	79.2	87.12	238.32
	Kerosine oil	1	1.5	1	1.5	2	3.0	3	4.5	3	4.5	3	4.5	12	18.0	19.8	21.78	59.58
	Sub-total - 5	1			11.9		23.8		30.9		30.9		28.5		126.0	125.4	137.94	389.34
E.	Vaccination & Drenching						19.25		37.3		67.0		79.0		202.55	209.5	226.1	638.15
	Total				150.7		378.65		532.2		260.7		650.8		2333.05	2296.47	2395.2	7024.72
	Total Capital Cost	--	--	--	200.5	--	790.25		186.0		134.25		28.25		1339.15	236.6	522.21	2097.96
	Grand Total	--	--	--	351.2		1168.9		718.2		754.95		679.05		3672.2	2533.07	2917.41	9122.68
	CREDIT*																	
a)	Purchasing buffalo cows	1	3.0	--	--	10	30.0	10	30.0	10	30.0	20	60.0	50	150.0	187.5	200.0	537.5
b)	Chaff cutter	1	1.0					10	10.0	10	10.0	10	10.0	30	30.0	45.0	50.0	125.0
c)	Cream seperator	1	5.0									2	10.0	2	10.0	20.0	20.0	50.0
d)	Poultry farm in miniscale	1	10.0									1	10.0	1	10.0	10.0	15.0	35.0
						1	30.0		40.0		40.0		90.0		200.0	262.5	285.0	747.5

*Repayment system is not taken into account.

Gorkha Capital Cost	Unit	Cost	Year - 1 Unit	Cost	Year - 2 Unit	Cost	Year - 3 Unit	Cost	Year - 4 Unit	Cost	Year - 5 Unit	Cost	TOTAL Unit	Cost	2nd 5 Year	3rd 5 Year	Grand Total
G. L.D. Sub-centre																	
a) Land	1	6.0	1	6.0	2	12.0	2	12.0	1	12.0	1	6.0	8	48.0	--	--	48.0
b) Construction																	
i) Office building cum quarter	1	90.0	--	--	1	90.0	2	180.0	2	180.0	3	270.0	8	720.0	--	--	720.0
ii) Ram shed	1	20.0	--	--	1	20.0	1	20.0	--	--	--	--	2	40.0	--	--	40.0
iii) Fencing	1	2.5	--	--	1	2.5	2	5.0	2	5.0	3	7.5	8	20.00	--	--	20.0
iv) Dipping tank	1	5.0	2	10.0	5	25.0	6	30.0	--	45.0	5	25.0	27	135.0	--	--	135.0
v) Water trough	1	1.25	10	12.5	30	37.5	35	43.8	45	56.2	30	37.5	150	187.5	--	--	187.5
vi) Buffalo bull station	1	1.0	1	1.0	2	2.0	2	2.0	2	2.0	1	1.0	8	8.0	--	--	8.0
Sub-total - 4				23.5		177.0		280.8		288.2		341.0		1110.5	--	--	1110.5
c) Equipment	1	5.0	1	5.0	2	10.0	2	10.0	2	10.0	1	5.0	8	40.0	--	--	40.0
d) Furniture	1	3.0	1	3.0	2	6.0	2	6.0	2	6.0	1	3.0	8	24.0	--	--	24.0
Sub-total - 5				8.0		16.0		16.0		16.0		8.0		64.0	--	--	64.0
Total				205.7		1011.0		539.3		614.5		774.9		3145.4	1088.92	1625.27	5859.59

R C U P
Daraundi Catchment Area
Gorkha District
Total Livestock Development Cost Estimate
Operating Cost
('000 NR)

Gorkha Operating Cost	Unit Cost		Year - 1 Unit Cost		Year - 2 Unit Cost		Year - 3 Unit Cost		Year - 4 Unit Cost		Year - 5 Unit Cost		TOTAL Unit Cost		2nd 5 Year	3rd 5 Year	Grand Total
A. Staff																	
a) L.D. Centre				23.7		54.7		55.8		56.9		58.1		249.2	274.12	301.5	824.8
b) L.D. Sub-centre				53.4		201.5		389.8		671.9		938.9		2255.5	2481.1	2729.2	7465.8
Sub-total - 1				77.1		256.2		445.6		728.8		997.0		2504.7	2755.22	3030.7	8290.62
B. Training				10.8		29.6		64.2		88.3		41.3		234.2	257.6	283.4	775.2
C. Building and other maintenance (5% annually)																	
i) L.D. Centre				--		--		29.2		29.2		29.2		87.6	96.3	127.5	311.4
ii) L.D. Sub-centre						1.2		10.1		23.1		40.2		74.6	100.0	108.9	283.5
Sub-total - 2						1.2		39.3		52.3		69.4		162.2	196.3	236.4	594.9
D. Operation of office																	
i) L.D. Centre																	
Rent (house)	1	12.0	--	12.0	--	12.0	--	--	--	--	--	--	--	24.0	--	--	24.0
Research & experiment	1	10.0	--	--	--	--	1	10.0	1	10.0	1	10.0	3	30.0	50.0	50.0	130.0
Stationary	1	5.0	1	5.0	1	5.0	1	5.0	1	5.0	1	5.0	5	25.0	27.5	30.2	82.7
Drugs	1	8.0	1	8.0	1	8.0	1	8.0	1	8.0	1	8.0	5	40.0	48.0	48.0	132.0

cont'd

Gorkha District cont'd

Gorkha Operating cost	Unit	Cost	Year - 1 Unit	Cost	Year - 2 Unit	Cost	Year - 3 Unit	Cost	Year - 4 Unit	Cost	Year - 5 Unit	Cost	TOTAL Unit	Cost	2nd 5 Year	3rd 5 Year	Grand Total
CREDIT																	
a. Purchasing buff. cows	1	3.0	--	--	20	60.0	20	60.0	20	60.0	30	90.0	100	300.0	187.5	200.0	687.5
b. Chaff cutter	1	1.0	--	--	--	--	20	20.0	20	20.0	20	20.0	60	60.0	45.0	50.0	155.0
c. Cream separator	1	5.0	--	--	--	--	--	--	--	--	4	20.0	4	20.0	30.0	40.0	90.0
d. Poultry farm in miniscale	1	10.0	--	--	--	--	--	--	--	--	1	10.0	1	10.0	20.0	20.0	50.0
Total						60.0		80.0		110.00		140.0		390.0	282.5	310.0	982.0

*Repayment system is not taken into account.

R C U P

Daraundi Catchment Area
Gorkha District

Total Livestock Development Cost Estimate

Gorka Capital Cost	Unit Cost		Year - 1 Unit	Cost	Year - 2 Unit	Cost	Year - 3 Unit	Cost	Year - 4 Unit	Cost	Year - 5 Unit	Cost	TOTAL Unit	Cost	2nd 5 Year	3rd 5 Year	Grand Total
A. Genetic Improvement																	
1. Improved male animal																	
a. Buffalo bull	1	6.5	-	-	4	26.0	5	32.5	10	65	15	97.5	34	221.0	221.0	221.0	663.0
b. Cattle bull(Jersey cross 50%)	1	4.5	-	-	5	22.5	31	139.5	2	144.0	52	234.0	120	540.0	540.0	540.0	1620.0
c. Improved ram																	
i) Ram (exotic breed)	1	12.75	-	-	12	153.0	-	-	-	-	-	-	12	153.0	-	-	153.0
ii) Cross breed ram	1	1.0	1	1	-	-	5	5	5	5	-	-	10	10.0	10.0	10.0	30.0
iii) Kage cross	1	0.5	-	-	4	2	4	2	4	2	4	2	16	8.0	8.0	8.0	24.0
d. Improved cross male goat	1	1.0	-	-	-	-	10	10.0	20	20.0	15	15.0	45	45.0	110.0	150.0	305.0
e. Poultry improved (fowl)	1	0.01	-	-	1000	10.0	1000	20.0	3000	30.0	4000	40.0	10000	100.0	100.0	100.0	300.0
Sub-Total - 1						213.5		209.0		266.0		388.5		1077.0	989.0	1029.0	3095.0
2. Equipments																	
a. Burdizo castrator	1	0.19	-	-	-	-	10	1.9	20	3.8	20	3.8	50	9.5	11.4	19.0	39.9
b. Shearing scissor	1	0.12	-	-	10	1.2	20	2.3	30	3.6	40	4.8	100	12.0	13.32	16.92	42.24
c. Hoof cutter	1	0.23	-	-	10	2.3	20	4.6	30	6.9	40	9.2	100	23.0	23.0	28.75	74.75
d. Livestock first aid box	1	0.2	12	2.4	28	5.6	63	12.6	90	18.0	68	13.6	261	52.2	52.2	52.2	156.6
Sub-Total - 2				2.4		9.1		21.5		32.3		31.4		96.7	99.92	116.87	313.49
B. L. D. Centre																	
a. Land	1	10.0	1	10.0	-	-	-	-	-	-	-	-	1	10.0	-	-	10.0
b. Construction	1	583.4	-	-	1	583.4	-	-	-	-	-	-	1	583.4	-	424.0	1007.4
c. Equipment	1	40.0	1	40.0	-	-	-	-	-	-	-	-	1	40.0	-	45.0	85.0
d. Furniture	1	10.0	1	10.0	-	-	-	-	-	-	-	-	1	10.0	-	10.4	20.4
e. Horse	1	5.0	1	5.0	-	-	-	-	-	-	-	-	1	5.0	-	-	5.0
f. Vehicle - 4 wheel	1	100.8	1	100.8	-	-	-	-	-	-	-	-	1	100.0	-	-	100.0
Sub-Total - 3				165.8		583.4							1	749.2	-	479.4	1228.6

R C U P
Gorkha District

Gorkha Operating cost	Unit	Cost	Year - 1 Unit	Year - 1 Cost	Year - 2 Unit	Year - 2 Cost	Year - 3 Unit	Year - 3 Cost	Year - 4 Unit	Year - 4 Cost	Year - 5 Unit	Year - 5 Cost	TOTAL Unit	TOTAL Cost	2nd 5 Year	3rd 5 Year	Grand Total
Kerosine oil	1	3.0	4	3.0	1	3.0	1	3.0	1	3.0	1	3.0	5	15.0	16.5	18.2	49.7
Horse ration	1	4.0	1	4.0	1	4.0	1	4.0	1	4.0	1	4.0	5	20.0	22.0	24.2	66.2
Vehical fuel & maintenance				10.0		17.0		17.0		17.0		17.0		78.0	85.8	94.3	258.1
Sub-total - 3				42.0		49.0		47.0		47.0		47.0		232.0	245.8	264.9	742.7
ii) L.D. Sub-centre																	
a. Buffalo bull maintenance at farmers level	1	2.4	--	--	1	2.4	4	9.6	12	28.8	26	62.4	43	103.2	--	--	103.2
b. Buff. bull maintenance at sub-centre	1	2.4			3	7.2	5	12.0	7	16.8	8	19.2	23	55.2	--	--	55.2
c. Cattle bull maintenance at farmers level	1	2.16	--	--	5	10.8	36	77.8	68	146.9	120	259.2	229	494.7	--	--	494.7
d. Male goat maintenance at farmers level	1	1.8	--	--	--	--	10	18.0	30	54.0	45	81.0	85	153.0	0	--	153.0
e. Ram maintenance "	1	1.8	--	--	16	28.8	25	45.0	34	61.2	38	68.4	113	203.4	144.0	--	347.4
Sub-total - 4						49.2		162.4		307.7		492.2		1009.5	144.0	--	1153.5
f. Rent (house)	1	2.4	--	2.4		7.2		4.8		4.8		7.2		26.4	--	--	26.4
g. Stationary	1	2.0	1	2.0	3	6.0	5	10.0	7	11.0	8	16.0	--	48.0	52.8	58.1	158.9
h. Drugs	1	6.0	1	6.0	3	18.0	5	30.0	7	42.0	8	48.0	--	144.0	158.4	174.24	476.6
i. Kerosine oil	1	1.5	1	1.5	3	4.5	5	7.5	7	10.5	8	12.0	--	36.0	39.0	43.56	119.2
Sub-total - 5				11.9		35.7		52.3		71.3		83.2		254.4	250.8	275.9	781.1
E. Vaccination & Drenching						69.97		150.1		251.62		377.38		849.07	867.8	970.1	2686.97
Total				141.8		490.		960.9		1547.02		2105.48		5246.07	4717.52	5061.4	15024.99
Total Capital Cost				205.7		1011.0		539.3		614.5		774.9		3145.4	1088.92	1625.27	5859.59
Grand Total				347.5		1501.87		1500.2		2161.52		2880.38		8391.47	5806.44	6686.67	20884.5

R C U P
Upper Kali Gandaki Catchment Area
Myagdi District

Total Livestock Development Cost Estimate
Capital Cost ('000 NR)

	Unit	Cost	Year - 1 Unit	Cost	Year - 2 Unit	Cost	Year - 3 Unit	Cost	Year - 4 Unit	Cost	Year - 5 Unit	Cost	TOTAL Unit	Cost	2nd 5 Year	3rd 5 Year	Grand Total
A. Genetic Improvement																	
1. Improved male animals																	
a. Buffalo bull (Murriha)	1	6.5	-	-	5	32.5	5	32.5	5	32.5	5	32.5	20	130.0	130.	130.	390.
b. Cattle-bull (Jersey cross)	1	4.5	-	-	4	18.9	3	13.5	6	27.0	37	166.5	50	225.0	225.0	225.0	675.0
c. Improved ram																	
i) Ram (exotic breeds)	1	12.75	-	-	10	127.5	-	-	-	-	-	-	10	127.5	-	-	127.5
ii) Cross breed ram	1	1.0	-	-	5	5	10	10.0	5	5.0	5	5.0	25	25.0	25.0	25.0	75.0
iii) Kage cross	1	.5	-	-	4	2	4	2.0	4	2.0	4	2.0	16	8.0	8.0	8.0	24.0
d. Improved cross male goat	1	-	-	-	-	-	4	5.0	10	10.0	8	8.0	23	23.0	50.0	75.0	148.0
Sub-Total		25.25	-	-		185.0		63.0		76.5		214.0		538.5	438.5	463.0	1439.5
e. Poultry (fowl-improved)	1	0.01	-	-	500	5.0	1000	10.0	1000	10.0	1500	15.0	4000	40.0	40.0	40.0	120.0
Sub-Total-1						190.0		73.0		86.5		229.0		578.5	478.0	503.0	1559.5
2. Equipment																	
a. Burdizo castrator	1	0.19	-	-	-	-	-	-	10	1.9	10	1.9	20	3.8	4.6	7.6	16.0
b. Shearing scissor	1	0.12	-	-	10	1.2	20	2.4	30	3.6	40	4.8	100	12.0	13.2	16.92	42.12
c. Hoof cutter	1	0.23	-	-	10	2.3	10	2.3	20	4.6	20	4.6	60	13.8	13.8	17.25	44.85
d. Livestock first aid box	1	0.2	15	3.0	23	4.6	17	3.4	23	4.6	48	9.6	126	25.2	25.2	25.2	75.6
Sub-Total-2				3.0		8.1		8.1		14.7		20.9		54.8	56.8	66.97	178.57
B. L. D. Centre																	
i) Land	1	10.0	1	10.0	-	-	-	-	-	-	-	-	1	10.0	-	-	10.0
ii) Construction	-	-	-	-	-	700.0	-	-	-	-	-	-	1	700.0	-	347.0	1047.0
iii) Equipments	1	40.0	1	40.0	-	-	-	-	-	-	-	-	1	40.0	-	45.0	85.0
iv) Furniture	1	10.0	1	10.0	-	-	-	-	-	-	-	-	1	10.0	-	10.4	20.4
v) Horse	1	5.0	1	5.0	-	-	-	-	-	-	-	-	1	5.0	-	5.0	10.0
Sub-Total-3	-	-		65.0		700.0	-	-	-	-	-	-		765.0	-	407.4	1172.4

R C U P
Upper Kali Gandaki Catchment Area
Myagdi District

Total Livestock Development Cost Estimate
Capital Cost ('000 NR)
(continued)

Myagdi Capital Cost	Unit	Cost	Year - 1 Unit	Year - 1 Cost	Year - 2 Unit	Year - 2 Cost	Year - 3 Unit	Year - 3 Cost	Year - 4 Unit	Year - 4 Cost	Year - 5 Unit	Year - 5 Cost	TOTAL Unit	TOTAL Cost	2nd 5 Year	3rd 5 Year	Grand Total
C. L.D. Sub-centre																	
i) Land Sub-Total - 4	1	6.0	1	6.0	1	6.0	1	6.0	1	6.0	1	6.0	5	30.0	--	--	30.0
ii) Construction																	
a) Office building cum quarter	1	108.0	--	--	1	108.0	1	108.0	1	108.0	2	216.0	5	540.0	--	--	540.0
b) Ram shed	1	20.0	--	--	--	--	1	20.0	--	--	--	--	1	20.0	--	--	20.0
c) Fencing	1	2.5	1	--	1	2.5	1	2.5	1	2.5	2	5.0	5	12.5	--	--	12.5
d) Dipping tank	1	5.0	3	15.0	2	10.0	2	10.0	3	15.0	4	20.0	14	70.0	--	--	70.0
e) Water trough	1	1.25	21	26.25	15	18.8	15	18.8	21	26.25	28	35.0	100	125.0	--	--	125.0
f) Bull station	1	1.0	1	1.0	1	1.0	1	1.0	1	1.0	1	1.0	5	5.0	--	--	5.0
Sub-Total - 5				42.25		140.3		160.3		152.75		277.0		772.5	--	--	772.5
iii) Equipment	1	5.0	1	5.0	1	5.0	1	5.0	1	5.0	1	5.0	5	25.0	--	--	25.0
iv) Furniture	1	3.0	1	3.0	1	3.0	1	3.0	1	3.0	1	3.0	5	15.0	--	--	15.0
Sub-Total - 6				8.0		8.0		8.0		8.0		8.0		40.0	--	--	40.0
Total				124.25		1052.4		255.4		267.95		540.9		2240.8	534.8	977.37	3752.97

R C U P
Upper Kali Gandaki Catchment Area
Myagdi District

Total Livestock Development Cost Estimate
Operating Cost
('000NR)

Myagdi Operating Cost	Unit	Cost	Year - 1 Unit	Cost	Year - 2 Unit	Cost	Year - 3 Unit	Cost	Year - 4 Unit	Cost	Year - 5 Unit	Cost	TOTAL Unit	Cost	2nd 5 Year	3rd 5 Year	Grand Total
A. Staff																	
a) L.D. Centre				23.9		74.0		78.0		79.6		81.8		337.3	371.0	408.1	1116.4
b) L.D. Sub-centre				64.5		165.6		246.9		339.2		520.8		1337.0	1470.8	1617.8	4425.5
Sub-Total-1				88.4		239.6		324.9		418.8		602.6		1674.3	1841.7	2025.9	5541.9
B. Training				12.1		21.5		28.4		41.8		59.9		163.7	180.1	198.1	541.9
C. Building & Other Maintenance (5% annually)																	
i) L.D. Centre	-	-	-	-	-	-	-	35.0	-	35.0	-	35.0	-	105.0	115.5	146.0	366.5
ii) L.D. Sub-centre	-	-	-	-	-	2.1	-	9.1	-	17.1	-	24.7	-	53.0	73.3	79.3	205.6
Sub-Total-2						2.1	-	44.1	-	52.1	-	59.7	-	158.0	188.8	225.3	572.1
D. Operation of Office																	
i) L.D. Centre																	
Rent (house)	1	12.0	-	12.0	-	12.0	-	-	-	-	-	-	-	24.0	-	-	24.0
Research & experiment	1	10.0	-	-	-	-	1	10.0	1	10.0	1	10.0	3	30.0	50.0	50.0	130.0
Stationary	1	5.0	1	5.0	-	5.0	-	5.0	-	5.0	-	5.0	-	25.0	27.5	30.25	82.75
Drugs	1	8.0	-	8.0	-	8.0	-	8.0	-	8.0	-	8.0	-	40.0	44.0	48.0	132.0
Kerosine	1	3.0	-	3.0	-	3.0	-	3.0	-	3.0	-	3.0	-	15.0	16.5	18.15	49.65
Horse Ration	1	4.0	-	4.0	-	4.0	-	4.0	-	4.0	-	4.0	-	20.0	22.0	24.20	66.2
Sub-Total-3				32.0		32.0		30.0		30.0		30.0		154.0	160.0	170.6	484.6
ii) L.D. Sub-centre																	
a) Buffalo bull maintenance at Farmer's level	1	2.4	-	-	3	7.2	7	16.8	11	26.4	15	36.0	36	86.4			
b) Buffalo bull maintenance at sub-centre level	1	2.4	-	-	2	4.8	3	7.2	4	9.6	5	12.0	14	33.6			
c) Cattle bull maintenance farmer's level	1	2.16	-	-	4	8.6	7	15.1	13	28.1	50	108.0	74	159.8			
d) Male goat maintenance farmer's level	1	1.8	-	-	-	-	5	9.0	15	27.0	23	41.4	43	77.4			
e) Ram maintenance	1	1.8	-	-	19	34.2	33	59.4	42	75.6	51	91.8	145	261.0	120.0	-	120.0
Sub-Total-4						54.8		107.5		166.7		289.2		618.0	120.0	-	738.2

R C U P
Upper Kali Gandaki Catchment Area
Myagdi District

Total Livestock Development Cost Estimate
Operating Cost
('000NR)
(continued)

	Unit Cost		Year - 1 Unit Cost		Year - 2 Unit Cost		Year - 3 Unit Cost		Year - 4 Unit Cost		Year - 5 Unit Cost		TOTAL Unit Cost		2nd 5 Year	3rd 5 Year	Grand Total
ii) L.D. Sub-centre																	
f) Rent (house)	1	2.4	-	2.4	-	4.8		2.4		2.4		4.8		16.8	-	-	16.8
g) Stationary	1	2.0	1	2.0	2	4.0	3	6.0	4	8.0	5	10.0	15	30.0	33.0	36.3	99.3
h) Drugs	1	6.0	1	6.0	2	12.0	3	18.0	4	24.0	5	30.0	15	90.0	99.0	108.9	297.9
i) Kerosine oil	1	1.5	1	1.5	2	3.0	3	4.5	4	6.0	5	7.5	15	22.5	24.75	27.22	74.47
Sub-Total-5				11.9		23.8		30.9		40.4		52.3		159.3	156.75	172.42	488.47
E. Vaccination & Drenching						23.35		44.17		85.88		113.88		267.28	273.3	311.6	852.18
Total				144.4		397.15		609.97		835.68		1207.58		3194.78	2920.65	3103.92	9219.35
Total Capital Cost				124.25		1052.4		255.4		267.95		540.9		2940.8	534.8	977.37	3752.97
Grand Total				268.65		1449.55		865.37		1103.63		1748.48		5435.58	3455.45	4081.29	12972.32
CREDIT*																	
a) Purchasing of buffalo cows	1	3.0	-	-	10	30.0	10	30.0	20	60.0	30	90.0	70	210.0	187.5	200.0	597.5
b) Chaff cutter	1	1.0	-	-	-	-	10	10.0	10	10.0	20	20.0	40	40.0	45.0	50.0	135.0
c) Cream separator	1	5.0	-	-	-	-	-	-	-	-	2	10.0	2	10.0	20.0	30.0	60.0
d) Poultry farm in miniscale	1	10.0	-	-	-	-	-	-	-	-	-	-	-	-	10.0	15.0	25.0

R C U P
Upper Kali Gandaki Catchment Area
Mustang District
Total Livestock Development Cost Estimate
Capital Cost
('000 NR)

Mustang Capital Cost	Unit Cost		Year - 1 Unit Cost		Year - 2 Unit Cost		Year - 3 Unit Cost		Year - 4 Unit Cost		Year - 5 Unit Cost		TOTAL Unit Cost		2nd 5 Year	3rd 5 Year	Grand Total
A. Genetic Improvement																	
1. Improved male animals																	
a. Buffalo bull (Murrha)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
b. Cattle bull (Jersey cross 50%)	1	4.5	-	-	-	-	13	58.5	-	-	-	-	13	58.8	58.5	58.5	175.5
c. Improved ram:																	
i) Ram (exotic breed)	1	12.75	-	-	8	102.0	-	-	-	-	-	-	8	102.0	-	-	102.0
ii) Cross ram	1	1.0	-	-	5	5.0	5.	5.0	-	-	5	5.0	15	15.0	15.0	16.0	45.0
iii) Kage cross	1	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
d. Improved cross male goat	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sub-Total-1.						107.0		63.5				5.0		175.5	73.5	73.5	322.5
e. Poultry (fowl) impd.	1	0.01	-	-	500	5.0	500	5.0	500	5.0	500	5.0	2000	20.0	20.0	20.0	60.0
Sub-Total						112.0		68.5		5.0		10.0		195.5	93.5	93.5	382.5
2. Equipments:																	
a. Burdizo castrator	1	0.19	-	-	-	-	-	-	10	1.9	10	1.9	20	3.8	4.56	7.6	15.96
b. Shearing machine	1	0.12	-	-	-	-	10	1.2	10	1.2	10	1.2	30	3.6	3.96	4.8	12.36
c. Hoof cutter	1	0.23	-	-	10	2.3	10	2.3	10	2.3	20	4.6	50	11.5	11.5	14.95	37.95
d. Livestock first-aid box	1	0.2	29	5.8	35	7.0	32	6.4	38	7.6	10	2.0	144	28.8	28.8	28.8	86.4
Sub-Total-2				5.8		9.3		9.9		13.0		9.7		47.7	48.82	56.15	152.67

continued

R C U P
Upper Kali Gandaki Catchment Area
Mustang District
Total Livestock Development Cost Estimate
Capital Cost
('000 NR)
(continued)

Mustang Capital Cost	Unit Cost		Year - 1 Unit Cost		Year - 2 Unit Cost		Year - 3 Unit Cost		Year - 4 Unit Cost		Year - 5 Unit Cost		TOTAL Unit Cost		2nd 5 Year	3rd 5 Year	Grand Total
B. Livestock Development Centre																	
a. Land	1	10.0	1	10.0	-	-	-	-	-	-	-	-	1	10.0	-	-	10.0
b. Construction	1	831.5	-	-	1	831.5	-	-	-	-	-	-	-	831.5	-	424.0	1255.5
c. Equipment	1	40.0	1	40.0	-	-	-	-	-	-	-	-	1	40.0	-	45.0	85.0
d. Furniture	1	10.0	1	10.0	-	-	-	-	-	-	-	-	1	10.0	-	10.0	20.4
e. Horse	1	5.0	1	5.0	-	-	-	-	-	-	-	-	1	5.0	-	5.0	10.0
Sub-Total-3				65.0	-	831.5	-	-	-	-	-	-		896.5	-	485.0	1380.9
C. Livestock Dev. Sub-Centre																	
a. Land Sub-Total-4	1	6.0	1	6.0	1	6.0	1	6.0	2	12.0	-	-	5	30.0	-	-	30.0
b. Construction																	
i) Office building cum quarter	1	126.0	-	-	1	126.0	1	126.0	1	126.0	2	252.0	5	630.0	-	-	630.0
ii) Ram shed	1	20.0	-	-	1	20.0	-	-	-	-	-	-	1	20.0	-	-	20.0
iii) Fencing	1	2.5	-	-	1	2.5	1	2.5	1	2.5	2	5.0	5	12.5	-	-	12.5
iv) Dipping tank	1	5.0	-	-	1	5.0	-	-	-	-	-	-	1	5.0	-	-	5.0
v) Water trough	1	1.25	32	40.0	24	30.0	18	22.5	26	32.5	-	-	100	125.0	-	-	125.0
vi) Bull station	1	1.0	1	1.0	1	1.0	1	1.0	2	2.0	-	-	5	5.0	-	-	5.0
Sub-Total-5				41.0		184.5		152.0		163.0		257.0		797.5	-	-	797.5
c. Equipment	1	5.0	1	5.0	1	5.0	1	5.0	2	10.0	-	-	5	25.0	-	-	25.0
d. Furniture	1	3.0	1	3.0	1	3.0	1	3.0	2	6.0	-	-	5	15.0	-	-	15.0
Sub-Total-6				8.0		8.0		8.0		16.0				40.0			40.0
D. Strengthening Jomson Veterinary Hospital				80.0	-	-	-	-	-	-	-	-	-	80.0	50.0	50.0	180.0
TOTAL				205.8		1151.3		244.4		209.0		276.7		2087.2	192.32	684.05	2963.57

R C U P
Upper Kali Gandaki Catchment Area
Mustang District
Total Livestock Development Cost Estimate
Operating Cost
('000 NR)

Mustang Operating Cost	Unit Cost		Year - 1 Unit Cost		Year - 2 Unit Cost		Year - 3 Unit Cost		Year - 4 Unit Cost		Year - 5 Unit Cost		TOTAL Unit Cost		2nd 5 Year	3rd 5 Year	Grand Total
A. Staff																	
a. Livestock Development Centre	1	-	-	35.6	-	61.8	-	94.0	-	96.7	-	98.7	-	387.6	425.8	468.4	1281.8
b. Livestock Dev. Sub-Centre	-	-	-	93.9	-	222.6	-	381.4	-	583.9	-	607.7	-	1889.5	2078.5	2286.3	6254.3
Sub-Total				129.5		284.4	-	476.2	-	680.6		706.4		2277.1	2504.3	2754.7	7536.1
B. Training				18.4		27.9		39.7		49.9		56.4		192.3	211.5	232.7	636.5
C. Building & other maintenance (5% annually)																	
i) L.D. Centre	-	-	-	-	-	-	-	41.6	-	41.6	-	41.6	-	124.8	137.2	173.9	435.9
ii) L.D. Sub-centre	-	-	-	-	-	2.1	-	11.3	-	19.0	-	27.1	-	59.5	79.2	86.0	224.7
Sub-Total	-	-	-	-	-	2.1	-	52.9	-	60.6	-	68.7	-	184.3	216.4	259.9	660.6
D. Operation of Office																	
i) L.D. Centre																	
Rent (House)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Research & Experiment	-	-	-	-	-	-	1	10.0	1	10.0	1	10.0	5	30.0	50.0	50.0	130.0
Stationary			1	5.0	1	5.0	1	5.0	1	5.0	1	5.0	5	25.0	27.5	30.25	82.75
Drugs			1	8.0	1	8.0	1	8.0	1	8.0	1	8.0	5	40.0	44.0	48.0	132.0
Horse Ration			1	4.0	1	4.0	1	4.0	1	4.0	1	4.0	5	20.0	22.0	24.2	66.2
Kerosine oil			1	3.0	1	3.0	1	3.0	1	3.0	1	3.0	5	15.0	16.5	18.2	49.7
Sub-Total				20.0		20.0		30.0		30.0		30.0		130.0	160.0	170.0	460.0

R C U P
Upper Kali Gandaki Catchment Area
Mustang District
Total Livestock Development Cost Estimate
Operating Cost
('000 NR)
(continued)

Mustang Operating Cost	Unit Cost		Year - 1 Unit Cost		Year - 2 Unit Cost		Year - 3 Unit Cost		Year - 4 Unit Cost		Year - 5 Unit Cost		TOTAL Unit Cost		2nd 5 Year	3rd 5 Year	Grand Total
ii) L.D. Sub-Centre																	
Buffalo bull maintenance at sub-centre	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Buffalo bull maintenance at Farmer's level	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cattle at Farmer's level	1	2.16	-	-	-	-	13	28.1	13	28.1	13	28.1	29	84.3	-	-	84.3
Ram at Farmer's level	1	1.8	-	-	13	23.4	18	32.4	18	32.4	23	41.4	72	129.6	96.0	-	225.6
(male) goat at sub-centre	1	1.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sub-Total	-	-	-	-		23.4	-	60.5	-	60.5	-	69.5	-	213.9	96.0	-	309.6
Rent (house)	1	2.4	1	2.4	2	4.8	1	2.4	1	2.4	2	4.8	-	16.8	-	-	16.8
Stationary	1	2.0	1	2.0	2	4.0	3	6.0	5	10.0	5	10.0	-	32.0	35.2	38.7	105.9
Drugs	1	6.0	1	6.0	2	12.0	3	18.0	5	30.0	5	30.0	-	96.0	195.6	116.2	317.8
Kerosine oil	1	1.5	1	1.5	2	3.0	3	4.5	5	7.5	5	7.5	-	24.0	26.4	29.0	79.4
Sub-Total				11.9		23.8		30.9		49.9	5	52.3	-	168.8	167.2	183.9	519.9
E. Vaccination & Drenching	-	-	-	-	-	11.67	-	18.6	-	35.9	-	36.2	-	102.37	115.9	120.6	338.87
TOTAL				179.8	-	393.27		708.8		967.4		1019.5		3268.77	3471.3	3722.4	10462.47
Total Capital Cost	-	-	-	205.8	-	1151.3	-	944.4	-	209.0	-	276.7	-	2087.2	192.32	684.5	2963.57
GRAND TOTAL	-	-	-	385.6	-	1544.57	-	953.2	-	1176.4	-	1296.2	-	5355.97	3663.62	4406.45	13416.04
CREDIT																	
a. Purchasing of buffalo cows	1	3.0	-	-	-	-	10	30.0	10	30.0	10	30.0	30	90.0	187.5	200.0	477.5
b. Chaff cutter	1	1.0	-	-	-	-	5	5.0	10	10.0	10	10.0	25	25.0	45.0	50.0	120.0
c. Cream separator	1	5.0	-	-	-	-	-	-	-	-	2	10.0	2	10.0	10.0	10.0	30.0
d. Poultry farm in mini-scale	1	10.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTAL	-	-	-	-	-	-	-	35.0	-	40.0	-	50.0		125.0	242.5	260.0	627.5

Repayment system is not taken into account.

BENEFIT

Benefit is drawn from the following livestock products: (a) milk, (b) meat, (c) eggs, (d) wool, (e) hides/skins, (f) FYM and (g) draft power. Table 2 has been developed from different production parameters than those used in earlier tables (see tables 9, 10(a), 10(b)).*

(a) Milk. Milk is derived from buffalo and cattle. With the project, milk production will be increased by 28.6 percent in the fith year and 140.9 percent in the 15th year. Moreover, milk production accounts for 53.9 percent of the total benefit of the projects livestock component. It should be noted that an increment in milk production due to decrease in movement of animals has not been taken into account.

(b) Meat. Meat production is calculated from buffalo, sheep, goat and poultry. Pig has been excluded as the number of pigs in the project area is negligible. With this project meat production will increase 29.5 percent in the fifth year and 58.8 percent in the fifteenth year. However, only 7.8 percent of the total benefit is covered by meat production.

(c) Eggs. Contribution of eggs from poultry is 2.9 percent to the total benefit. With the project, this production will be increased by 44.9 percent and 124.4 percent in the fifth and fifteenth years, respectively.

(d) Wool. Wool production comprises 0.2 percent of the total benefit. Wool production will be increased by 26.7 and 81.0 percent in the fifth and fifteenth years, respectively.

(e) Hides/skins. Hide/skin production will cover only 0.4 percent of the total livestock benefit. Because of the gradual reduction in livestock mortality, there will be no increment in hide/skin production. The benefit of the fifth year of the project will be the same as the "without project" baseline because of growth rate (2.1 percent) of large animals. There will be reduced production by the fifteenth year.

(f) FYM. The increment of FYM is based on the proportion of increased feed. FYM production will be increased by 11.3 percent in the fifth year and 64.2 in the fifteenth year of the project and the benefit will amount to 23.0 percent of the total project benefit.

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* All benefits are in conservative figures.

(g) Draft Power. The contribution of draft power to the total benefit is 11.8 percent. The increment benefit of draft power is based on the cropped area (see agronomy sector). The benefit will be increased by 5.6 percent and 8.7 percent in the fifth and fifteenth years, respectively.

However, this is only based on population increase; it does not take into account the benefit from draft power as a result of improved breeds and improved feeding.

COST

Cost is classified into three major categories: (a) cost of rearing livestock, (b) cost of green and dry fodder and (c) cost of herding.

(a) Cost of rearing. This includes the cost of concentrate feed, housing, medicine, etc. Table 6 has been developed from Table 7.

(b) Cost of green and dry fodder. It is assumed that 50 percent of the feed will be hand harvested and 50 percent feed is available from grazing. Here green and dry fodder has been calculated as only 50 percent of the feed total, as seen in Table 5.

(c) Cost of herding. As mentioned, 50 percent of the feed is made available from grazing. At the same time, it is assumed that one family laborer can herd 10 livestock units.

Table 3 summarizes Tables 4, 5 and 6. It should also be pointed out that benefit figures have been conservatively estimated.

Table 7 shows the rate of concentrated feed distributed by animal type. For oxen, which are mainly used for draft power, concentrated feed is given at the rate of one kg. per day per animal during the time of ploughing (a total of 90 days a year). Similarly, 0.2 kg and 0.3 kg per day concentrated feed is provided for lactating cows and buffaloes for 300 days (lactation period) a year. This rate of concentrated feed will be increased as the project proceeds -- 0.3 kg for cows and 0.6 kg for buffaloes in the fifth project year; and 0.4 kg for cows and 0.6 kg for buffaloes for the 10th to 15th year is recommended. The cost of feed is Rs..2.00/kg.

The cost of rearing goats, sheep and poultry is low respectively (per animal), i.e, Rs. 20, 16 and 10 for first year -- as these animals will not be provided with substantial amounts of concentrated feed. Sheep and goats will exclusively depend on green and dry fodder. See Table 6.

Cattle and buffalo herd size. In the first project year, the cattle herd size will be 131,505; in the fifth year it will be 142,904 and the total size will be 844,129 head from the 10th to the 15th year. Regarding buffalo, the total herd size will be 52,071 head in the first year, 56,585 head in the fifth year, and 334,240 head from the 10th to the 15th year. It is assumed that the population of cattle and buffalo (large animals) will be increased at the rate of 2.1 percent (national average) every year. The population of different types of animals -- male/female, productive (lactating) and non-productive female and young stock of cattle and buffalo -- is given in Table 9.

For sheep and goats the flock size in the first year will be 15,000 and 130,000, respectively. This population or flock size will remain constant every year as the growth rate for small animals is zero (national average). The growth rate is also zero for poultry. In the first year, the poultry population will be 232,000 and there will be an increment of 5,000 birds each year. This increase will be due to the introduction of improved birds.

Breakdown of livestock and poultry birds into adult and young sexwise. Table 9 indicates that only 3 percent of the buffalo population is male, 55 percent is adult female, 16 percent is young male and another 16 percent is young female. At present, 45 percent of the adult females are lactating (productive). In the case of cattle, 40 percent of the adult females are lactating. For details see Table 9.

PRODUCTION PARAMETER

Buffalo. At present, without the project, the buffalo calving percentage is 45 percent. With the project, the calving percentage will increase to 50 percent in fifth year, 55 percent in the second five years and 60 percent in the third five years. In the same way, milk yields will also increase. At present the milk yield per day per head is 2.2 liters. This will increase to 2.4 liters in the fifth year, 2.75 liters in the second five years and 3.25 liters in the third five years. But, lactation length will remain constant throughout the whole project period. Because of cross breeding and other development activities, the bulk of milk production will be increased at the rate of 9.1 percent, 25.0 percent, 47.7 percent in the fifth year, second and third five year, respectively.

Male buffaloes are used for meat production and manure. 5 percent of the adult males will slaughtered every year (see Table 10a). At present one adult male buffalo produces 80.0 kg of edible meat and the benefit is calculated at the rate of Rs. 10.0/kg of meat.

Cattle. At present, the calving percentage for cows is 40. This will be increased to 43, 45 and 50 percent in the fifth, second and third five years respectively. It is estimated that all calved cows produce milk for 240 days at the rate of 0.8 liter/day/head. This milk yield is relatively low, but the yield will be increased as the project proceeds, largely because of cross-breeding. The milk yield will be 0.84, 0.92 and 1.0 liter/day/head in the first, second and third five years, respectively. The lactation period of 240 days will remain constant throughout the project. In this way, the total volume of milk production will be increased by 5, 15 and 25 percent in the first, second and third five years, respectively. (See Table 10a.)

Sheep. At present the lambing percentage is 60. This increased to 80 and 90 percent in the first, second and third five years, respectively. These conservative estimates and the percentage could be higher with the introduction of good management and breeding practices. Regarding wool production, kage sheep produce are low, only 0.3 kg/head/year, Baruwal sheep are higher, 0.8 kg/head/year. The average wool production is calculated as 0.55/kg/head /year, though the Baruwal sheep population is substantially larger than the kage. It has been also estimated that only adult male sheep will produce 14.0 kg of edible meat at present. This will be increased to 14.5 kg, 15.0 kg and 16.0 kg in the first, second and third five years, respectively (see Table 10b).

Goat. The kidding percentage at present is 80. This will be increased to 110, 130 and 150 in the first, second and third five years, respectively. Edible meat production is at present 15.0 kg/head. This will increase up to 20.0 kg in the third five years. Only adult males are slaughtered for meat; the benefit from meat production is calculated at the rate of Rs. 16.0/kg. See also Table 10b.

Poultry. Adult female birds produce eggs at the low rate of 30/year. But with the help of introduction of improved cockerels and other poultry birds, it is expected that egg production will increase 40, 50 and 60 birds/year in the first, second and third five years, respectively. The edible meat production, which is 0.8 kg per bird at present, is expected to remain constant

throughout the project. The prevailing price for eggs and meat are Rs. 0.75 per egg and Rs. 20.0/kg of meat (see also Table 10b).

RCUP

LIVESTOCK SECTOR

TOTAL BENEFIT AND COST

Table 1 ('000 NR)

Year	Gross Benefit	Farm Cost	Net Benefit
Yr. 1	85,245.0	37,957.0	47,288.0
Yr. 2	88,114.0	40,466.0	47,648.0
Yr. 3	90,706.0	44,661.0	46,045.0
Yr. 4	94,452.0	47,499.0	46,953.0
Yr. 5	99,767.0	56,233.0	43,534.0
1st five year	458,285.0	226,815.0	231,470.0
2nd five year	603,288.0	361,204.0	242,084.0
3rd five year	787,207.0	474,185.0	313,022.0
Total (1-5 yrs)	1,800,032.0	1,062,204.0	737,828.0

Table 1 is in the summarized form of all gross benefit and cost, also net benefit is calculated.

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Table - 2

Total Benefit from Different Types of Livestock Products:

('000 NR)

Product	Year - 0	Year - 1	Year - 2	Year - 3	Year - 4	Year - 5	1st five Year	2nd five Year	3rd five Year	GRAND TOTAL
1. Milk										
a) Buffalo	24,996.0	25,518.0	27,236.0	28,415.0	30,286.0	33,612.0	145,067.0	225,547.0	322,625.0	693,239.0
b) Cattle	11,868.0	12,120.0	12,529.0	12,950.0	13,383.0	13,829.0	64,811.0	90,714.0	121,555.0	277,080.0
Sub-Total	36,864.0	37,638.0	39,765.0	41,365.0	43,669.0	47,441.0	209,878.0	316,261.0	444,180.0	270,319.0
2. Meat										
a) Buffalo	1,117.0	2,082.0	2,126.0	2,225.0	2,328.0	2,433.0	11,194.0	14,460.0	17,380.0	43,034.0
b) Goat	4,056.0	4,056.0	4,326.0	4,326.0	4,462.0	4,597.0	21,767.0	24,336.0	27,040.0	73,143.0
c) Sheep	355.0	355.0	355.0	355.0	363.0	368.0	1,796.0	1,901.0	2,028.0	5,725.0
d) Poultry bird	1,094.0	1,114.0	1,134.0	1,152.0	1,168.0	1,184.0	5,752.0	6,048.0	6,144.0	17,944.0
Sub-Total	6,622.0	7,607.0	7,941.0	8,058.0	8,321.0	8,582.0	40,509.0	46,745.0	52,592.0	139,846.0
3. Eggs	1,950.0	1,984.0	2,220.0	2,394.0	2,643.0	2,827.0	12,068.0	17,963.0	21,888.0	51,919.0
4. Wool	116.0	116.0	122.0	126.0	137.0	147.0	648.0	893.0	1,050.0	2,591.0
5. Hides/Skins (leather)										
a) Buffalo	146.0	156.0	159.0	149.0	152.0	141.0	757.0	603.0	585.0	1,945.0
b) Cattle	367.0	395.0	403.0	384.0	392.0	372.0	1,946.0	1,826.0	1,688.0	5,460.0
Sub-Total	513.0	551.0	562.0	533.0	544.0	513.0	2,703.0	2,429.0	2,273.0	7,405.0
6. FYM[1/]	23,428.0	23,906.0	23,952.0	24,530.0	25,229.0	26,092.0	123,709.0	147,415.0	192,350.0	414,726.0
7. Draft Power[2/]	13,406.0	13,443.0	13,553.0	13,700.0	13,909.0	14,165.0	68,770.0	71,582.0	72,874.0	213,226.0
TOTAL:	82,899.0	85,245.0	88,114.0	90,706.0	94,452.0	99,767.0	458,285.0	603,288.0	787,207.0	1,800,032.0

[1/] Based on Yields increasing proportionate to increased feed.

[2/] Benefit from draft power is based on the cropped area (see agronomy component). It is assumed that requirement of bullock power for land preparation = 35 pairs of bullock power/ha. and it is estimated that there are 40% hired and 60% owned by farmers themselves. Hired bullock power = Rs. 10.0/day/pair of bullock power without operator. Owned bullock power - Rs. 4.55/day/pair of bullock power without operator. (Rs. 4.0 is for cone feed and Rs. 0.55 for green and dry fodder.)

Table - 3

R C U P

Total Cost of Rearing (Production) of Animals in the Project Area:

('000NR)

Particular	Year - 0	Year - 1	Year - 2	Year - 3	Year - 4	Year - 5	1st five Year	2nd five Year	3rd five Year	GRAND TOTAL
Cost of rearing 3/	24,221.0	24,221.0	25,042.0	28,182.0	29,362.0	35,623.0	142,429.0	218,730.0	253,867.0	615,026.0
Cost of green and dry fodder 4/	6,544.0	6,664.0	8,220.0	9,196.0	10,661.0	12,994.0	47,651.0	95,231.0	168,338.0	311,304.0
Cost of herding 5/	6,943.0	7,072.0	7,204.0	7,283.0	7,476.0	7,616.0	36,651.0	47,243.0	51,980.0	135,874.0
TOTAL	37,708.0	37,957.0	40,466.0	44,661.0	47,499.0	56,233.0	226,815.0	361,204.0	474,185.0	1,062,204.0

3/ Cost of concentrate feed given medicine and other management of livestock.

4/ Cost of forage - Rs. 75.0/ m.t. green weight. It is assumed that 50% fodder requirement is fulfilled by hand harvesting.

5/ Opportunity cost = Rs. 4.4/ man day. This cost is both for male and female, though females are being involved in larger proportionation. Beside this it is estimated that 50% feed is available from grazing. So, for herding it is estimated that one man day is required for 10 livestock unit.

Table - 4

R C U P

Total Cost of Rearing (Production) of Animals in the Project Area.

Product	Year - 1	Year - 2	Year - 3	Year - 4	Year - 5	1st five Year	2nd five Year	3rd five Year	GRAND TOTAL
1. Cattle	13,571.0	14,071.0	15,924.0	16,448.0	18,927.0	78,941.0	113,818.0	129,160.0	321,919.0
2. Buffalo	5,490.0	5,771.0	7,017.0	7,634.0	10,016.0	35,928.0	64,062.0	76,407.0	176,397.0
3. Goat	2,600.0	2,600.0	2,600.0	2,600.0	3,900.0	14,300.0	26,000.0	32,500.0	72,800.0
4. Sheep	240.0	240.0	240.0	240.0	300.0	1,260.0	2,250.0	3,000.0	6,510.0
5. Poultry	2,320.0	2,360.0	2,400.0	2,440.0	2,440.0	2,480.0	12,600.0	12,800.0	37,400.0
Total	24,221.0	25,042.0	28,181.0	29,362.0	35,623.0	142,429.0	218,730.0	253,867.0	615,026.0
1. Cattle									
a) Total male adult	7,890.0	8,056.0	8,225.0	8,398.0	9,003.0	41,572.0	47,931.0	53,180.0	142,683.0
b) Total non-productive adult female	1,578.0	1,611.0	1,941.0	1,948.0	2,607.0	9,685.0	13,390.0	13,506.0	36,581.0
c) Total youngstock	1,578.0	1,611.0	2,468.0	2,519.0	3,430.0	11,606.0	18,260.0	20,259.0	50,125.0
d) Total lactating female	2,525.0	2,793.0	3,290.0	3,583.0	3,887.0	16,078.0	34,237.0	42,207.0	92,522.0
Sub-Total	13,571.0	14,071.0	15,924.0	16,448.0	18,927.0	78,941.0	113,818.0	129,160.0	321,911.0
2. Buffalo									
a) Total male adult	250.0	255.0	261.0	383.0	391.0	1,540.0	2,711.0	3,008.0	7,259.0
b) Total non-productive adult female	1,260.0	1,263.0	1,424.0	1,585.0	2,178.0	7,710.0	11,184.0	11,030.0	29,924.0
c) Total youngstock	1,531.0	1,563.0	1,824.0	1,862.0	3,090.0	9,870.0	16,448.0	18,250.0	44,568.0
d) Total lactating female	2,449.0	2,690.0	3,508.0	3,804.0	4,357.0	16,808.0	33,718.0	44,120.0	94,646.0
Sub-Total	5,490.0	5,771.0	7,017.0	7,634.0	10,016.0	35,928.0	64,062.0	76,407.0	176,397.0

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Table - 5

Total requirement of fodder for animals:

	Without	Year - 1	Year - 2	Year - 3	Year - 4	Year - 5	2nd five year	3rd five year
1. Total livestock unit	126,820	129,177	131,584	133,041	136,550	139,112	862,896	949,403
2. Quantity of green fodder needed/L/U/ (GW in mt.)	1.376	1.376	1.666	1.839	2.082	2.491	2.943	4.729
3. Total green wt. in (000 mt.)	174.5	177.7	219.2	244.7	284.3	346.5	2539.5	4489.7
Cost of total green matter @ Rs. 75/m.t. (000 Rs.)	13,087.5	13,327.5	16,440.0	18,392.5	21,322.5	25,322.5	190,462.5	336,675

Table - 6(a)

Cost of Rearing of Animal or Poultry Birds
(Per head per year)

(in Rs.)

Particular	Year-0	Year-1	Year-2	Year-3	Year-4	Year-5	2nd 5 yr.	3rd 5 yr.
Cattle								
Male Adult	200	200	200	200	200	210	210	210
Non-productive female	50	50	50	60	60	80	100	100
Lactating female	120	120	130	150	160	170	250	250
Youngstock	40	40	40	60	60	80	80	80
Buffalo								
Male Adult	160	160	160	160	230	230	300	300
Non-productive female	80	80	80	90	100	140	150	150
Lactating females	190	190	200	250	260	280	370	400
Youngstock	70	70	70	80	80	130	130	130

Table 6(b) Cost of Production (in Rs.)

Particular	Year-0	Year-1	Year-2	Year-3	Year-4	Year-5	2nd 5 year	3rd 5 year
Goat	20	20	20	20	20	30	40	50
Sheep	16	16	16	16	16	20	30	40
Poultry	10	10	10	10	10	10	10	10

Note: This cost of rearing per head per year includes the cost of concentrate feed given to the animal and also the cost of medicine and management.

Table - 7 Quantity of concentrate feed given (per head per year) to animal

(kg.)

	Year-0	Year-1	Year-2	Year-3	Year-4	Year-5	2nd 5 year	3rd 5 year
Cattle								
Male adults(for 90 days)	1.0	1.0	1.0	1.0	1.0	1.5	1.5	1.5
Non-productive female (for 90 days)	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2
Lactating female (300 days)	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4
Youngstock (300 days)	0.05	0.05	0.5	0.07	0.07	0.1	0.1	0.1
Buffalo								
Male adult (365 days)	0.2	0.2	0.2	0.2	0.3	0.3	0.4	0.4
Non-productive female (180 days)	0.1	0.1	0.1	0.15	0.15	0.2	0.3	0.3
Lactating female (300 days)	0.3	0.3	0.3	0.4	0.4	0.4	0.6	0.6
Youngstock (300 days)	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2

Concentrate feed - @ Rs. 2.0 kg.

Table 1

Cattle and Buffalo Herd and Sheep, Goat and Poultry Flock Development Composition

(In heads)

	Year-1	Year-2	Year-3	Year-4	Year-5	2nd 5 year	3rd 5 year
Cattle							
Total Herd size	131,505	134,267	137,086	139,965	142,904	760,814	844,129
Total Male Adults	39,452	40,280	41,216	41,990	42,871	228,244	253,239
Total Female Adults	52,602	53,707	54,834	55,986	57,162	304,326	337,652
Total Non-productive Female	31,561	32,222	32,352	32,472	32,582	167,379	168,826
Total Lactating Females	21,041	21,483	21,934	22,394	22,865	136,947	168,826
Total youngstock	39,452	40,280	41,126	41,990	42,871	228,244	253,239
Buffalo							
Total Herd size	52,071	53,164	54,281	55,421	56,585	301,255	334,240
Total Adults	1,562	1,595	1,628	1,663	1,698	9,038	10,027
Total Female Adults	28,639	29,240	29,855	30,482	31,122	165,690	183,832
Total Non-productive Female	15,751	15,790	15,823	15,851	15,561	74,560	73,533
Total Lactating Females	12,888	13,450	14,032	14,631	15,561	91,130	110,299
Total Youngstock	21,870	22,329	22,798	23,277	27,766	126,527	140,381
Goat							
Total flock size	130,000	130,000	130,000	130,000	130,000	650,000	650,000
Sheep							
Total flock size	15,000	15,000	15,000	15,000	15,000	75,000	75,000
Poultry							
Total population	232,000	236,000	240,000	244,000	248,000	1260,000	1280,000
Total number layers	88,160	89,690	91,000	92,720	94,240	478,800	486,400

Table - 9

R C U P

Breakdown of Livestock and Poultry Bird into Adult and Young Sexwise

(percentage)

Animal	ADULT		YOUNG		Total	Lactating animal out of total adult female
	Male	Female	Male	Female		
Buffalo	3	55	16	26	100	45
Cattle	30	40	15	15	100	40
Sheep	15	55	16	14	100	--
Goat	15	50	18	17	100	0
Yak/Nak	4	66	8	22	100	40
Chauri	70	13	9	8	100	40
Pig	8	72	10	10	100	0
Poultry	14	38	23	25	200	0

Table - 10

IMPACT OF PROJECT IN LIVESTOCK DEVELOPMENT

	Year-0	Year-1	Year-2	Year-3	Year-4	Year-5	2nd 5 year	3rd 5 year
i. Buffalo								
*Herd size ('000 heads)	51							
Mortality rate (%)	12	12	12	11	11	10	8	7
Off-take rate (%)	7	7	7	8	9	10	12	15
Production Parameter								
Calving percentage3/	45	45	46	47	48	50	55	60
Milk Female percentage	100	100	100	100	100	100	100	100
Milk yield-litre/day	2.2	2.2	2.25	2.25	2.3	2.4	2.75 1/	3.25 3/
Lactation length-days	300	300	300	300	300	300	300	300
Increment of milk volume taking the base of 0 yr(%)					--	9.1	25.0	47.7
ii. Cattle								
*Herd size (000 heads)	128							
Mortality rate (%)	15	15	15	14	14	13	12	10
Off-take rate (%)	1	1	1	1.5	1.5	2	3	4
Production parameter								
Calving percentage	40	40	40	41	42	43	45	50
Milk Female percentage	100	100	100	100	100	100	100	100
Milk yield-litre/day	0.8	0.8	0.81	0.82	0.83	0.84	0.92	1.0
Lactation length - days	240	240	240	240	240	240	240	240
Increment of milk volume taking base of 0 yr.(%)					--	5	15	25
Buffalo meat production kg/head on an average	80	80	80	82	84	86	96	104

1/ (2.4 - 3.0)
2/ (3.0 - 3.5)
3/ Out of total adult female only

*annual growth rate for large animal - 2.1% (national average)

Note: Buffalo: At present there are 16% youngstock male and 3% adult male. It is assumed that 5% out of 16% young male get matured every year. In this manner there will be a total 8% adult male out of the total herd size, leaving 3% male for breeding purpose. A total 5% will go for slaughtering every year.

Sheep

Table - 10(b)

	YEAR							
	0	1	2	3	4	5	2nd 5 year	3rd 5 year
Flock size (000' heads)	30	30	28	27	26	25	20	18
Mortality rate (%)								
Production parameter								
Lambing percentage	60	60	62	65	68	70	80	90
Wool production - kg/head1/	0.55	0.55	0.58	0.6	0.65	0.7	0.85	1.0
Meat production(edible) kg/head i.e. adult male	14	14	14	14	14.3	14.5	15	16
Goat								
Flock size (000' heads)								
Mortality rate (%)	30	30	28	27	26	25	20	18
Production parameter								
Kidding percentage	80	80	85	90	95	110	130	150
Meat (edible) production kg/head i.e. adult male	15	15	16	16	16.5	17	18	20

Note: Total of 13% out of 15% adult male will go for slaughtering (meat purpose) and the rest (2%) will be kept for breeding purpose every year, assuming growth rate is zero, the national average in case of sheep/goat.

1/ Kage sheep - 0.3 kg/head
Barumal sheep 0.80 kg/head 0.55 kg. on an average
Caracas wt. 65 - 70% of total live wt.

Table - 11 PREVAILING PRICE LISE OF LIVESTOCK PRODUCTS

			Rs.
1.	Milk	Litre	3.0
2. Meat	Goat	Kg	16.0
	Sheep	Kg	13.0
	Buff	Kg	10.0
	Chicken	Kg	20.0
3. Hide	Buffalo	Piece	25.0
	Cattle	Kg	20.0
4.	Wool	Kg.	20.0
5.	Egg	one	0.75

--0--

Poultry

	YEAR							
	Year-0	Year 1	Year-2	Year-3	Year-4	Year-5	2nd 5 yr.	3rd 5 yr.
Production parameter								
Egg production-number per bird per year.	30	30	33	35	38	40	50	60
Meat production-kg/bird (edible)	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8

Note: Total of 30% out of 100% of the adult males and females will go for slaughtering (meat purpose).

R C U P

Total Livestock and Poultry Birds of Different Panchayats of Kulekhani Catchment Area
(Makawanpur District)
(in heads)

Panchayat / Animal	Chitlang	Kulekhani	Phakel	Sisneri	Daman	Palung	Thachok	Total (Kulekhani Catchment Area
Buffalo	748	287	212	166	1793	1180	1018	5,404
Cattle	3670	1984	3666	1716	1365	2059	2963	17,423
Cow/Calf	2414	1566	3243	1338	1182	1208	2597	13,548
Ox	1256	418	423	378	183	851	366	3,875
Sheep	11	-	-	-	5	-	23	39
Goat	3766	2571	4794	4007	3475	1748	1453	22,814
Pig	-	-	-	-	-	-	-	-
Poultry	3982	8904	2587	5723	1315	3633	995	27,139

RCUP

Total Number of Livestock Population and Poultry Birds
of Different Panchayats of Daraundi Catchment Area
(Gorkha District)
(In heads)

	Buffalo	Cattle	Cow/calf	Oxen	Sheep	Goat	Horse/mule	Pig	Poultry
1. Manakamana	738	2,320	1,389	931	39	2,036	-	72	3,802
2. Bhogteni	841	2,320	1,389	931	45	2,320	-	44	4,333
3. Deurali	1,042	2,513	1,532	981	-	2,672	-	73	3,843
4. Dhunwakot	790	1,778	1,036	742	-	1,118	-	33	1,474
5. Mirkot	815	2,249	1,346	903	52	2,249	-	51	4,200
6. Taranagar	694	2,034	1,314	720	25	1,759	-	39	3,612
7. Raniswanra	934	2,577	1,542	1,035	60	2,577	-	25	4,812
8. Bhungkot	1,304	3,600	2,155	1,445	76	3,600	-	73	6,722
9. Corakhkali	1,397	3,856	2,308	1,548	73	3,856	-	55	7,200
10. Taple	1,182	2,660	1,550	1,110	50	1,672	-	17	2,206
11. Nareswar	1,174	2,642	1,540	1,102	505	1,661	-	38	2,190
12. Khoplang	981	2,706	1,620	1,086	105	2,706	-	24	5,054
13. Chhopark	907	3,463	2,395	1,068	204	3,078	-	227	3,935
14. Khanchok	1,357	3,745	2,242	1,503	75	3,745	-	19	6,993
15. Pandrung	1,062	2,932	1,756	1,176	200	2,932	-	21	5,475
Sub-total	15,218	41,395	25,114	16,281	1,054	37,981	-	811	65,853

		Buffalo	Cattle	Cow/calf	Oxen	Sheep	Goat	Horse/mule	Pig	Poultry
16.	Shrinathkot	646	1,782	1,068	714	60	1,782	-	11	3,329
17.	Taku	1,326	3,658	2,190	1,468	80	3,658	-	42	6,831
18.	Jaubari	1,128	2,538	1,478	1,060	70	1,596	-	36	2,105
19.	Muchok	1,072	2,413	1,406	1,007	65	1,517	-	21	2,000
20.	Swarra	780	2,153	1,289	864	73	2,153	-	13	4,020
21.	Saurpani	1,240	3,423	2,050	1,373	75	3,423	-	18	6,393
22.	Simjung	506	3,944	2,415	1,529	380	2,220	-	17	2,883
23.	Barpak	408	1,780	1,005	775	4,340	1,860	-	19	2,922
24.	Taklung	1,046	3,064	1,980	1,084	50	2,650	-	51	4,080
25.	Harmi	1,034	2,496	1,385	1,111	105	3,480	-	17	7,164
26.	Ghairung	905	2,652	1,713	939	48	2,292	-	25	4,080
27.	Amppipal	930	2,723	1,759	964	55	2,354	-	34	4,190
28.	Palungtar	1,984	4,698	2,865	1,833	60	4,996	-	26	7,185
29.	Gaikhur	1,317	3,177	1,937	1,240	45	3,380	-	27	4,860
	Sub-total	14,286	40,501	24,540	15,961	5,506	37,361	-	357	62,042
	Grand Total	29,504	81,896	49,654	32,242	6,560	75,342	-	1,168	127,895

RCUP

Total Number of Livestock Population and Poultry Birds
of Different Panchayats in Upper Kali-Gandaki
Catchment Area (Myagdi District)
(In heads)

		Buffalo	Cattle	Cow/calf	Oxen	Sheep	Goat	Horse/mule	Pig	Poultry
1.	Ghatan	1,206	1,801	1,347	545	730	1,244	5	-	4,457
2.	Jheen	1,264	1,775	1,270	505	177	1,156	10	8	6,714
3.	Pakhopani	1,043	1,465	1,047	418	703	1,021	8	10	3,658
4.	Kuine Nangale	807	1,205	901	304	470	832	3	-	2,982
5.	Darmeega	1,341	2,133	1,665	468	1,443	1,550	4	-	2,538
6.	Pipale	1,612	1,803	1,408	395	208	1,002	8	12	7,600
7.	Bhagawati	1,412	1,983	1,418	456	198	1,292	12	-	7,500
8.	Begkhola	848	1,588	1,231	357	141	502	3	8	2,678
9.	Doba	854	1,275	953	322	497	880	3	-	3,155
10.	Dana	1,140	2,135	1,655	470	190	675	68	-	5,115
11.	Baralia	1,101	1,645	1,230	415	642	1,146	6	-	4,070
12.	Siekh	1,010	1,623	902	721	270	1,082	54	12	4,690
13.	Histan Mandali	1,092	1,631	1,220	411	637	1,127	4	0	4,037
14.	Ramche	1,411	2,107	1,576	531	822	1,455	6	-	5,215
	Total	16.141	24,169	17,833	6,336	7,128	14,954	194	50	64,409
	Average	2.15	3.22	2.38	0.85	0.95	2.00	0.025	0.007	8.60/20.2

RCUP

Total Number of Livestock and Poultry Birds
Of Different Panchayats in Upper Kali Gandaki
Catchment Area (Mustang District

		Buffalo	Cattle	Cow/calf	Oxen	Sheep	Goat	Yak	Jhopa	Horse/mule	Poultry
1.	Kunjo	-	977	857	120	300	250	44	20	52	1,430
2.	Lete	20	890	730	160	650	510	140	30	59	2,552
3.	Kobang	-	208	148	60	-	309	750	32	40	896
4.	Tukuche	-	218	148	70	-	310	85	40	45	645
5.	Marpha	-	319	249	70	-	1,438	260	61	350	937
6.	Jomsom	-	672	662	10	-	2,652	50	231	416	962
7.	Kagbeni	-	121	121	-	-	2,407	193	180	141	236
8.	Chusang	-	292	280	12	53	2,580	-	178	215	206
9.	Jharkot	-	187	185	2	-	434	30	105	103	98
10.	Muktinath	-	202	202	-	-	857	40	128	155	148
11.	Ghami	-	360	288	72	70	1,680	35	172	133	50
12.	Cherang	-	547	547	-	63	2,417	113	121	114	21
13.	Surkhang	-	50	50	-	155	320	75	36	140	114
14.	Chhoser	-	73	73	-	165	370	85	24	130	144
15.	Chhonhup	-	102	102	-	160	400	60	37	150	159
16.	Lomthang	-	87	87	-	140	310	52	130	90	151
	Total	20	5,305	4,729	576	1,756	17,244	2,012	1,425	2,333	8,749

Appendix 2
Table 1
Page 6

1. Milk Production
   a. Buffalo

	Total # of milking buffalo cows	Milk Yield liter/day/ buffalo cow	Length of lactation (days)	Total milk production per year ('000 liter)
Makawanpur	1336	2.2	300	882.0
Gorkha	7301	2.2	300	4819.0
Myagdi	3984	2.2	300	2629.0
Mustang	4	2.2	300	3.0
Total	12625	2.2	300	8332.0

   b. Cattle

	Total # of milking cattle cows	Milk yield liter/day/ cattle cow	Length of lactation (days)	Total milk production per year ('000 liter)
Makawanpur	2784	0.8	240	534.0
Gorkha	13104	0.8	240	2516.0
Myagdi	3872	0.8	240	743.0
Mustang	848	0.8	240	163.0
Total	20608	0.8	240	3956.0

   c. Nak/Chauri

	Total # of milking nak/chauri	Milk yield liter/day/ animal	Length of lactation (days)	Total milk production per year ('000 liter)
Makawanpur	-	1.0	90	0
Gorkha	-	1.0	90	-
Myagdi	600	1.0	90	54.0
Mustang	600	1.0	90	54.0
Total	600	1.0	90	54.0

Appendix 2
Table 2
Page 7

Milk 10% H.C. + 90% of ghee production

2. Ghee production
a. Buffalo

	Total quantity of milk for ghee making (000 liters)	Ghee yield gm/liter milk	Total ghee production (tons)
Makawanpur	793.8	70	55.56
Gorkha	4337.1	70	303.60
Myagdi	2366.1	70	165.62
Mustang	2.7	70	.20
Total	7499.7	70	524.98

b. Cattle

	Total quantity of milk for ghee making (000 liters)	Ghee yield gm/liter milk	Total ghee production (tons)
Makawanpur	480.6	40	19.22
Gorkha	2264.4	40	90.58
Myagdi	668.7	40	26.75
Mustang	146.7	40	5.87
Total	3560.4		142.42

c. Nak/Chauri

	Total quantity of milk for ghee making (000 liter)	Ghee yield gm/liter milk	Total ghee production (tons)
Makawanpur	-	70	-
Gorkha	-	70	-
Myagdi	-	70	-
Mustang	4816	70	3.40
Total	48.6	70	3.40

Appendix 2
Table 3
Page 8

3. Meat Production
a. Buffalo

	Total # of adult male buffalo (heads)	Wt. of edible meat per head (kg)	Total meat production (tons)
Makawanpur	270	80.0	21.6
Gorkha	1475	80.0	118.0
Myagdi	805	80.0	64.4
Mustang	-	-	-
Total	2550	80.0	204.0

b. Goat

	Total # of adult male goat (heads)	Wt. of edible meat per head (kg)	Total meat production (tons)
Makawanpur	2964	15	44.0
Gorkha	9789	15	147.0
Myagdi	1950	15	29.0
Mustang	2236	15	34.0
Total	16939	15	254.0

Meat - (a) Goat -- 16 kg/head
(b) Sheep -- 13 kg/head

Appendix 2
Table 4
Page 9

d. Poultry

	Total # of adult male bird (heads)	Wt. of edible meat per head (kg)	Total meat production (tons)
Makawanpur	8130	0.8	6.5
Gorkha	38370	0.8	30.7
Myagdi	19320	0.8	15.4
Mustang	2610	0.8	2.1
Total	68430	0.8	54.7

c. Sheep

	Total # of sheep (heads)	Wt. of edible meat per head (kg)	Total meat production (tons)
Makawanpur	5	14	0.1
Gorkha	858	14	12.0
Myagdi	923	14	12.9
Mustang	234	14	3.2
Total	2020	14	28.2

Appendix 2
Table 5
Page 10

4. Egg Production

	Total # of adult female bird (heads)	No. of eff. production per head/year (No.)	Total egg production (000)
Makawanpur	10298	30	308.9
Gorkha	48602	30	1458.1
Myagdi	24472	30	734.1
Mustang	3306	30	99.2
Total	86678	30	2600.3

5. Wool Production

	Total # of adult sheep (heads)	Wt. of wool head/year (kg)	Total wool production
Makawanpur	-	0.55	-
Gorkha	4620	0.55	2.5
Myagdi	4970	0.55	2.7
Mustang	1260	0.55	0.6
Total	10500	0.55	5.8

Appendix 2
Table 6
Page 11

6. Hides and skins
a. Buffalo

Mortality rate 12%

District	Total # of dead buffalo animal (heads)	Total # of hide pieces (No.)	5% loss of hide pieces[1] (No.)	Total # of hide pieces (No.)
Makawanpur	648	648	32	616
Gorkha	3540	3540	177	3363
Myagdi	1932	1932	96	1836
Mustang	-	-	-	-
Total	6120	6120	306	5815

b. Cattle

Mortality rate 15%

	Total # of dead cattle (animal)	Total # of hide pieces (No.)	5% loss of hide pieces[1] (No.)	Total # of hide pieces (No.)
Makawanpur	2610	2610	130	2480
Gorkha	12285	12285	614	11671
Myagdi	3630	3630	182	3448
Mustang	795	795	40	755
Total	19320	19320	966	18354

[1]Sometimes death occurs in such a place where about nobody knows and nobody can collect it.

7. Farm Yard Manure (FYM)
   a. Buffalo
      i. Adult

	Total # of adult buffalo animal (heads)	FYM -- Tons/ year/head	Total Wt. of FYM/year (tons)
Makawanpur	3132	6.0	18792
Gorkha	17110	6.0	102660
Myagdi	9338	6.0	56028
Mustang	12	6.0	72
Total	29592	6.0	177552

      ii. Youngstock

	Total # of adult buffalo animal (heads)	FYM -- Tons/ year/head	Total Wt. of FYM/year (tons)
Makawanpur	2268	2.0	4536
Gorkha	12390	2.0	24780
Myagdi	6762	2.0	13574
Mustang	8	2.0	16
Total	21428	2.0	42906

b. Cattle

i. Adult

	Total # of adult cattle (head)	FYM -- tons/ head/year	Total FYM production (tons)
Makawanpur	12180	3.0	36540
Gorkha	57330	3.0	171990
Myagdi	16940	3.0	50820
Mustang	3710	3.0	11130
Total	90160	3.0	270480

ii. Youngstock

	Total # of Youngstock cattle (head)	FYM -- tons/ head/year	Total FYM production (tons)
Makawanpur	5220	2.0	10440
Gorkha	24570	2.0	49140
Myagdi	7260	2.0	14520
Mustang	1590	2.0	3180
Total	38640	2.0	77280

c. Sheep and Goat

	Total # of adult sheep & goat (heads)	FYM -- tons/ head/year	Total FYM production (tons)
Makawanpur	14846	0.15	2227
Gorkha	66740	0.15	10017
Myagdi	14720	0.15	2208
Mustand	12440	0.15	1866
Total	108746	0.15	16318

d. Poultry

	Total # of adult poultry (bird)	FYM -- tons/ head/year	Total FYM production (tons)
Makawanpur	14092	.01	141
Gorkha	66508	.01	665
Myagdi	33488	.01	335
Mustang	4524	.01	45
Total	11812	.01	1186

Total Farm Yard Manure (FYM) Production

	Tons
Makawanpur	72,676
Gorkha	359,252
Myagdi	137,485
Mustang	16,309
Total	585,722

R C U P

KULEKHANI CATCHMENT AREA

(Makawanpur District)

A. Livestock Development Centre, Chitlang[1/]

B. Livestock Development Sub-centres:

Implementation (Project year)					Location (Panchayat)	Commanding area (Panchayat)
Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5		
*					1. Kulekhani	(a) Kulekhani (b) Chitland (c) Sisneri
		*			2. Phakel	(a) Phakel
	*				3. Daman	(a) Daman (b) Palung (c) Thahohok

1/ Chitlang Sheep and Goat Farm, Chitlang will be converted into Livestock Development Centre and will be implemented in the first project year.

R C U P

DARAUNDI CATCHMENT AREA
(Gorkha District)

A. Livestock Development Centre: Pokharithok Gorkha[1/]

B. Livestock Development Sub-centre

Implementation (Project year)					Location (Panchayat)	Commanding Area (Panchayat)
Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5		
	*				1. Barpak	(a) Barpak
				*	2. Taku	(a) Taku (b) Saurpani (c) Swanra (d) Pandrung (e) Khanchok
		*			3. Jaubari	(a) Jaubari (b) Muchok (c) Shrinathkot (d) Simjung
*					4. Choprak	(a) Choprak (b) Khoplang
	*				5. Palungtar	(a) Palungtar (b) Gaikhur (c) Mirkot (d) Amppipal (e) Harmi

cont'd...2

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Implementation (Project year)					Location (Panchayat)	Commanding Area (Panchayat)
Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5		
		*			6. Deurali	(a) Deurali
						(b) Dhunwakot
						(c) Taranagar
			*		7. Raniswanra	(a) Raniswanra
						(b) Gorakhakali
						(c) Bungkot
						(d) Taple
						(e) Nareswanra
			*		8. Manakamana	(a) Manakamana
						(b) Ghairung
						(c) Bhogteni
						(d) Taklung

1/ Co-ordinated sheep and goat development programme, Pokharithok Gorkha will be converted intoaLivestock Development Centre and will be implemented in the first project year.

R C U P

UPPER KALI-GANDAKI CATCHMENT AREA
(Myagdi District)

A. Livestock Development Centre: District Agriculture Development Office.

B. Livestock Development Sub-centre

Implementation (Project year)					Location (Panchayat)	Commanding Area (Panchayat)
Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5		
	*				1. Darmija	(a) Darmija
						(b) Kuime mangale
		*			2. Dana	(a) Dana
						(b) Duba
			*		3. Rakhu Bhagawati	(a) Rakhu Bhagawati
						(b) Pipale
						(c) Begkhola
				*	4. Sikh	(a) Sikh
						(b) Barah
						(c) Histan Mandali
						(d) Ramche
*					5. Jhee	(a) Jhee
						(b) Pakhapani
						(c) Ghatan

1/ District Agriculture Development Office will be recognized as a Livestock Development Centre from the very first project year. It will be separate from the second five years.

R C U P

UPPER KALI GANDAKI CATCHMENT AREA
(Mustang District)

A. Livestock Development Centre - Sheep and Goat Development Centre[1/]

B. Livestock Development Sub-centres

Implementation (Project year)					Location (Panchayat)	Commanding Area (Panchayat)
Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5		
		*			1. Lamthang	(a) Chhonhup
						(b) Choser
						(c) Lomthan
			*		2. Chusang	(a) Chusang
						(b) Surkhang
*					3. Jomsom	(a) Jomsom
						(b) Marpha
						(c) Kagbeni
						(d) Muktinath
						(e) Jharkot
	*				4. Lete	(a) Lete
						(b) Kobang
						(c) Kunjo
						(d) Tukuche
				*	5. Cherang	(a) Cherang
						(b) Ghami

1/ Sheep and Goat Development Centre will be converted into a Livestock Development Centre in the first year of project implementation.

Table 1

R C U P

Recommended Staffing Pattern of Livestock Development Centres

	Particular	Rank	1st five year Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5	2nd 5 year	3rd 5 year	Total requirement of manpower
A.	Livestock Development Centre Chitlang (Makwanpur)									
1.	Livestock Officer	G II	--	1	--	--	--	--	--	1
2.	Asst. Livestock Extn. Officer	G III	1	--	--	--	--	--	--	1
3.	Asst. Pasture Dev. Officer	G III	1	--	--	--	--	--	--	1
4.	Junior Technician	NG I/T	2	--	--	--	--	--	--	2
5.	Junior Technical Asst.	NG II/T	1	--	--	--	--	--	--	1
6.	Asst. Accountant	NG I/A	--	1	--	--	--	--	--	1
7.	Asst. Clerk cum typist	NG II/A	1	--	--	--	--	--	--	1
8.	Storekeeper	NG II/A	--	1	--	--	--	--	--	1
9	Peon		10	--	--	--	--	--	--	10
10.	Driver		1	--	--	--	--	--	--	1

cont'd

R C U P

Recommended Staffing Pattern of Livestock Development Centres

	Particular	Rank	1st five year					2nd 5 year	3rd 5 year	Total requirement of manpower
			Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5			
B.	Livestock Dev. Centre Gorakhkali (Gorkha)									
1.	Livestock Officer	G II	--	--	--	--	--	1	--	1
2.	Asst. Livestock Dev. Officer	G III	1	--	--	--	--	--	--	1
3.	Asst. Pasture Dev. Officer	G III	--	1	--	--	--	--	--	1
4.	JT	NG I/T	1	1	--	--	--	--	--	2
5.	Asst. Accountant cum Storekeeper	NG I/A	--	--	--	--	--	1	--	1
6.	Asst. Clerk cum typist	NG II/A	1	--	--	--	--	--	--	1
7.	Peon		2	--	--	--	--	--	--	2
8.	Driver		1	--	--	--	--	--	--	1

	Particular	Ranks	1st five year					2nd 5 year	3rd 5 year	Total requirement of manpower
			Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5			
C.	Livestock Dev. Centre Beni, Myagdi									
1.	Livestock Officer	G II/T	--	--	--	--	--	1	--	1
2.	Asst. Livestock Officer	G III/T	1	--	--	--	--	--	--	1
3.	Asst. Pasture Officer	G III/T	--	1	--	--	--	--	--	1
4.	JT	NG I/T	1	1	--	--	--	--	--	2
5.	Asst. Accountant cum storekeeper	NG I/A	--	--	--	--	--	1	--	1
6.	Asst. Clerk cum typist	NG II/A	1	--	--	--	--	--	--	1
7.	Peon		2	--	--	--	--	--	--	2
8.	Syce (Horse watchman)		1	--	--	--	--	--	--	1
9.	Livestock Dev. Centre Marpha, Mustang									
1.	Livestock Dev. Officer	G II	--	--	1	--	--	--	--	1
2.	Asst. Livestock Dev. Officer	G III	1	--	--	--	--	--	--	1
3.	Asst. Pasture Dev. Officer	G III	--	1	--	--	--	--	--	1
4.	JT	NG I/T	1	1	--	--	--	--	--	2
5.	Asst. Accountant cum storekeeper	NG I/A	--	--	1	--	--	--	--	1
6.	Asst. Clerk cum typist	NG I/A	1	--	--	--	--	--	--	1
7.	Peon		2	--	--	--	--	--	--	2
8.	Syce (Horse watchman)		1	--	--	--	--	--	--	1

Appendix 5
Table 2

Recommended Staffing Pattern

Total required number of manpower for each Livestock Development Sub-centre.

	Particular	Ranks	Required Number
1.	Junior Technician	NG I/T	1
2.	JTA	NG II/T	1
3.	Stockmen	NG III/T	1
4.	Peon		1

Table - 5

Conservative figure of Farm Yard Manure Production (FYM)

	Fresh dung daily average prod. (kg)	Annual production fresh dung tons	Loss of fresh dung in grazing field 3/	Actual amt. of available dung annually 3/ (tons)	Ratio of dung with litter & grass,etc 3/	Total FYM production annual conservative figure (tons) 3/
1. Adult cattle	9.0 1/	3.3	40%	2.00	1:2	3.00
2. Adult buffalo	11.0 1/	4.0	20%	3.20	1:2	6.00
3. Young stock	4.5 1/	1.65	20%	1.32	1:2	2.00
4. Pig	3.0 2/	1.10	--	--	--	--
5. Horse	10.0 2/	3.65	--	--	--	--
6. Sheep/Goat	2.5 2/	0.90	--	--	--	--
7. Poultry	0.1 2/	0.04	--	--	--	--

Source:

1/ Nepal The Energy Sector.

Energy Research & Development Group
Institute of Science, T.U.
Kathmandu, Nepal.

2/ Dr. A. B. Karki, Soil Expert (Personal Communication).

3/ Detailed Feasibility Survey Finding Team, APROSC - 1979.

Table 3

R C U P

Total required number of manpower for Livestock and Paster Development

	Particular	Ranks	1st five year					2nd 5 year	3rd 5 year	Total
			Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5			
1.	Livestock Dev. Officer	G II/T	--	1	1	--	--	2	--	4
2.	Asst. Livestock Dev. Officer	G III/T	4	--	--	--	--	--	--	4
3.	Asst. Pasture Dev. Officer	G III/T	1	3	--	--	--	--	--	4
4.	Junior Technician	NG I/T	11	8	5	5	2	--	--	31
5.	Junior Technical Assistant	NG II/T	5	12	15	17	18	--	--	67
6.	Accountant/Store Keeper	NG I/A	2	--	--	--	--	2	--	4
7.	Asst. Clerk/Typist	NG II/A	4	--	--	--	--	--	--	4
8.	Stockmen/Field Assistant		6	5	5	5	2	--	--	23
9.	Peon		23	5	5	5	2	--	--	40
10.	Driver		2	--	--	--	--	--	--	2
11.	VAA		67	112	133	156	126	--	--	594
12.	Syce (Horse watchman)		2	--	--	--	--	--	--	2

Table 4

R C U P

Total number of manpower in different offices at present in the project area

	Particular	Rank	Makawanpur	Gorkha	Myagdi	Mustang	Total
1.	Asst. Livestock Dev. Officer	G III/T	1	1	--	1	3
2.	Junior Technician	NG I/T	1	1	--	2	4
3.	Junior Technical Assistant	NG II/T	1	--	--	1	2
4.	Stockman/Field Assistant	NG III/T	1	--	--	1	2
5.	Field man	NG IV/T	--	3	--	5	8
6.	Asst. Clerk (Kharidar) cum typist	NG II/A	1	--	--	--	1
7.	Mukhia	NG III/A	1	--	--	--	1
8.	Peon	--	7	--	--	1	8

R C U P

Incremental staff in Livestock and Pasture Development

	Particular	Rank	Yr. 1	Yr. 2	Yr. 3	Yr. 4	Yr. 5	2nd 5 year	Total
1.	Livestock Dev. Officer	G II/T	--	1	1	--	--	2	4
2.	Asst. Livestock Officer	G III/T	1	--	--	--	--	--	1
3.	Asst. Pasture Dev. Officer	G III/T	1	3	--	--	--	--	4
4.	Junior Technician	NG I/T	7	8	5	5	2	--	27
5.	Junior Technical Assistant	NG II/T	3	12	15	17	18	--	65
6.	Asst. Accountant/Store-keeper	NG I/A	2	--	--	--	--	2	4
7.	Asst. Typist cum clerk	NG II/A	3	--	--	--	--	--	3
8.	Stockmen/Field Assistant	NG III/T	4	5	5	5	2	--	21
9.	Peon		15	5	5	5	2	--	32
10.	VAA		67	112	133	156	126	--	594
11.	Driver		2	--	--	--	--	--	2
12.	Styce	2	--	--	--	--	--	--	2

The existing staff of project area are adjusted in the first year.

Appendix 6
Table 1

5. Training

(a) Preparation cost of incremental JTA in project area for the first five years.

Rs.

	Year - 1		Year - 2		Year - 3		Year - 4		TOTAL	
	No.	Cost	No.	Cost	No.	Cost	No.	Cost	No.	Cost
Gorkha	4	3,000	3	2,250	--	--	12	9,000	19	14,250
Kulekhani	3	2,250	4	3,000	9	6,750	--	--	16	12,000
Myagdi	4	3,000	2	1,500	2	1,500	6	4,500	14	10,500
Mustang	4	3,000	6	4,500	6	4,500	--	--	16	12,000
Total	15	11,250	15	11,250	17	12,750	18	13,500	65	48,750

Cost of preparation = Rs. 750 per JTA

JTA preparation time = 3 months.

Appendix 6
Table 2

(b) Preparation cost of VAA in the project area for the first five years.

	Year - 1		Year - 2		Year - 3		Year - 4		TOTAL	
	No.	Cost	No.	Cost	No.	Cost	No.	Cost	No.	Cost
Gorkha	46	6,900	57	8,550	90	13,500	68	10,200	261	39,510
Kulekhani	37	5,550	21	3,150	5	450	--	--	63	9,450
Myagdi	38	5,700	17	2,550	22	3,300	49	7,350	126	18,900
Mustang	58	8,700	38	5,700	39	5,850	9	1,350	144	21,600
Total	178	26,850	133	19,950	156	23,400	126	18,900	594	89,100

Cost of preparation = Rs. 150 per VAA

VAA preparation period = 1 month.

Table 3

(c) Inservice Training:

(i) Total cost involved in training for lower level staff:

	Year 1		Year 2		Year 3		Year 4		Year 5		1st 5 year		2nd 5 year	3rd 5 year	Total
	A	B	A	B	A	B	A	B	A	B	A	B			
No. of trainees	1	17	1	37	2	65	2	92	3	114	9	325	570	570	1465
Cost ('000 NR)	14.5		19.7		37.2		44.4		60.2		176.0		301.0	301.0	778

A = No. of group of trainees

B = No. of trainees

(a) Types of trainees = JT, JTA, Stockmen

(b) Location of training = (i) Pokhara Livestock Farm

(ii) GADP Khairenitar

(c) Training period = 15 days once a year

(d) Training cost

(i) Daily allowance for trainees = Rs. 15/man day

(ii) Training materials = Rs. 40/trianee

(iii) Trainers allowance = Rs. 10,000/group/year.

(ii) Refresher course training:

No. of personnel to be trained in the project area.

	Year - 1	Year - 2	Year - 3	Year - 4	Year - 5	1st 5 year	2nd 5 year	3rd 5 year	Total
JT	9	17	22	27	29	104	105	145	394
JTA	5	12	32	49	67	165	335	335	835
Stockmen	3	8	11	16	18	56	90	90	236
TOTAL	17	37	65	92	114	325	570	570	1465

(a) Type of trainees = JT, JTA, Stockmen

(b) Location of trianing = Livestock Development Centres

(c) Period of training = 7 days once in a year.

(iii) Farmer's Day

(number)

	Year - 1	Year - 2	Year - 3	Year - 4	Year - 5	1st 5 year	2nd 5 year	3rd 5 year	Total
Makawanpur	1	2	3	3	3	12	15	15	42
Gorkha	1	3	5	7	8	24	40	40	104
Myagdi	1	2	3	4	5	15	25	25	65
Mustang	1	2	3	5	5	16	25	25	66

(a) It welcomes all farmers

(b) Location = village which is most convenient for all farmers

(c) Farmer's day will be organized by each sub-centre

(d) Period = 1 day once in a year.

(iv) Total cost involved in training*

(in '000 NR)

	Year - 1	Year - 2	Year - 3	Year - 4	Year - 5	1st 5 year	2nd 5 year	3rd 5 year	Total
Cost	6.7	14.7	25.1	35.2	42.6	124.3	213	213.0	550.3

* Includes cost of refresher course training and Farmer's Day (Rs. 400/Farmer's Day)

Training cost

(a) Daily allowance for JT, JTA, Stockman = Rs. 15/manday

(b) Training materials = Rs. 25/trainee

(c) Trainers allowance = Rs. 5000/year

However, to train one personnel (JT, JTA, stockman) necessitates Rs. 300/- approximately).

(d) Farmer's Training:

	Year - 1	Year - 2	Year - 3	Year - 4	Year - 5	1st 5 year	2nd 5 year	3rd 5 year	Total
No. of trainees	40	90	140	190	210	670	1050	1050	2770
Cost ('000 NR)	7.2	16.2	25.2	34.2	37.8	120.6	189.0	189.0	498.6

(a) Types of trainees = 10 selected farmers from each sub-centre in every year

(b) Location of training = sub-centre

(c) Period of training = 3 days thrice a year

(d) Training cost

i) Daily allowance for trainee = Rs. 10/manday

ii) Training materials = Rs. 200/sub-centre

iii) Miscellaneous = Rs. 100/sub-centre

(e) VAA Training - Refresher course

	Year - 1	Year - 2	Year - 3	Year - 4	Year - 5	1st 5 year	2nd 5 year	3rd 5 year	Total
No. of trainees	67	179	312	468	594	1620	1782	1782	5184
Cost ('000 NR)	13.7	33.5	55.7	79.1	96.1	278.2	480.5	480.5	1239.2

(a) Type of trainees = VAA

(b) Location of training = Sub-centre

(c) Training period = 5 days twice a year

(d) Training cost

i) Daily allowance for trainee = Rs. 10/man day

ii) Trainer's allowance = Rs. 1500/year/sub-centre

iii) Miscellaneous = Rs. 250/year/sub-centre

Appendix 7

R C U P

Norms for buildings

(1) Livestock Development Centre

Offices II	150
Officer III	150
JT, JTAS	150
Accounts	80
Administration	80
Stores	150
Toilets	60
Net area	820 Sq. ft.
Circulation 33%	270.60 Sq. Ft.
	1090.60 Sq. Ft. (say 1100 sf)

(2) Sub-centre

Office space	180
Stores	120
Room	120
Kitchen/dining/stores	120
	540
+ 33%	178.2
	718.2 Sq. ft. (Say 720 sf)

Appendix 7

Quarters

(1) A type quarters

Sitting room	150	
2 bedrooms	300	
Kitchen/dining	150	
Store	50	
Servant	80	
	780	Sq. Ft.
	+ 257	
	1037	Sq. Ft. (Say 1050 Sq. ft.)

(2) B type quarters

Sitting room	150	
Bedroom	150	
Bedroom	120	
Kitchen/drinking	150	
Toilets	50	
Store	50	
	670	Sq. ft.
	+ 221	Sq. ft.
	891	Sq. ft. (Say 900 Sq. ft.)

Appendix 7

For costing

1) Main offices - Rs. 125 Sft. of plinth area and A type quarter

2) Field offices and B type quarter - Rs. 110/Sq. ft.

3) Sub-centre - Rs. 100/Sq. ft.

Coefficients

Using maximum local materials and manpower available

Kulikhani	.....	1
Gorkha	.....	1.25
Myagdi	.....	1.5
Jomsom	.....	1.75

APPENDIX Ib

RANGE MANAGEMENT AND ANIMAL HUSBANDRY COMPONENTS

Prepared by: Meril G Carter/SECID

CONTENTS

	Page
A. SUMMARY OF CONCLUSIONS	1
B. PHYSICAL CHARACTERISTICS	2
C. PROJECT SETTING	
1. Livestock	3
2. Animal Husbandry and Health	3
3. Human Nutrition	4
4. Range Condition and Animal Numbers	4
5. Patterns of Livestock Production	6
6. Panchayat Forests	7
7. Grazing Rights	7
8. Demands for Grazing	7
9. Social Considerations	7
D. PROJECT METHODOLOGY	
1. Selection of Techniques	9
2. Integrating On and Off-Farm Production of Animal Feeds	9
3. Plan Design	9
4. Treatment Alternatives	9
E. SURVEYS AND INTERPRETATIONS	
1. Range Site and Condition Surveys and Soil Surveys	10
2. Inventories	11
3. Range and Pasture Management Planning and Design	11
4. Pasture Planning and Design	11
5. Costs and Personnel	11

F. PROJECT COMPONENTS — Page

1. Range Management — 12
2. Animal Husbandry and Health — 14
3. Improved Pastures — 16
4. Feeds and Forages from Cropland — 17

G. RESEARCH NEEDS

1. Range Management — 18
2. Improved Pastures — 18
3. Research Institutions — 19
4. RCUP Research Contributions — 19

H. RECOMMENDED SITE SPECIFIC PROJECT ACTIONS

1. Project Actions - Year One — 19
2. Project Actions - Year Two — 21
3. Project Actions - Year Three — 21
4. Non-Site Specific Project Actions — 22

REFERENCES — 24

ATTACHMENTS

A. Panchayat Forest Legislation — 26
B. Job Description - Animal Husbandry (Expatriate) — 28
C. Range Management/Forage Specialist (Expatriate) — 30
D. Budgets — 32

A. SUMMARY AND CONCLUSIONS

Range management, improved pasture development and animal husbandry are indispensable elements of a Resource Conservation and Utilization Project. The inclusion of these elements is dictated by the land uses occurring in the project watersheds and a rural economy founded to a great measure on livestock and their products.

Each land use has definable capabilities and limitations based on inherent characteristics. Sound treatment of each land use is based on needs for protection from erosion and economical improvement in productive capacities. Proper assessment of these factors, coupled with appreciation of socio-economic aspirations and needs, will be the project approach to the development of the resource base.

Integration of on-farm production of animal feeds, with increased forage production from rangeland and pastures, is the approach taken to balance feed supplies and animal number. Concurrently, an effective extension program is needed to develop an ethic of quality, rather than mere quantity, in animal numbers.

Animal husbandry improvements, while secondary to increasing feed supplies, will substantially aid in augmenting outputs of livestock products. Containment of rinderpest and control of intestinal parasites in small ruminants are the two most important health objectives. Simple improvements in animal care are featured in husbandry recommendations rather than importation of exotic breeds and artificial insemination.

All project actions will be carefully planned and applied with full participation in decision making by the farmers or village groups involved. It is recommended that maintenance of community (Panchayat forests) pasture lands be paid for by users by means of equitable fees for products harvested.

Project inputs for range, pasture and animal husbandry are expected to cost U.S. $2,750,000.00, not including project personnel salaries and support. Project outputs based on normally accepted production increases in forages, fodder, and animal products is expected to exceed input costs by a conservative margin of 1:25-1, or greater over life of project. Of equal or greater importance, the application of recommended land treatments will have a positive effect in controlling soil erosion in the watersheds.

B. PHYSICAL CHARACTERISTICS

A description of the areas as it relates to range management follows:

Plant Succession

Other than the Kagbeni - Muktinath - Mustang Dolpa areas of low rainfall and cold winters, nearly all lands in the project area were originally in sub-tropical forest at elevations up to 1000 meters, temperate forests of 1000-2700 meters, and alpine forest and meadows of 2700-4500 meters. The central hill lands, on soils other than shallow and rocky, have been largely deforested and are now either bench terraced for cultivation or used for community grazing. The remaining forests and denuded lands are nearly all heavily grazed and regularly burned. Wood for domestic fuel and construction is cut from remaining trees and in accessible areas, the trees are severely lopped for livestock fodder. Large areas are now nearly devoid of trees with the villagers having little or no access to forest areas.

Successional changes in plant communities are largely due to man's activities. The successional stages in the lower and middle hills are characterized by full canopy forests --> open forests --> brush-grass --> weeds --> denuded. Most soil erosion results from burning of forests and grasslands followed by heavy grazing and farming of unsuitable soils. Well managed bench terraced land on stable soils on slopes up to 45 degrees are successfully farmed. Unstable soils begin to erode at an unacceptable rate at about 30 degrees, unless stone and vegetated protected terrace back slopes are used.

In the higher hills and mountains (3000-4000 meters), alpine forests and meadows predominate. The successional stages are quite direct upon disturbance, from alpine forests or grass-sedge (Festuca-Agropyron-Carex) meadows to persistent brush species, invading grasses and weeds to denude conditions. Unless landslides or severe erosion has occurred, the plant successional stages are generally reversible over time to the original forests or alpine meadows. This process can be as little as 10-20 years or as much as many decades.

In the Mustang - Dolpa - Muktinath dry steppe areas, the plant climax was apparently composed of thorny shrubs, Caragana, Lonicera, Eleagnus, associated with Festuca - Stipa grasslands which degrades under heavy grazing to thorny shrubs protecting the remaining grasses. Poisonous herbs (Astragalus), and unpalatable weeds plus accelerated erosion occur in the later

stages. The process is reversible but slow particularly on the lower, assessible slopes.

C. PROJECT SETTING

1. Livestock

The typical hill country farm family of 6 persons derives about 60% of its cash income from livestock. Normally, the major sources of cash income come from milk and butter. Livestock products generate 16% of GNP. Stock holdings per average hill family farm consist of about 4.4 head of cattle or buffalo with possibly 2 head of sheep or goats. Occasionally, mules and horses are kept for transport. Yak and yak-cattle crossbreeds are owned mainly in the 3000 meter plus areas for transportation, milk, and ghee.

In general, the more grazing land available to a farmer in proportion to cropland, the more livestock he will have. In the dry steppe areas, 2700 meters and higher, goats, sheep and yaks assume more importance than buffalo. Practically all animals are exploited as multi-purpose. Among the many uses are meat, milk, butter, cheese, wool, hides, manure, ploughing, cultivating, transport of materials and breeding purposes. Cattle are kept for milk and as oxen. At the same time, little or no care or feeding is expended on them except for oxen during ploughing and cultivating seasons. Buffalo receive better care for milking purposes. Religious and legal prohibitions on cattle slaughter result in 50% of cattle being unproductive. In-breeding prevails everywhere.

2. Animal Husbandry and Health

Most cattle in the project area are in a near permanent state of semi-starvation. Due to better care and feeding, buffaloes and oxen are less under nourished but still not fed to optimum productive levels. Goats, due to their ability to climb and utilize a wide range of feeds, are less affected. Sheeps are often unthrifty, some of which is due to intestinal parasites.

By an overwhelming margin, insufficient nutrition is the worst malady of livestock. Constant dietary deficiencies have a far more deleterious effect than all the animal diseases in Nepal.

Mature weights are 25 to 50% less than normal. Live weight average for cows is 150 Kg. and 300 Kg. for buffalo cows. Cattle and sheep approach

dwarf sizes with the goats considerably more normal. Milk production is less than one-half genetic capabilities.

Beyond the generally low level of animal nutrition, there are serious deficiencies in rudimentary animal husbandry that must be addressed. Supportive animal husbandry techniques, generally feasible and simple but not now a normal part of livestock operations, are necessary and are discussed in the body of the report.

3. Human Nutrition

Livestock ownership does not necessarily result in adequate diets for humans. The diet of a typical Nepalese, already low in caloric content, is woefully short in animal proteins including milk. The project can be expected to substantially bridge this dietary gap.

4. Range Conditions and Animal Numbers

Weak, emaciated animals and minimal production rates of meat, milk, and wool are easily observable in all project areas, although somewhat better conditions prevail where villages have access, at least seasonally, to relatively large areas of mountain or alpine pasture. The correlation is direct between animal condition and the vegetative condition of available grazing lands.

With important exception, overgrazing is widespread, indicating that more animals use the land than the natural vegetation can support. The literature is silent on the carrying capacity of the grazing lands. Moreover, although it is obvious that grass and associated herbs support by far most of the grazing load, there is practically no information on grasses nor the successional stages of grasslands on which to base grazing management decisions. In lieu of reliable information and research, most range management decisions will necessarily come from close observations of vegetative condition, state and trend of plant succession under different levels of use, and relative abundance and spread over time of carefully selected key indicator species. The project must achieve a reasonable balance of livestock numbers with the potential productive capacities of the combined farm and community managed grazing lands and pastures.

Grazing lands are subjected to grazing pressures from two to four times what could be considered normal stocking rates. At these rates, serious depletion of the soil-plant resource base is assured. Apparently, the extreme

grazing pressures have occured within the past 15 to 20 years, since many desirable range plants still persist in all but the most eroded situations. Productivity of rangelands is correlated with soil depth and fertility, rainfall, temperatures, and presence of plants capable of high production.

Vegetative condition classes provide a guide to estimating stocking rates:

Excellent condition - 75 to 100% of the vegetation is composed of the better adaptable grasses, herbs, forbs and browse.

Good condition - 50 to 75% of the better species occur on site.

Fair condition - 25 to 50% of the better species survive with increasing amounts of less desirable plants and sparse ground cover.

Poor condition - 0 to 25% of the better species survive. Numerous invading species, bare ground and erosion is evident.

A table of recommended stocking rates in hectares per livestock unit (LU) follows:

STOCKING RATES IN HECTARES PER LIVESTOCK UNIT*

Range Site	Condition Class	Precipitation in mm. 250	500	1000	15000	2000
Middle hills - good soils, steep but grazeable slopes, open grassland or partially forested (year long grazing)	Excellent			2.	1.5	1.
	Good			3.	2.5	1.5
	Fair			6.	4.	2.5
	Poor			10.	6.	4.
Alpine meadow - high open forest (5 months grazing season)	Excellent			2.	1.5	1.
	Good			3.	2.5	2.
	Fair			6.	4.	3.5
	Poor			10.	8.	7.
Dry steppes (7 months grazing season)	Excellent	4.	3.			
	Good	5.	4.			
	Fair	8.	7.			
	Poor	14.	11.			

Subject to revision as actual data or research becomes available.

* Livestock Unit

1 Buffalo = 1 L.U., 1 Cow = 0.7 L.U., 10 Sheep = 1 L.U.
10 Goats = 1 L.U., 3 Calves = 1 L.U.,

5. Patterns of Livestock Production

Livestock are raised and fed entirely on the output of the farm. This pattern most often occurs when forest and community grazing land is not available or occurs in negligible amounts. It is typified by the intensely cultivated mid-elevations of Kulekhani and Gorkha areas. Due to the small size of most farms, rather large increases in on-farm production of crops, residues, forages from terrace back slopes, and fodder trees will be necessary to satisfy the nutritional needs of the farm animals. Inputs in terms of fertilizer, composting, better seeds, stall feeding, and off-season forage production will be required. There will also be opportunities to retire non-productive eroding cropland to forage and fodder tree production.

The most common pattern of production is that where a combination of on-farm produced feeds is supplemented, to an appreciable degree, by grazing from community grazing lands and forests. In terms of number of farm families involved, this is the most common pattern. Desirable levels of forages will come from the balanced mix of community managed range and forest lands, pasture development, and crop and forage increases on-farm. Inputs will be low for grasslands and forest-rangelands consisting mainly of range management techniques, but moderate for improved pastures and fodder trees and on cropland.

The third category is found in extensive areas where rough broken mountain forests, grasslands and cold alpine and drier zones occur. In terms of area but not population, it is the most extensive pattern of production. It occurs in nearly all of the Myagdi-Mustang area and the upper reaches of the Daraudi watershed (Gorkha area). Livestock raising is extensive in nature, quite often involving herding and moving to high summer grazing areas from distant locations. Villages are fewer in number and the proportion of cropland to range and forest land is less. Lack of winter available feeds is the most serious restraint to improved animal production. The topography is most suited to sheep and goat production. Most production increases will come from two sources. Where excess irrigation water is available, every effort is warranted to develop irrigated improved pastures near villages where forages can be produced and stored for winter use. The other production source will come from range management improvements, mainly by controlled grazing by accessible areas.

6. Panchayat Forests

Another potentially important source of livestock production increases is the opportunity for participation in panchayat forest developments. From such lands, improved pastures, fodder trees, fuel and timber can be produced on a sustainable basis. A panchayat forest has a miximum limitation of 125 hectares per panchayat. See Appendix A for summary of panchayat forest legislation.

7. Grazing Rights

Where grazing lands are available, village farmers recognize a common right to graze a particular area. While outsiders may transgress, disputes are remarkable few. Recognized grazing rights are decided plus factors, aiding in demarcation of grazing and pasture areas and fostering local participation in management decision and operation.

8. Demands for Grazing

Farmers responding to inventory queries about their felt needs rank increased forages and fuel nearly at par with domestic water supply, health and irrigation. It was definitely established that farmers are most interested in improving their privately owned lands. These expressed desires should be plus factors in local planning and decision making. The felt needs also set priorities for project actions.

National forest management, at present, is not able to cope with the surge of people seeking cropland and grazing areas on national forests. Consequently, forest areas are rapidly being encroached upon, with fire the most common method of clearing the land. Totally unsuited areas are being used for cropping, apparently with the idea in mind of establishing de facto ownership before the national forests can be surveyed and demarcated.

A few farmers have established individual rights to grazing lands by enclosing them. Croplands are privately owned, even though they may be leased at up to 50% sharing of crops with inputs at lessee's cost, a decidedly negative factor in fostering production improvements.

9. Social Considerations

Dense populations and limited availability of productive soils place extreme pressures on the land to produce human food and other necessities.

Every niche is exploited to satisfy human needs. In such a competitive situation, animals are not accorded the resources necessary to be fully productive. Instead, they mainly exist on the residues from crops raised on the farm, supplemented with meager grazing of fodder from trees in the surrounding forests and pastures.

Farmers do not callously deny their animals proper feeding. Granted, they do not have extensive knowledge of animal needs and care, yet if they did, they cannot, under current production levels, satisfy animal needs. There appear to be no basic social tenents that make it impossible for the area farmers to learn and accept new concepts in improving crop and animal production.

On the contrary, the people have an outstanding capacity to successfully farm and protect from soil erosion the marginal and extremely steep lands. They demonstrate a high degree of social interaction and cooperation. While there are good reasons to assume that the area farmers will accept new ideas and methods, it is stressed that there are severe economic and ecological limits to land productivity. Increasing human and animal populations cannot go on indefinitely. Efforts to increase production must be coupled with population limits. In cases, on the truly marginal lands, out-migration is warranted and should be encouraged.

Improved animal diets will have immediate positive effects on livestock production, reduction of death losses and increased reproductive rates. At this point, the danger of rapidly increasing herds could negate all efforts to augment and balance feed supplies. At best, the project will be able to instill only moderate concepts of management-production levels; levels just able to cope with the needs of the current herds. Therefore, continuously increasing heads cannot be tolerated if the resource base is to be protected. A very powerful, consistent and effective education-extension program to foster the concept of substitution of quality for quantity will be mandatory.

Formation of village watershed and project area conservation councils should be encouraged to reinforce and extend the existing conservation ethic among the populations and to foster participation in land use and treatment decisions affecting their welfare.

D. PROJECT METHODOLOGY

1. Selection of Techniques

The project, in its efforts to increase forage production on native grading lands, will be dealing with natural eco-systems. Such eco-systems are most economically manipulated by using ecologically sound and proven range management techniques. The principle of multiple use of the eco-systems will be followed. Soil and water conservation plans will consider recreational and wild life needs where feasible. The forage production capacities of the grazing lands will be integrated with on the farm productive capacities to achieve nutritionally adequate diets for farm animals.

2. Integrating On and Off-Farm Production of Animal Feeds

The integration of on and off-farm production is best illustrated by the following simple model:

Farmer A owns 5 livestock units (LU's - see definitions in section C-4) for which he can adequately produce on his farm, with project fostered production increases, enough feed and crop residues to adequately support 3 LU's. Therefore off-farm produced forages (range, community pastures, fodder trees) must supply sufficient feed for two animal units. Thus production from off-farm sources must be sufficiently increased to support the equivalent of 2 LU's. Village or community needs for increased animal feeds can thus be determined using this procedure.

3. Plan Design

The methodology used in design is primarily based on sound and proven techniques of assessing the inherent capabilities of the land and designing economically feasible treatments in accordance with its needs for protection and improvement. Soil surveys of suitable intensities will characterize and interpret for use the various cropland soil units. Range surveys will be made to determine plant composition, current condition and plant successional stages, on which to base decisions involving grazing capacities, seasons of use, control of fire and treatments needed to improve productive capacities.

4. Treatment Alternatives

The combination of range surveys on native plant communities and soil surveys on cropland or improved pastures will provide the base data necessary

to determine treatment alternatives. The treatments selected will be socially acceptable and economically feasible. They will meet production goals and protect the soil, water and plant resource base.

While the scientific assessment and design treatment of the resource base is fundamental, the overall project objectives can be reached only by community supported actions and efforts by farmers and local groups. Such support is gained by leadership, organization, education-extension, availability of inputs and finances, supported by consistent practical technical guidance.

E. SURVEYS AND INTREPRETATIONS

1. Range Site and Condition Surveys and Soil Surveys

Soil surveys supplemented with vegetative condition assessments can be used to develop the range site surveys, which in turn are needed to develop the range management land use and treatment plans. Lacking soil surveys, range site surveys can be developed by competent technicians. In the early stages of the project, standard soil surveys will probably not be available. In this case, range site surveys will be developed independently as a basis for preparing the detailed range management plans and subsequent application of planned treatment.

Since the range and pasture components of land development will be integrated with on-farm produced forages and feeds, detailed soil surveys on cropland must be available concurrently to coordinate planning and treatment design. Range site and condition surveys should be made on maps or air photos of not greater than 1 to 12,000 scale. A scale of 1 to 10,000 would be more suitable. Standard range management texts (see references) outline procedures and contents of range surveys and development of treatment alternatives. All range site and condition surveys and alternative treatments are necessarily based on ecological principles of plant succession. It should be understood that maintaining grasslands, on areas where the climax vegetation is forest, involves the manipulation and management of a disclimax. Where less than climax vegetative associations are to be managed, more consideration needs to be given to adequate protection of the soil and water resource base. In some extreme cases, a rational decision may require converting grass of brushland to forest for adequate protection. However, a managed stand of fodder trees and/or grass provides sufficient protection to the resources base in most cases.

2. Inventories

Inventories of the numbers of livestock by village and panchayat are the bases for determining the need for animal feeds. Supplementing this data are inventories of the current levels of production of all kinds of feeds and forages. The deficiencies in animal feeds can then be determined by localities. The next step is to determine what levels of production increases can be expected by the development of new sources of feed plus production increases from all sources (farm, fodder trees, community pastures, forests). By applying the project recommended program, the gap between current supplies and the goal of nutritionally adequate animal diets will be met.

3. Range and Pasture Management Planning and Design

Ecological considerations largely dictate the management and treatment of natural grasslands. The techniques used are summarized in section F.1.a.

4. Pasture Planning and Design

Conversely, the development and use of improved pasture, either on farms or community lands, require a different set of management and treatment needs:

-- Improved pastures are nearly always seeded or sprigged on previously prepared and fertilized productive soils;
-- Harvesting is by grazing or hand cutting. Hand cutting and stall feeding is more productive and conserves all manure for use on cropland;
-- Renovation of improved pastures is generally needed after a few years;
-- Production levels can be widely manipulated by amounts of fertilizer used and availability of irrigation water;
-- Legumes are often part of pasture mixture to help maintain nitrogen levels and improve quality of forage;
-- Annual plants are often used for forage production.

5. Costs and Personnel

Costs of installing project recommended actions are given in section F and included in the budgets Attachment D. Labor for installation is included in the costs cited but do not include project personnel costs. Project personnel categories and costs are given elsewhere. Job descriptions for recommended expatriate assistance are given in Attachments B and C.

F. PROJECT COMPONENTS

1. Range Management Component

a. Planning

Nearly every village and panchayat has access to degraded forest lands and disclimax grasslands used for community grazing. In localities where most of the lands are intensely farmed, there are inadequate amounts of forest areas or grasslands to support the herds. At the other extreme there are rough mountain areas where isolated villages have relatively large areas for grazing. All degrees in-between exist, often within short distances. Plans for treatment and management of the community grazing areas cannot be standardized, and require intimate on-ground knowledge of soils-plants-successional stages and the social capacity of the farmers to act in common to manage their grazing resources. All range management plans must be site specific. The techniques of treating and managing the grazing lands will derive from well known range management principles and practices. They are:

-- Proper grazing use based on proper numbers and mix of livestock, and based on estimated carrying capacity as judged by plant condition, reproduction, density and spread of selected key species. See section C-4 for 'Estimated Carrying Capacities by Conditon Classes.'

-- Proper season of use where a seasonal deferment is needed for seed production or improvement in plant density.

-- Rest-rotations where feasible and effective to improve natural seeding and spread of desirable ground cover.

-- Control of burning - fire is used as a management tool only.

-- Fencing only where needed and local materials available. Village voluntary cooperation or guards are preferable. Control of undesirable brush or trees may be necessary in limited areas.

-- Planting of fodder trees where needed to balance forage supplies. Fodder trees can be planted in blocks, mixed with fuel producing trees, or interspersed in grasslands, depending upon local situations and needs.

-- Hand harvesting of forage production from grasslands. This is especially applicable where grazing lands are insufficient or villagers do not agree on allocation of grazing rights. Hand harvested forage

can also be a means for villages or panchayats to collect funds on an equitable basis to pay for maintenance and village guardians, where volunteers are not available. Harvesting will generally be limited to one cutting the first year and not more than 2-3 cuttings per year following, depending on productivity after satisfactory conditions are achieved.

-- In a few cases, poisonous plants that cannot be eliminated by competition from better and more competitive vegetation will be controlled.

-- While most animals return to the farm overnight, there will likely be areas within large tracts or rough mountains where livestock water developments will be needed for better distribution of grazing. Schistosomiasis is not present in the area and malaria is rare at elevations encountered in the project areas. Therefore no special protective measures are warranted in locating or constructing stock water developments.

-- Total exclusion of livestock is indicated on severely eroding sites, landslides and their contributing catchment area, and from valuable commercial forest if livestock is a hazard to reproduction or growth.

-- Improvement of herding techniques is needed in all grazing areas. At present poor herding accounts for much of the erosion from trailing and denudation of bedding grounds.

Range management plans will contain one or more of the foregoing treatments as the individual case warrants. The minimum plan would contain estimations of carrying capacity, season of use, grazing or harvesting plan, and key plants on which to judge proper use and condition trends.

b. Project Actions in Range Management

Over the life of the project it is expected that the majority of the natural grasslands, mixed forest-grasslands and grazed forests will have range management plans developed on them as prepared by range trained technicians and the farmer users. Estimated planning and application accomplishments by end-of-project are:

Area	Range land and grazed forests sq. im.	Planned sq. km.	Undermanagement end-of-project sq. km.
Kulekhani	61	45	30
Gorkha	372	250	140
Mustang	No data at time of study.		
Myagdi	No date at time of study.		

c. Inputs

The inputs necessary to carry out an effective range management program over life-of-project are summarized below:

Reseeding seriously depleted grasslands, including land preparation, seed labor 3000 ha @ $60	$180,000 U.S.
Range Water developments and troughs. Includes labor and materials. Estimate 400 developments @ $125	$ 50,000 U.S.
Demonstrational equipment-clippers, wire cages, shovels, hand scales, printed material, equipment for meeting, easels,etc.	$ 60,000 U.S.
Guardians (50% volunteers, 50% paid)	700 man/years

d. Outputs

It is difficult to quantify output from range improvements in productivity terms. Productivity is related to the vegetative condition of the grasslands after management is installed. Improvement in range conditions have an immediate effect in controlling soil erosion in the watershed which, in the long term, is the most important objective. In summary the benefits are:

-- Improvement of vegetative conditions with corresponding increases of usable forage production amounting to 25% on poor condition ranges to over 100% on good condition ranges.

-- Increased forage resulting from management has a direct effect on animal production (increased milk, meat, wool).

-- While not quantified, range management, as judged by improvements in vegetative density (ground cover) and soil protection, have a direct and immediate effect in controlling erosion.

-- The control of fire has direct benefits by improving plant vigor and density, thereby reducing soil erosion.

2. Animal Husbandry and Health

Project actions in animal husbandry and health will be aimed at alleviating restraints to livestock production. The previously described actions to bring feed and fodder supplies more in balance with livestock numbers by range management, development of improved pastures, and increase of farm

crops are of first importance. Second, relatively simple and inexpensive animal husbandry technniques will be introduced through extension and health services to improve the care of farm animals, thus adding an additional increment to production.

The animal husbandry techniques will be introduced in two stages and are applicable to all project areas:

a. Animal Husbandry

Simple low cost animal nutrition and husbandry practices to be introduced early in the project:

-- Eliminate water stress by watering livestock twice a day to repletion;
-- Supplementary feeding during stress periods;
-- Drainage and sanitation improvements of shelter facilities;
-- Mineral supplements where indicated;
-- Selection of better herd sires among locally available animals;
-- Eliminating inbreeding by purchase or trade of sires from other villages;
-- Elimination of the negative breeding practice of castrating the best males for oxen leaving the scrub bulls for breeding.
-- Stall feeding to conserve feeds and manure.

b. More Advanced Animal Husbandry

More advanced animal husbandry to be introduced by the project but not before farmers demonstrate ability to produce adequate forages and feeds for their herds:

-- Feeding of females during gestation and laction;
-- Castration of scrub animals and young males not needed for breeding;
-- Separation of sires from the herd for controlled breeding;
-- Pasturing ewes on fresh grazing or forage during lambing period.
-- Flushing (accelerated feeding) of females prior to breeding.

Lastly, and only when the feed and forage deficiencies are eliminated, introduction of better herd sires is warranted. Local breeds selected for quality are preferred. Exotic breeds or artificial insemination is not recommended.

c. Animal Health Actions

Other actions needed to improve animal husbandry and health consist of activities aimed at moderating the harmful effects of two major diseases prevalent in the project areas:

-- Extension assistance to farmers to help them recognize symptoms of major diseases such as rinderpest and to alert the Veterinary Service to mount vaccination campaigns to contain outbreaks;

-- Extension assistance to show farmers how to administer Thibenzole alternated with Exhelm medications to control the most harmful internal parasites of sheep and goats, Haemonchus (nematode) and the Helmintheae. The tablet form of medication is preferred having advantages in transport, storage and administration over the liquid form. Two treatments per year are indicated, one prior to and one after the monsoon season.

d. Inputs

-- Salt mineral blocks for demonstrational purposes. 10,000, 2 kg blocks @ $1.00 each. Delivered on site.	$ 10,000 U.S.
-- Medicines for internal parasite control, 1,500,000 doses @ 0.20 site.	$300,000 U.S.
-- Demonstrational supplies and equipment (antiseptics, external parasite control, castration equipment, scales).	$ 20,000 U.S.

e. Outputs

Outputs are calculated on increased production of livestock products over baseline production traceable to animal care and management only but not to increased feed supplies. The output from feed supplies is a benefit of range, pasture and cropland production increases in forages and other feeds.

3. Improved Pastures Component

The need to augment animal feed supplies was noted throughout the area. The increases in forage production needed to overcome current shortages will partly come from planting and managing improved pastures. Lists of adaptable native and introduced grasses have been prepared and are available from the RCUP staff.

The inputs necessary to carry out an effective program of pasture development are:

a. Inputs

-- An estimated 5000 hectares of improved pastures will be established by planting or sprigging at a cost of $135 per hectare — $625,000 U.S.

-- Guardians (50% volunteer, 50% paid)
Villagers — 900/man years

b. Outputs

The output from developing and managing improved pastures is readily quantifiable by comparing annual production of useable forages production after treatment. Increases in usuable production will range from 400 to 1500 kg. field dry weight per hectare.

4. Feeds and Forages from Cropland

The most important project component in animal husbandry will be the extension effort to foster increased production of animal feeds derived from cropland in terms of better and more abundant edible crop residues, forages and grains. Demonstrations of how such increases can be obtained concurrently with increased production of human food are crucial to project success. Inputs for extension demonstrations of this kind are fertilizers, new and improved seeds, insecticides and visual aid materials.

a. Inputs

Demonstrational Supplies and Materials:
Fertilizer, ammonium nitrate and triple P_2O_5, pellet type, plastic sacks with outer protective cover. 5000 demonstrations benefiting 12,000 farm families. 600 metric tons.

Delivered on-site cost per MT $1200	$720,000 U.S.
Improved and new seeds	$450,000 U.S.
Other (insecticides, visual aids)	$110,000 U.S.

b. Outputs

Increased production and availability of annual feeds (edible residues, forages and grains) deriving from increased production of normal human food crops on-farm should be in the range of 25-50% over current base-line production.

G. RESEARCH NEEDS

1. Range Management

a. Introduced Species

Field trials and evaluations of survival, seeding characteristics, competitive performance, productivity, feed values and eco-zone adaptability of promising introduced grasses, legumes and shrubs are needed to provide suitable plant materials for revegetating degraded areas scheduled for range management or erosion control. Such trials should not be limited to the project areas but country wide in extent.

b. Native Species

Similar trials and evaluations should be made of selected superior strains of native plants. Trials of the most promising native materials should take precedence over trials of introduced species because the problem of adaptation is not in question.

c. Grazing Capacities

Short term research to evaluate grazing capacities of native grazing lands in various stages of plant succesion is not advisable. Experience has shown that definitive results are rare. Rather, research in grazing capacities should be long term if at all. The difficulty and costs of such research should not be underestimated. On the other hand, research to identify key plants that indicate by their increase or decrease in vigor, spread and density, the trends in plant succession and productivity, is warranted.

d. Identification

Research is needed to develop range plant identification keys along with notes on ecology and phenology especially of the grass and forb components.

2. Improved Pasture Research

a. Plant Materials

A continuing program of research is needed to select, test and evaluate promising grasses and legumes both native and introduced.

b. Levels of Management

Research is needed to correlate pasture productivity and costs with various levels of inputs on the major soil units. Such research is ex-

pected to be of value to determine cost-productivity relations where land is in short supply and livestock numbers are high requiring precise correlation of management levels.

3. Research Institutions

All research in range and pasture management should be institutionalized preferably centered in a qualified University. The cost and results of such research should be equitably shared by benefiting department and projects concerned with land development an conservation.

4. Recommended RCUP Research Contributions to Range and Pasture Research

Year 1 thru 5	75,000
Year 5 thru 10	75,000
Year 10 thru 15	75,000
	$225,000 U.S.

(above costs included in budgets-Attachment D)

Costs are based on fielding a University team to conduct research in key locations of the project area.

H. RECOMMENDED SITE SPECIFIC PROJECT ACTIONS - FIRST THREE YEARS

1. Project Actions - Year One

a. Kulekhani Watershed

i. Kulekhani Sheep Farm

Location is one kilometer north of Markhu about 1650 meter elevation.

A management plan for the government sheep breeding farm will be developed. The plan will provide for enlargement of the farm from 20 ha to about 60 ha in order to produce enough forages and grazing to support the present herd of 125 ewes, 100 yearlings and 100 lambs without the overgrazing that presently exists. Such overgrazing sets a bad example among the local farmers. Moreover, the sheep farm includes the entire water source (springs and seeps) for the town and administrative centre of Markhu. The plan, when applied, should fully protect this water source.

The remodeled farm will produce upgraded sheep breeds and will demonstrate how to manage improved pastures and rangeland. It is expected to provide data useful for extension to farms throughout the watershed. The area of improved pasture will be doubled and several varieties of grasses and legumes will be used to extend the pasturing season and provide for soil fertility maintenance.

The improved operations will include a range management plan specifying number of animals, season of use, rotations, and proper herding of animals to prevent trailing and erosion. Livestock water development away from headquarters will also be needed.

The plan and needed treatments should be completed over a period of 18 months, spanning two monsoon seasons.

Materials and costs are included in the budgets, Attachment D.

Plans and supervision of application will be carried out by normally assigned panchayat and area level technicians and guided by national specialists. Plans will be developed jointly with Livestock Service personnel.

Operation and Maintenance

Operation and maintenance costs will be borne by the Livestock Service, the same as at present.

ii. Improved Pasture Component of Panchayat Forests Scheduled for Year One

Daraundi Watershed (Gorka) - Choprak Panchayat

Location, Choprak panchayat, villages of Chorkate, Nargasangu, Mahtar, Nibel, Archale, and Choprak.

Development of panchayat forests (PF) located in several plots adjacent to the above villages.

The PF's will be located in areas now used as village community grazing lands. A maximum of 125 hectares of PF will be developed for the entire panchayat.

Plans for each village forest (PF) will be developed in consultation with the village councils. Mutual decisions and agreements will be made on specific location, extent, species to be planted (fuel, forage, fodder trees). Voluntary contributions of labor, if any, and management and protection of the PF after establishment, will be included.

Materials and costs. Costs are included in budgets, Attachment D.

Planning assistance and application supervision will be furnished by panchayat and district project personnel, guided by national level specialists. Subsequent management and maintenance guidance will be provided village groups by project personnel.

It is recommended that panchayat or villages set a fee for harvested products (fuel, forage, fodder) adequate to pay for maintenance and renovation costs (fertilizer, replacement plants etc). If voluntary guardians are not available the cost of guardians should be covered in the fee.

iii. Kulekhani Watershed-Chitlang Panchayat Villages

Location - Village in Chitlang Panchayat. Work with village and panchayat councils to develop mutually agreed upon plans for establishment of panchayat forests adjacent to villages. A maximum of 125 hectares will be developed.

All costs are included in the budget, Attachment D.

Operations and maintenance are the same as described above for the Daranundi watershed.

2. Project Actions - Year Two

Kulekhani Watershed

Palung Panchayat - Villages of Phendigaon, Dwankate, Pairo, Lakholi, Chataura.

-- Develop panchayat forests (pasture component) adjacent to the villages in areas now used as community grazing land, a maximim of 125 ha. will be developed.

-- Actions, plan development, application, and management are similar to those described for panchayat forest for the Daraundi watershed described above.

-- Costs are included in budget, Attachment D.

3. Project Action - Year Three

Daraundi Watershed (Gorkha) - Deurali Panchayat

-- Location - Deurali panchayat villages.

-- Project actions - develop panchayat forest (PF) in areas near villages now used for common grazing. A maximum of 125 hectares will be developed.

-- The actions to be taken, plan development, application management and costs are similar to those described above for the Daraundi watershed.

-- Costs are included in the budget, Attachment D.

4. Non-Site Specific Project Actions

a. Extension

The site specific actions detailed above should not take priority over day to day, farm to farm, extension assistance provided to farmers. Socially and economically, it is most important that production increases on private lands precede or at least occur simultaneously with those from site specific projects. The needed production increases can be achieved by effective extension assistance in cropping systems, uses of compost, new and better seeds, irrigation water management, crop residue management, stall feeding, terrace improvements, fertilizer inputs, and pasture and fodder tree development.

There will be a time lag of 1 to 4 years before production increases are assured with site specific actions involving panchayat forest, range management or new irrigation developments. The only sure way to offset this lag is to gain the needed crop and forage production increases on private lands through effective extension assistance. Failure to place priority on this aspect of project efforts will make it difficult, if not impossible, to gain social acceptance and cooperation in site specific actions.

The costs of extension assistance largely derive from salaries and support of professional and sub-professional project technicians and are quoted elsewhere in the report. Other costs consists of demonstrational inputs such as new varieties, fertilizers, insecticides, and animal health supplies. Such costs are included in Attachment D.

b. Demonstrational Strategies

Demonstrations will involve leaders, groups of farmers or entire villages. In the case of cropland, comparative demonstrations of perhaps 1 ropani (.05 hectares) per farm would be ideal for showing benefits of new seeds, fertilizer, cropping systems, and insecticides. Over a period of years, inputs by the project should diminish to be replaced by local merchants or cooperative stocking adequate supplies of the needed inputs.

The project should take an active part in encouraging merchants or cooperatives to initiate such enterprises and assist them to find credit and sources of supply. Such enterprises will augment the local economy and help overcome a serious restraint to production increases.

The demonstrations of intestinal parasite control in sheep and goats should be concentrated to the degree possible, in areas with large sheep and goat populations. Training of project personnel in using tablet form of Thibenzole or equivalent should be followed by training of groups of livestock owners. Demonstrations in animal husbandry will involve comparisons of treated animals in terms of weight, reproduction, milk yield vs non-treated.

Rangeland demonstrations will include comparisons of herbage volume from overgrazed, moderately grazed and ungrazed ranges. Weights, condition, and reproduction of livestock will be compared from ranges in the various condition classes.

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Attachment A

PANCHAYAT FOREST LEGISLATION

1. One September 7, 1977, HMG enacted the Forest (First Amendment) Act, which designates in Chapter 5 four categories of forest which can be entrusted to community control. These include:

a. Panchayat Forests

"Any governmental forest area or any part there of, which has been rendered waste or contains only stumps, may be entrusted by His Majesty's Government to any village panchayat on prescribed terms and conditions for reforestation in the interest of the village community, and such forests shall be called Panchayat Forests." (Limited to a maximum of 125 ha. per panchayat).

b. Panchayat Protected Forests

"Governmental forests in any area or part there of may be entrusted by His Majesty's Government to any local panchayat on prescribed terms and conditions for the purpose of protection and proper management, and such forests shall be called Panchayat Protected Forests." (Limited to a maximum of 250 ha. per panchayat).

c. Religious Forests

"Any Governmental forest or part thereof located at any place of religious importance may be entrusted by His Majesty's Government to any religious institution on prescribed terms and conditions for the purpose of protection and proper management, and such forests may be called Religious Forests."

d. Contract Forests

"Any Governmental forest in any area or any part thereof which is devoid of trees, or has only stray trees, may be entrusted by His Majesty's Government to any individual or agency on prescribed terms and conditions for reforestation and for production and consumption of forest products, and such forests shall be called contract forests."

2. In Section 31. "Adjudication," the Law also states that "The appropriate panchayat shall have the power to hear cases relating to offenses punishable with a maximun amount of one hundred rupees under this act, or involving a

claim of the same amount in respect to Panchayat Forests and Panchayat Protected Forests."

3. The Rules and Regulations to implement the Forest First Amendment Act, including the regulations pertaining to the management of Panchayat Forest and Panchayat Protected Forests, are to be passed by the National Panchayat in July 1978.

Attachment B

Job Description-Expatriate-Animal Husbandry

Job Title. Animal Husbandry Extension Specialist (other titles are acceptable, e.g. Extension Training and Evaluation Specialist for Animal Husbandry, etc.)

Place of Assignment. Project Headquarters, Kathmandu, Nepal. Most working time, however, will be spent in the field.

Reports To. Co-Team Leader Resource Conservation and Utilization Project.

Period of Employment: Two years, with possible extensions.

Scope of Work. The Specialist will assist in all aspects related to the organization of livestock extension service geared to on-farm assistance to small producers in animal health, animal feeding, and animal husbandry. Specifically, together with his counterpart, the Specialist will:

- -- assist in organizing, directing and executing the training of field agents, supervisory staff and progressive farmers in animal husbandry, extension and health techniques;
- -- develop training guides and other instructional and extension materials;
- -- formulate region-specific technology packages and phased intervention strategies;
- -- provide regular on-the-ground guidance to the project technicians;
- -- organize simple on-farm demonstrations;
- -- make regular program evaluations and result evaluations of Project outputs;
- -- assist in organizing a system of record-keeping;
- -- propose research topics useful to farmer-livestock producers and
- -- make regular progress reports.

Employment Factors. Ability to get along with and motivate people in a variety of cultures and conditions; ability to use available resources effectively and overcome possible temporary setbacks in supplies and communications; ability to work and trek in rural areas under most severe conditions. Overseas experience desirable, especially in mountainous countries.

Educational Requirements. M.S. in an appropriate profession, D.V.M., or B.S. degree with extensive experience.

Experience. The Specialist must have had experience in developing and supervising animal health and animal husbandry programs, preferably under a wide variety of climatic and cultural conditions.

Language Requirements. Nepali competence desirable but not mandatory.

Attachment C

Job Description-Expatriate-Range Management

Job Title. Range Management/Forage Specialist (other titles are acceptable e.g. Range Conservationist/Pasture Specialist).

Place of Assignment. Project Headquarters, Kathmandu, Nepal. Work will be divided between field and Headquarters.

Reports To. Co-Team Leader Resource Conservation and Utilization Project.

Period of Employment. Two year minimum assignment with additional tours possible.

Scope of Work. The Specialist will assist in all aspects related to the organization, operations, evaluations and training of the Resource Conservation and Utilization Project in the fields of range management, improved pasture development and related conservation work. Specifically, together with his assigned counterparts, the specialist will:

- assist in the organization, and training of panchayat, area and national level professional and sub-professional project employees, in the fields of range management, improved pasture development and related conservation and development work;
- develop instructional and other extension materials;
- formulate region-specific technology packages and phased intervention strategies, including range site and condition surveys and standards for planning and application;
- provide regular on-the-ground guidance to project technical officers;
- organize simple on-farm demonstrations;
- make regular program evaluations and result evaluations of project outputs and lmake recommendations for project modifications as warranted;
- organize range and pasture planning and application records;
- propose research topics useful in range management and pasture improvement work;
- make regular progress report.

Employment Factors. Ability to work harmoniously with and motivate people in a variety of culture and conditions; ability to use available resources effectively and overcome possible temporary set-backs in supplies and communi-

cations; ability to work and trek in mountainous rural areas under most severe conditions. Overseas experience desirable especially in mountainous countries.

Educational Requirements. M.S. in an appropriate profession or B.S. with extensive experience.

Experience. The specialist must have had experience in developing and supervising animal health and animal husbandry programs, preferably under a wide variety of climatic and cultural conditions.

Language Requirements. Nepali competence desirable but not mandatory.

BUDGETS

Attachment D

Range and Pasture Components

1 -- Person days of employment, 2 -- Unit of work to be done, 3 -- Cost ($000)

Proposal Project	1st 5 year program																2nd 5 year			3rd 5 year			Total
	Year 1			Year 2			Year 3			Year 4			Year			Total							
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	$U.S.	1	2	3	1	2	3	
RANGE MANAGEMENT																							
1. Range seeding (including seed, land preparation, transport, seeding, and labor) Unit-Hectares @ $60 per ha. cost		10 ha	.6		20	1.2		100	6.0		150	9.0		200	12.0	28.8		1200	72.0		1320	79.2	(3000 ha) $180,000
Includes paid labor @ 15% of unit cost																							
2. Range livestock water developments (including materials transport and labor) 400 @ $125 per unit		2 ha	.25		4	.5		10	1.25		20	2.5		30	3.8	8.3		150	18.7		184	23.0	(400 No.) $50,000
Paid labor 20% of unit cost																							
3. Improved pasture development 5000 ha. @ $125		128 ha	16		200	25		280	35		320	40		400	50	166		2400	300		1272	159.	(5000 ha) $625,000
(Estimate 1600 guardian man-years of which 50% voluntary for guarding ranges and pastures)																					Sub-total		$855,000

Add 15% for contingencies and 10% per year for inflation.

BUDGETS

Animal Husbandry, Materials for Demonstrations, Trials and Research

Attachment D

1 - Person days of employment, 2 - Unit of work to be done, 3 - Cost ($000)

Proposal Project	1st 5 year program																2nd 5 year			3rd 5 year			Total
	Year 1			Year 2			Year 3			Year 4			Year 5			Total							
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3		1	2	3	1	2	3	
DEMONSTRATIONAL SUPPLIES AND MATERIALS-ANIMAL HUSB.																							
1. Internal parasite Medicinals			3.0			7.0			20.0			50.0			80.0	160			140				$ 300,000
2. Animal Husbandry Supplies & Equipment			1.0			2.0			3.0			3.0			3.0	12.0			8.0				20,000
3. Salt blocks			.2			.4			.6			1.0			2.0	4.2			5.8				10,000
CROPLAND DEMONSTRATION SUPPLIES & MATERIALS																							
1. Fertilizers			5.0			15.0			40.0			80.0			150	290.0			430				720,000
2. Improved seeds			2.0			6.0			8.0			12.0			20.0	48.0			402				450,000
3. Other			1.5			3.5			10.0			15.0			20.0	50.0			60.0				110,000
RANGE- PASTURE DEMONSTRATION - SUPPLIES & MATERIALS																							
1. Range and Pasture supplies & materials			1.0			3.0			8.0			10.0			15.0	37.0			23.0				60,000
RANGE AND PASTURE RESEARCH SUPPORT			4.0			11.0			20.0			20.0			20.0	75.0			75.0			75.0	225,000
																						Total:	1,895,000
																GRAND TOTAL OF ALL COMPONENTS							$2,750,000

Add 15% contingencies and 10% per year inflation

APPENDIX Ic

RANGE AND PASTURE PRODUCTION

Prepared by: APROSC

RANGE AND PASTURE PRODUCTION

TABLE OF CONTENTS

List of Tables i

List of Appendices iii

I. Survey and Interpretation

A. Introduction 1

B. Ecological Grouping of Range Land 1

C. Growth Indices and Pasture Production 7

D. Feeding Resources 8

E. Livestock Feed Requirements 14

II. Recommended Programs to Increase Fodder Production in RCUP Areas

A. Introduction 17

B. Terms Used in the Program 17

C. Foreage Crop Development 18

D. Pasture Development Program 20

E. National Forest Grazing Management 41

F. Range Management 41

G. Seed Production 46

H. Improved Pasture and Range Management Research and Study . . 48

I. Cost Component 49

J. Project Benefit 50

Bibliography 53

LIST OF TABLES

TABLE		PAGE
1.1	Distribution of Pasture/Range Land in Various Ecological Zones in the RCUP Area	3
1.2	Vegetation Type in Mustang and Myagdi District	4
1.3	Source of Livestock Feed in RCUP Area	8
1.4	Source and Quantity of Livestock Feed in RCUP Area	9
1.5	Feed Availability from Crop Sector	11
1.6	Number of Fodder Trees per Household	12
1.7	Feed Consumption Requirement (TDN m.t.)	15
1.8	Total Feed Available to Livestock Requirement	15
1.9	Feed Available to Livestock Requirement	16
2.1	Area Under Forage Crops	18
2.2	Forage Species Recommended for the Project Area	22
2.3	Area Under Improved Private Pastureland	32
2.4	Area Under Pasture Production on Terrace Walls	34
2.5	Recommended Fodder Trees Species for the Project Area	36
2.6	Area Under Forest Pasture Development	40
2.7	Area Under Pasture Development in Planted Plantation	42
2.8	Distribution of Pasture/Range land in Various Ecological Zones after 15 Years of the Project	43
2.9	Area Under Range Management in Various Catchment Areas	45
2.10	Area Under Range Management in Various Ecological Zones	45
2.11	Seed Requirement for Pasture Development	47

LIST OF TABLES
(continued)

TABLE		PAGE
2.12	Increased Fodder Production with the Project	51
2.13	Total Feed Available to Livestock Requirement with the Project	52

LIST OF APPENDICES

APPENDIX	TITLE	PAGE
1.1	Panchayatwise Pastureland by Altitude in Kulekhani Catchment Area	55
1.2	Panchayatwise Pastureland by Altitude in Daraundi Catchment Area	56
1.3	Panchayatwise Pastureland by Altitude in Kali Gandaki Catchment Area (Myagdi District)	57
1.4	Panchayatwise Pastureland by Altitude in Upper Kali Gandaki Catchment Area (Mustang District)	58
1.5	Source and Quantity of Livestock Feed in Myagdi District	59
1.6	Source and Quantity of Livestock Feed in Daraundi Catchment Area	60
1.7	Source and Quantity of Livestock Feed in Mustang District	61
1.8	TDN Available in Feeding Stuff	62
1.9	Feed Availability - Assumption	63
1.10	Ruminant Livestock and Feed Requirement in The Project Area	64
1.11	Feed Consumption Requirement of Livestock	65
2.1	Area Under Forage Crops in the Project Area	66
2.2	Area under Improved Private Pastureland	67
2.3	Area Under Pasture Production on Terrace Walls	68
2.4	Seed Requirement for Pasture Production	69
2.5	Production Potential of Various Pasture Components	70
2.6 (1.1)	Proposed Pasture Production Program in the Project Area	72
2.6 (1.2)	Cost Involved for Pasture Production Program in the Project Area	73

LIST OF APPENDICES
(continued)

APPENDIX	TITLE	PAGE
2.6 (2.1)	Proposed Pasture Production Program in Kulekhani Catchment Area	75
2.6 (2.2)	Cost Involved for Pasture Production Program in Kulekhani Catchment Area	76
2.6 (3)	Proposed Pasture Production Program and Cost Involved in Daraundi Catchment Area	78-80
2.6 (4)	Proposed Pasture Production Program and Cost Involved in Myagdi District	81-83
2.6 (5)	Pasture Production Program and Cost Involved in Mustang District	84-86
2.7	Cost Calculation for Proposed Projects	87

I. SURVEY AND INTERPRETATION

A. INTRODUCTION

Problems of population pressure, economic resources, sociological factors, the lack of conciousness among the graziers, and the technical knowledge limit the pasture improvement in the project area. Most of the grazing lands laying in the mountainous belt are extensively grazed and have very low carrying capacity. Generally, many of the productive and palatable species of grasses have been either destroyed or greatly reduced in vigour, as a result of too close and haphazard grazing and mishandling for many years. Weed species have gradually replaced the native grass and other palatable species. In most of the shrublands or degenerated forest and barrenland Eupotorium app, non-edible weedy species have rapidly spread and have completely replaced the natural vegetation. The exposed barrenland is subjected to erosion, forming gullies, etc. Depleted pastureland and shrubland have been regarded as the reserve land and are being ploughed-up and put under cultivation when the population pressure and other factors become sufficiently demanding. Shortage of feeding stuff has very much aggravated the livestock production.

Natural grassland is rare in midhills within the project area, with an exception of the Kulekhani catchment area, which seems to be the product of ecosystem brought about by human activities. One at a time, the dense deciduous forest has to woodland, savanah type, with very little palatable grass species as the ground cover. Alpine meadows in the Myagdi and Daraundi catchment area are being utilized for only 4 to 5 months by sheep and goat. The steepe range in Mustang has scattered vegetation and the lowest carrying capacity in the RCUP area. There is little room for grazing in the cropland area and the intensity of the cropping system has left no alternative but to graze in the nearby forest area. Thus, forest has become the only alternative source of pasturing for ruminant livestock in lower and upper midhills up to 3000 m. Under the existing feeding system hardly 52-60% of the total digestible nutrients for ruminant livestock has been met either from pastureland, forest grazing, or cropland area.

B. ECOLOGICAL GROUPING OF RANGE LAND

RCUP area is spread over various ecological zones, from tropical to alpine, and having a wide range of climatic and soil conditions. Environmental factors influence the natural distribution of plant species, their growth, reproduction

and regeneration. A wide range of vegetation and grass species occur in various ecological zones. Distribution of grazing/range land in the various ecological zones in the RCUP project area is shown in Table 1.1 Barrenland and depleted forestland or bushland/shrubland are considered as pasture or rangeland in tropical to warm temperate zones. Panchayat wise distribution of pastureland is presented in Appendix 1.1 to 1.4 Vegetation type in Mustang and Myagdi is illustrated in Table 1.2.

1. Tropical Zone

At an altitude range of 800-1000 m. which is the highest tropical level, the area being very much limited, 3.4% of the total grazing land is in the project area, as shown in Table 1.1. Scattered grazing land in the river valleys and surrounding areas of Daraundi catchment constitute 24.6% of the total available grazing land in Daraundi. In a true sense, there is no pastureland but the degraded forest land as a result of tree felling for fuelwood, followed by continous burning. Burning seems to be accidental in some places but mainly it is done to clear the forest for shifting cultivation. Burning kills most of the seeds and the young plants, leaving little opportunity for natural reseeding and regeneration. Shorea robusta and sub-tropical riverain forests exist in patches. Chrysopogan aciculatus, Dicanthium annulatum, Bothriochloa Partusa, Imperata cylindrica, Paspalum distichum, and Cynodon dactylon are the dominant grass species. Imperata Cylindrica is widely spread, owing to the low fertility level of the rangeland. Legume species are non-existant at this altitude. The most terrific weed, Eupatorium Daratum, is gradually replacing palatable species in the rangeland.

2. Sub-tropical Zone

The lower midhills of the project area, from 1000-13000 m. elevation, constitute 9.2% of the total rangeland in the project area - sub-tropical riverian forest (Alnus nepalensis cedrella toona, Albizzia spp., etc.) to dry forest (Pinus roxburghii). Except in Kulekhani, grazing land is scattered and does not seem to have much openland but the woodland, savannah type. In Kulekhani, there is continuous openland, mostly grass species, giving a first hand impression of climatic vegetation. This is the product of ecosystem brought about by human activities. Rangeland, in this zone, is badly grazed and heavily infested with non-edible weedy species such as Eupatorium adenophorum, bracken fern (pteridium aquilinum), stinging

TABLE 1.1

DISTRIBUTION OF PASTURE/RANGE LAND IN VARIOUS ECOLOGICAL ZONES IN THE RCU PROJECT AREAS

(1979)

(Area in Sq. Km.)

Ecological Zone	CATCHMENT AREA				TOTAL	%
	Kulekhani	Daraundi	Myagdi	Mustang		
1. Tropical Zone (800-1000 m)	-	32.67	-	-	32.67	3.37
2. Sub-tropical zone (1000-1800 m)	8.27	52.23	27.68	0.73	88.91	9.16
3. Warm temperate zone (1800-2450 m)	12.94	9.59	55.34	5.85	83.72	8.63
4. Cool temperate zone (2450-3050 m)	-	2.94	50.32	27.02	80.28	8.27
5. Sub-alpine zone (3050-3950 m)	-	18.99	77.43	74.98	152.40	15.70
6. Alpine zone (3950 m)	-	16.66	75.01	50.09	141.76	14.60
7. Steepe zone (2450-3650 m & above)	-	-	-	389.0	389.0	40.08
TOTAL	21.21	133.08	285.78	547.67	970.64	100.00

TABLE 1.2

VEGETATION TYPE IN MUSTANG AND MYAGDI DISTRICT

LOCATION	VEGETATION
Dand - Lete	Sub-tropical dry forest Pinus roxburghii broad leaved trees - Pine forest (Acer spp.).
Lete - Kukuche	Pine Forest, Pinus excelsa.
Tukuche - Jomsom	Pine-cypress forest (Pinus excelsa cypressus torulosa)
	Open cedar cypress forest (Cedrus deodara cupressus torulosa)
Jomsom - Tillichho	Open juniper forest (Juniperus indica) Alpine meadows on the southern side of the Himalaya: high altitude discontinuous vegetation (cushion plants)
Jomsom - Kagbeni	Open cedar cypress forest Sophora - oxytropis steepe, both the sides of Mustang river (Sophora moorcrofliana oxytropis sericopetala); caragana - Aretemisia steepe (Caragana gerardiana - Aretemisia spp.)
Kagbeni - Muktinath	Caragana - Artemisia - Perenial grass steppe; Caragana - Lonicera - grass steppe (Caragana brevispina - Lonicera spinosa); dry alpine vegetation on the northern side of the Himalaya; high altitude discontinuous forest.
Ghilling - Mustang	Caragana - Artemisia grass steppe; caragana Lonicera grass steppe.
Beni - Rakhu	Sub-tropical riverain forest (Alnus nepalensis - Cedrella toona, Albizzia mollis)
Rakhu - Banduk - Doba -Darmija -Ghatan-Jhee	Sub-tropical dry forest - sub-tropical Wet forest (Castanopsis, indica - Schima wallichii - Engelhardtia, spicata)
Pakhapani - Chimkhola -Kuine Mangale	Quercus Lamellosa forest Rhododendron - oak - tsuga forest (Quercus Semecarpifolia), Rhododendron - fir - birch forest (Ables spectabilis - Betula utilis Rhododendron campanulatum) Alpine meadows on the southern slope of the Himalaya.

*Jest, C. (1965)

nettle (Utrica parviflora), Silver flower (Anaphalis nubegena) and Artimisia vulgaris. Imperata cylindrica, eragrostis spp, setaria pallidefusa, saccharum spontaneum, themeda spp, and cynodon dactylon are the predominant grass species. Legumes are practically absent. Burning of grazing land or the forest land is common. Imperata, the most unpalatable grass species, is spreading rapidly at the cost of other palatable species. Only 20-30% of the rangeland is suitable for grazing, due to heavy weed infestation. There is heavy stocking of cattle, buffalo, and goat, which gives little change for regrowth and regeneration. The carrying capacity is approximately 0.4 LU per hectare.

3. Warm Temperate Zone

Upper midhills range from 1800 to 2450 m in elevation. Rhododendronoak-Tsuga forests are on the southern slopes. Sub-tropical grass species still dominate up to 2500 meter elevation: Chrysopogan aciculatus, Dicanthium annulatum, Sacchrum spp, Imperat cylindrica, Themeda spp, Heteropogan spp, Andropogan spp, ischaemum angustifolium, Isetaria glauca. Poa spp are dominant at comparatively cooler and moist environments. Leguminous species are lacking, with an exception of some native medics of very low productivity. Non-palatable weedy plants such as Eupatorium adenophorum, rumex, etc., are gradually replacing the palatable species. Burning is an annual practice and the stocking rate is very high. This is the main winter grazing area for ruminant livestock. Cattle and buffalo are kept for a longer period in a trans-human system. Mostly depleted forest or scrubland, 30-40% could be considered suitable for grazing. Browse trees are considerably available and are being lopped heavily, mostly fed to animals while grazing. Some is brought to the homestead for barn animals. Carrying capacity is approximately 0.4 LU per hectare.

4. Cool Temperate Zone

Upper midhills ranging from 2450 to 3050 meters in elevation. Grass composition is better and leguminous species, mainly medics, are well spread. Patchy grassland and a pseudo-meadow type could be observed. Poa annun, Phleum alpinum, festuca spp, Arundinella hookeri, Carex spp, Themeda hookeri, Poa alpigena are the main grass species. Burning of grazing land is very common. Oak forest is cut extensively for animal feeding. The stocking rate is very high. This is the main grazing area for cattle and buffalo during summer and winter months. Large ruminants are barned there for most of the time. Sheep and goat graze there on the way to alpine meadows and back. Carrying capacity is approximately 0.6 LU per hectare and 40-50% is suitable for grazing.

5. Sub-alpine Zone

Upper midhills ranging from 3050 to 3650 meters in altitude. This constitute 15.7% of the total grazing land in the project area and 60-70% is suitable for grazing. Limited grazing period of 5-8 months owing to heavy snow during the winter. Cattle, sheep and goat graze in this area during warm months. This area is predominantly grassland, moist most of the time.Burning after the main grazing season and early spring is a common practice. Grass species are more palatable, legumes mainly medics are numerous. Forest is of rhododendrum - fir - birch type. Poa sp phleum alpinum, Festuca spp, (Festuca gigantea), Carex spp, Arundinella spp, Trigonell emodi, Polygonum viviparum are the main palatable species. Annual weed species such as Rumex, Cyathula, Ranuculus, etc., are gradually replacing perennial grasses. Carrying capacity is approximately 0.6 LU per hectare.

6. Alpine Zone

Ranges or meadows above the tree line from 3950 to 4600 meters. Climax vegetation and open grassland. Festuca and Agropyron are the predominant grass species; numerous rhizomatous and bulbiferous herbs are wide spread on moist, deeper soils. These native rangelands are principal grazing areas for sheep and goats from June to September. It seems to be undergrazed and highly productive,having a carrying capacity of approximately 1 LU per hectare. Alpine zone constitutes 14.6% of the total range area. Poisonous weed (Aconitam div. sp.) is common.

7. Steep Zone

North of Jomson in the Mustang district. Spiny dwarf shrubs dominate the vegetation, a climax formation. Vegetation type is presented in Table 1.2. Caragana brevizpina, Caragana gerardina, Artemisia spp, Lonicera spinosa, are the main dwarf shrubs used for grazing plants. Festuca and Agropyron species associated with thorny shrubs are found in negligible proportions. Rainfall is below 200 mm. Evaporation rate seems to be very high, due to continuous dry winds and high solar radiation, resulting in a very little moisture availability to plants. Chyangra (Pashmina goat) is the main grazing animal and the stocking rate is very high. Shrubs are occassionally uprooted and collected for fuel. A quadrant in the rangeland near Kagbeni, on the way to Muktinath, showed 12-22% ground vegetation coverage: 60-80%

Caragana spp., 15-33% Artemisia spp., 1-2% perennial grass species and 3-4% other weed species. Astragalus, a poisonous herb was seen in some places.

8. Grazingland

Grazingland in tropical to cool temperate environments has been developed mainly as a result of agriculture, tree cutting for fuel and fodder, and burning activities by the native population. Over-grazing/stocking and frequent burning have changed the botanical composition, with unpalatable species favored at the expense of palatable. Thus, overstocking of ruminant livestock has resulted in continuous destruction of ground cover. In many places, perennials have been destroyed and replaced by annuals, and where present, are low in vigour. Plant communities have changed to a greater extent from the full forest canopy to the open forest/scrubland/depleted grazing land, resulting in the cultivation of sub-marginal land and, ultimately, are an erosion hazard. Thus, the existing grazingland, if left as such unimproved, will become a barren wilderness. An increase in population, and the decline in the fertility level of cultivated land, has forced the poor farmers to encroach the grazing land to its upper limit. Unmanageable cattle population has left little room for forest regeneration. Due to high cattle population, it is not possible to take out all grazing animals from forests or grazinglands. The alternate solution seems to be the gradual conversion of depleted grazing lands into productive pastures.

C. GROWTH INDICES AND PASTURE PRODUCTION

The moisture index value remains more or less 0.85 to 1 from June to October in tropical to warm temperate zones. This moisture index value seems to be unfavorable for plant growth from December to February. The moisture index value will be less than 0.25 in steepe zones from October to February and will be practically unavailable to plants due to freezing temperatures. There will be a seasonal growth curve for most of the native species. Moisture will be the main limiting factor in winter months for pasture production at lower midhills, and throughout the whole year in Mustang area.

The thermal index value during the winter months in the sub-tropical to warm temperat: belt will not be sufficient for tropical grass species. The light index value will not be the limiting factor in any ecological zone. In lower midhills, sub-tropical grass species and a combination of tropical legumes will provide a good cover during summer months (from March to December) and if the moisture environment is corrected, temperate annual legumes could thrive well during winter months.

A high moisture index will result in higher green matter production from June to October, but at the same time, limit efficient conservation of surplus herbage.

D. FEEDING RESOURCES

Livestock feed is available from cropland areas and forest or grazinglands. Source and quantity of livestock feed in the RCUP area is shows in Table 1.4 and Appendix 1.5 to 1.7 (Panchayat wise).

1. Cropland Area

Cropland area supplies 25% of the total feed, ranging from 10% in Mustang to 48% in Kulekhani Catchment Area. Fodder cultivation is non-existant, although native *Medicago sativa* is occasionally cultivated in Mustang area.

TABLE 1.3

SOURCE OF LIVESTOCK FEED
(% contribution)

Feeding Resources	CATCHMENT AREA			
	Kulekhani	Daraundi	Myagdi	Mustang
1. Cropland Area				
a. Crop residues	17.8	13.8	9.9	2.1
b. Grass & weed	27.7	16.0	7.8	6.9
c. Leaf fodder	1.8	2.1	1.4	0.2
d. Others	0.8	0.9	0.9	0.9
TOTAL	48.1	32.8	20.0	10.0
2. Forest/Pasture				
a. Grass & weeds	-	2.2	3.8	0
b. Leaf fodder	3.7	5.1	4.2	0.2
c. Grazing	48.2	59.9	72.0	89.7
TOTAL	51.9	67.2	80.0	89.9
GRAND TOTAL	100.0	100.0	100.0	100.0

TABLE 1.4

SOURCE AND QUANTITY OF LIVESTOCK FEED IN RCUP AREA

S.No.	Feeding Resources	Av. a/u household TDN Regd. (1)	Total TDN available kg. (2)	% Feed to requirement (3)	% Contribution (4)	Upper Kaligandaki Catchment							
							Myagdi				Mustang		
						(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
1.	Cropland Area												
	a. Crop residues	5.04	672	8.44	13.83	5.26	479	5.76	9.86	7.18	129	1.14	2.13
	b. Grass & weeds	7963	771	9.68	15.87	8313	377	4.54	7.76	11345	420	3.70	6.94
	c. Leaf fodder		104	1.31	2.14		68	0.92	1.40		11	0.10	0.18
	d. Others		46	0.58	0.95		48	0.58	0.98		56	0.49	0.93
	SUBTOTAL		1593	20.01	32.79		972	11.70	20.10		616	5.43	10.18
2.	Forest/Pasture												
	a. Grass & weeds		108	1.36	2.22		185	2.23	3.81		-	-	-
	b. Leaf fodder		249	3.13	5.13		206	2.48	4.24		11	0.10	0.18
	c. Grazing		2908	36.51	59.86		3497	42.07	71.95		5427	47.83	89.64
	SUBTOTAL		3265	41.00	67.21		3888	46.78	80.00		5438	47.93	89.82
GRAND TOTAL			4858	61.01	100.00		4860	58.48	100.0		6054	53.36	100.0

TABLE 1.4 (a)

SOURCE AND QUANTITY OF LIVESTOCK FEED IN RCUP AREA

S. No. Feeding Resources	KULEKHANI CATCHMENT				AVERAGE			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
1. Cropland Area								
a. Crop residues	3.54	647	11.57	17.76	5.26	482	5.80	9.93
b. Grass & weeds	5594	1008	18.02	27.68	8311.	644	7.75	13.28
c. Leaf fodder		67	1.20	1.84		63	0.76	1.30
d. Other		30	0.54	0.82		45	0.54	0.91
SUBTOTAL		1752	31.33	48.10		1234	14.85	25.42
2. Forest/Pasture								
a. Grass & weeds		-	-	-		73	0.88	1.50
b. Leaf fodder		135	2.41	3.71		150	1.80	3.10
c. Grazing		1755	31.37	48.19		3397	40.87	69.98
SUBTOTAL		1890	33.78	51.90		3620	43.55	74.58
GRAND TOTAL		3642	65.11	100.0		4854	58.40	100.0

FEED AVAILABILITY FROM CROP SECTOR
(Area in ha. and total TDN available in m.t.)

	KULEKHANI		DARAUNDI		MYAGDI		MUSTANG		TOTAL FOR RCUP AREA	
	Area	Total TDN Available	Area	Total TDN Available	Area	Total TDN Available	Area	Total TDN Available	Area	Total TDN Available
1. Paddy straw	2143	2087.3	9561	9312.4	1716	1617.4	-	-	13420	13071.1
2. Paddy bran	2143	338.6	9561	1510.6	1716	271.1	-	-	13420	2120.3
3. Maize stover	3904	788.6	13158	2657.9	7030	1420.1	179	36.2	24271	4902.8
4. Maize cob straw	3904	218.6	13158	736.9	7030	393.7	179	10.0	24271	1359.2
5. Wheat straw	1043	79.3	2308	175.4	960	73.0	964	585.2	5275	912.9
6. Wheat bhunsa	1043	98.0	2308	212.4	960	88.3	964	88.7	5275	485.4
7. Wheat bran	1043	38.6	2308	85.4	960	35.5	964	35.6	5275	195.1
8. Millet	1460	743.1	6264	3188.4	1074	546.7	-	-	8798	4478.2
9. Barley straw	52	3.2	495	306.9	1327	82.3	428	210.6	2302	603.0
10. Buckwheat	-	-	-	-	48	3.0	536	33.2	584	36.2
11. Sugarcane	208	15.6	184	13.8	27	2.1	-	-	419	31.5
12. Mustard residue	782	33.6	659	28.3	95	4.4	71	3.10	1607	69.1
13. Mustard cake	782	163.4	659	137.7	95	19.9	71	14.8	1607	335.8
14. Pulse residue	313	53.20	132	22.4	960	163.2	107	18.2	1512	257.0
15. Naked barley residue	-	-	50	30.30	27	16.3	1036	626.8	1113	673.4
16. Grain and others	-	118.0	-	5.0	-	227.0	-	22.0	-	772.0
TOTAL		4777.1		18823.8		4963.7		1684.4		30249.00

a. Crop Residues.

Livestock feed availability from crop sector/crop residues is presented in Table 1.5. Feed Availability - Assumption (Appendix 1.9) is used for calculation of feed availability from crop sectors. Feed availability is shown in TDN values. Rice straw supplies 43% of the total roughages and is fed as such to livestock, mainly buffalo and cattle. Wheat straw is usually not fed to stock and is mainly used for roofing.

b. Grass and Weeds.

Farmers collect annual grasses and weeds from crop fields, bunds, terrace slopes, and roadsides during the main crop season of 120 to 150 days. Generally, such collected green matter is fed only to productive animals, such as milking and draft animals. It is a major contributor (Table 1.3) and provides more TDN than crop residues.

c. Leaf Fodder.

Percentage contribution of leaf fodder from cropland zones is negligible. Farmers generally have fodder trees around the homestead and on the bunds of upland field. These are lopped from the middle of November to April and fed to stock, the major portion of which goes to goat and buffalo. Fodder trees are accidentally grown, although a few farmers have started planting Fiscus species in recent days.

TABLE 1.6

NUMBER OF FODDER TREES/HOUSEHOLD

Description	CATCHMENT AREA			
	Kulekhani	Daraundi	Myagdi	Mustang
1. Average number of fodder trees household	8.5	12.5	7	-
(range)	(6-13)	(8-32)	(3-28)	-
2. Fodder tree production per tree (kg.GM)	28.1	50.4	41.4	-
(range)	(20-60)	(40-60)	(35-50)	-

On an average, 75% of the total households raise ruminant livestock and could plant fodder trees on their unproductive land, bunds, and around the homestead. 25% of the old and unproductive trees have to be gradually replaced.

d. Others

A minor contributor, including kitchen residues, crop biproducts are fed mainly to milch and advance pregnant animals.

2. Forest and Pasture

Forest land and open pasture land shares 52 to 90% of the total available total digestible nutrients, depending upon the catchment area, forest conditions, and the nearness to a village. There seems to be a positive correlation between the number of livestock units and the percentage of dry matter available from the forestland. An increase in livestock units per household increases the dependence on forest grazing. Average livestock units per household ranges from 3.54 to 7.85, the lowest in Kulekhani and the highest in the Mustang area. Under the existing system, 2. to 2.5 livestock units per household with 30% dependence on forestland for their dry matter requirement seems to be manageable from a forest restoration/production point of view.

a. Grass and weeds.

Farmers collect grass and weeds from forest and open grazing land in Daraundi and Myagdi area, depending upon the nearness to the village. Hay making is rare.

b. Leaf fodder.

Major portions of total leaf fodder comes from forestland. Trees are lopped haphazardly and continuous lopping gives no chance for regrowth. In general, leaf fodder production in forestland is one-fifth of that planted or grown in cropland areas, the simple reason being privately owned trees are lopped with due care and the trees in the forest are lopped haphazardly. In most of the places, farmers first lop the trees in forests and then the trees grown in their private land. Lopping of forest fodder trees in Daman and Palung Panchayats (Kulekhani catchment) has been forbidden by the Panchayat authorities and within the last five years trees have grown tremendously.

Regeneration has taken place and it seems to be a good practice to control lopping for 3-5 years on a rotation basis.

c. Grazing.

Grazing in open barrenland, scrub, and forest land in lower and upper midhills provides 48 to 90% of the total TDN, depending upon the catchment areas. The daily green matter availability per livestock unit from grazing land is estimated to be 15 kg/day from May to October and 8 kg/day from November to April. In the Alpine zone, it is 25 kg GM/day/LU during the main lush season. However, with an exception of sub-alpine to alpine grazing, quality of total available forage/roughage is very poor. At least 7-9% protein in total feeds is essential for effective maintenance and milk production, whereas under the prevailing system, 4-5% is estimated to be available. It is quite obvious that open pasture land or forest grazing in midhills has become the loitering place for the ruminant livestock. Thus the herbaceous vegetation lacks productivity and nutritive value. The overall feeding resources in the hills are not adequate to support the existing ruminant livestock population. A sharp decline in the productivity and the fertility of the grazing animals is taking place under current practices.

E. LIVESTOCK FEED REQUIREMENTS

Under the existing system, the percentage of feed available for requirements ranges from 53.4 to 65.1 percent in the project area (Table 1.8).

Feed consumption requirements for the existing grazing animals has been calculated based on certain assumptions (Appendix 1.11) and set out in Table 1.7.

a. Average livestock units per household has been calculated from the household survey. Their TDN requirements and availability are presented in Table 1.9.

TABLE 1.7

FEED CONSUMPTION REQUIREMENTS (TDN mt)

Kind of Livestock	CATCHMENT AREA				TOTAL
	Kulekhani	Daraundi	Myagdi	Mustang[1/]	
1. Buffalo	5,170.3	28,821.5	16,550.8	-	50,542.6
2. Cattle	11,748.5	66,718.6	17,644.2	4,668.3	100,779.6
3. Goat	4,104.0	12,801.0	2,610.0	2,348.9	21,863.9
4. Sheep	-	1,161.6	1,363.2	205.2	2,730.0
5. Horse & Mules	-	-	-	1,166.2	1,166.2
TOTAL	21,022.8	109,502.7	38,168.2	8,388.6	177,082.3

1/ Excluding 6 panchayats North To Jomson.

TABLE 1.8

TOTAL FEED AVAILABLE TO LIVESTOCK REQUIREMENT

Items	CATCHMENT AREA				TOTAL
	Kulekhani	Daraundi	Myagdi	Mustang	
1. Livestock requirement[1/]	21,023	109,503	38,168	8,389	177,083
2. Feed available for utilization[1/]	13,686	66,767	22,328	4,480	107,261
3. % feed to requirement	65.1	61.0	58.5	53.4	

1/ TDN in m.t.

TABLE 1.9

FEED AVAILABLE TO LIVESTOCK REQUIREMENT

Items	CATCHMENT AREA				MEAN
	Kulekhani	Daraundi	Myagdi	Mustang	
1. Average animal unit/household	3.54	5.04	5.26	7.18	5.26
2. TDN requirements (kg.)	5594	7963	8313	11345	8311
3. Total TDN available (kg.)	3642	4858	4860	6054	4854
4. % feed to requirement	65.1	61.0	58.5	53.4	58.4

With an increase in livestock population, feed requirements will have an annual increase of 2.1%, whereas feed availability will decline at an estimated rate of 1.25% annually due to overgrazing, mishandling of grazing lands, elimination of browse trees in forest and various other factors. This sector needs immediate attention, otherwise there will be a further devastation in natural resources, and if not controlled in time, will lead to a complete deterioration of forest resources.

II. RECOMMENDED PROGRAMS TO INCREASE FODDER PRODUCTION IN RCUP AREAS

A. INTRODUCTION

In the project area, production potential per livestock unit is in continuous decline, the main reason being limited feeding resources. Improper and overgrazing has caused an immense loss of preferred species; unpalatable and weedy species have taken over the grazing land. Depleted grazing land has caused increased soil erosion and ultimately invironmental degradation. Thus pasture development and range management will have a positive effect on soil fertility, forage resources for livestock production, and the stability of the farming system. With the project, the percentage of feed available in proportion to the requirement will increase from the present level of 58% to at least 90% by the end of the project period. This will sufficiently increase the production potentiality of native and crossbred livestock in terms of meat, milk and wool. Furthermore, this will help decrease the encroachment of the forest by livestock and will protect the watersheds and conserve soil and water. The proposed means of increasing feeding resources have been described in detail. Considerable emphasis has been given to improved pasture production and range management. Varification studies on pasture and range management will help to launch a full-scale program. Seed multiplication will be primarily done in pasture research and production units. Farmers will be motivated to produce seeds and will be provided a good price.

B. TERMS USED IN THE PROGRAM

Range is considered to be any naturally vegetated and (usually) unfenced land in areas grazed by domestic livestock and game animals.

Range Management is the art of securing maximum sustained use of natural forage crops without serious damage to other resources. Range management will include deferred rotation grazing, revegetation to increase ground cover to a satisfactory level, control of weeds and non-forage species, forage improvement through partial reseeding with grass and legume species, provision of drinking water for grazing animals, and partial fencing of the range.

Pasture refers to any improved, fertilized and partially fenced grazing lands in favorable environmental conditions which are seeded with domesticated forage plants.

Improved pastures will generally be hand-harvested, and partial grazing will be allowed at certain stages of plant growth. Pasture management will include rest rotation grazing, reseeding, fertilizing and the removal of non-forage plants.

Deferred rotation grazing is discontinuous grazing on various parts of range of pasture in suceeding years.

Rest rotation grazing is discontinuous grazing on one part of a range or pasture for an entire year or longer.

Steepe is the rangeland in upper Mustang area.

C. FORAGE CROP DEVELOPMENT

Farmers generally have a mixture of upland and low land, indicating a diversification of the cropping system. Most of the cultivated land remains unused after the main crop harvest. Annual forage crops, both grass and legume species, will be included in the projected cropping sequence.

Approximately 5% of the total cultivated land in the project area, excluding the Mustang district, could be put under various summer and winter forage crops. In Mustang, 2.5% of the total cultivated land is estimated to be under leguminuous forage crops, mainly Medicago spp. Phasing areas to be under forages crops in the catchment areas and the sub-centers is presented in Appendix 2.1. The adoption rate is assumed to be 20% in the first five years and then 40-60% in the second and third five years respectively.

Seeds of summer and winter forage crops will be made available to farmers at 50% subsidized rate during the plan period.

TABLE 2.1

AREA UNDER FORAGE CROPS

tchment ea	First Five Years						2nd Five Year	3rd Five Year	Total
	1	2	3	4	5	Total			
ilekhani	0.8	4.7	7.4	18.5	33.8	65.2	131.6	177.2	374
raundi	0.6	4.7	11.9	22.6	56.1	95.9	470.8	882.3	1449
agdi	0.7	4.2	8.5	21.1	36.4	70.9	208.7	395.4	675
istang	0.1	0.6	0.9	1.8	3.8	7.2	32.4	56.4	96
TAL	0.2	14.2	28.7	64.0	130.1	239.2	843.5	1511.3	2594

1. Introduction of forage crops

a. Annual forage crops such as teosinte, Sudan Pennisetum pedicillatum, Sorghum spp, together with suitable legumes, such as annual species of stylosanthes, will be introduced during the summer season. These can be grown as rainfed crops in maize or millet fields. Forage produced during the rainy season could be hand-harvested and fed to livestock or conserved in the form of hay or silage and fed during the lean periods.

b. Forage production after main crop harvest.

After the rice harvest, 30-40% of the cultivable land is fallow. This land could be used by sowing legumes such as Trifolium alexandrinum, vetches, etc., in the standing rice crop. At least one to two cuts could be taken without irrigation. Oat can be successfully grown after rice harvest. In Kulikhani Catchment (Palung, Tistung and Sikharkot area), land is generally unused between rice harvest and potato seeding and could be better utilized for oat cultivation. Immediately after rice harvest, oat associated with vetches or peas could be sown and two to three cuttings could be taken before land preparation for potato seeding. This will lead to a better utilization of unused land and produce forage for livestock during the main period of scarcity.

c. Inter-cropping.

Teosinte, Sorghum spp. and Pennioetum pedicillatum could be inter-cropped with maize and millet and could be harvested for forage before competing with the main crops. A hedge legume such as lencaena could be interplanted in rows in maize fields which would not only supply forage of high quality but also increase the maize yield and decrease soil erosion. Leucaena, as a hedge or fodder shrub, should be planted only in tropical environmenta.

d. Introduction of dual purpose crops.

Soyabean, Phaseolus spp, and Vigna spp, are the main leguminous crops generally grown with maize during summer. Selected and improved varieties could be grown which could result in a higher grain yield as well as forage of high quality.

e. With the provision of irrigation, leguminous and high yield forage crops could be included in the projected cropping system. In the irrigated area, perennial forage crops such as Nepier + annual legumes during summer followed by Berseem + Brassica in the same standing crop can be

grown. This forage cropping system could have a carrying capacity of 6-8 milch buffalos per hectare in tropical and sub-tropical zones. Napier can be grown as a rainfed crop in patches close to barns and homesteads.

2. Crop Residues Improvement

Rice straw, millet straw and other crop residues alone are not adequate to maintain animals. Crop residues supply at least one-third of the roughage for animals in the RCUP area. The Crude Protein content of paddy straw is less than 3% and the total digestible nutrient ranges 40-44%. Urea and molasses treatment increases digestibility, nutritive value and voluntary intake. This can increase fodder efficiency by 30-40%. This program will be launched in selected areas (dairy development pockets) in the first five year period and later extended to other areas.

D. PASTURE DEVELOPMENT PROGRAM

A pasture development program will be carried out, as per the projected land use pattern, with the objective of producing sufficient forage for the livestock and better utilization of land. Because the native species are low in nutritive value, low yielding, seasonal in growth pattern and less utilized, the pasture development program will be based upon the replacement of native species with sown pasture of introduced grasses and legumes.

1. Choice of Species

RCUP covers various ecological zones, from tropical (800/1000m) to alpine (9000m and above). The suitable species for the corresponding ecological zones will be selected. However, species of tropical origin could be successfully grown from tropical to warm temperate environments up to 2450 m altitude. Temperate grass and legume species can be extensively used in cool temperate and sub-alpine zone. *Paspalum dilatatum*, *Pennesetum clandestinum*, *setaria* spp and other grass species having a wide range of tolerance to varied temperature and moisture environments will be preferred. Fast growing perennial legume species will be preferred since these not only supply considerable quantities of nitrogen and maintain soil fertility but also protect the soil from the erosive effects of heavy rainfall.

Recommended legume species for various ecological zones are:

1. Tropical to sub-tropical zone (800 to 1800 m altitude)	Legume species of equatorial group viz. calapogonium spp, cemtrosema spp, puerasia spp, glycine spp, etc.
2. Sub-tropical to warm temperate zone (1000 to 2450 m altitude)	Legume species with wide latitudinal range viz. stylosanthes spp., Phaseolus spp., Desmodium spp., Melilotus spp., Lupinus spp., Medicago spp.
3. Warm temperate to sub-alpine zone (1800 to 3950 m altitude)	Tropical species such as Desmodium, Phaseolue, stylosanthes, etc., and temperate species such as Trifolium repens, Trifolium Pratense, Trifolium subterraneum, Trifolium fragiferum, etc.

A list of recommended grass and legume species is presented in Table 2.2.

However, the selection of suitable grass species will depend mainly upon their uses. A stoloniferons and rhizomatons grass species with low fertility requirement for growth is ideal for soil conservation purposes. On the other hand a combination of highly productive grasses and legumes will be preferred for areas used for livestock production.

2. Pasture Establishment

Pastures will be established either by direct sowing of seeds with minimum cultivation techniques, or by transplanting rooted materials or seedlings, depending upon the locations and seed treatments. Reseeding or direct sowing is the standard method that will be adopted in the establishment of private pastureland and forest pasture. However, seedlings or planting materials will be used for pasture development on terrace walls. Sowing techniques will be site-specific, depending upon the herbacesous layer present in the grassland, slope, and season.

3. Management and Utilization

Management of such improved pastureland will include reseeding; uprooting weedy, poisonous and non-forage plants; partial fertilizing, mainly with phosphate; and deferred and rest rotation grazing. Improved pasture will be generally hand-harvested and the excess green matter produced during the main season will be conserved in the form of hay.

Proper grazing of pastureland is essential and will depend on the site location and the growth behavior of the species. Grazing will be controlled at the time of seed setting and seed ripening. For the first four or five years of pasture establishment, rest rotation grazing will

TABLE 2.2

FORAGE SPECIES RECOMMENDED FOR THE PROJECT AREA

pecies	Adaptability	Source
Tropical Grass species perenial		
1. Brachiaria decumbens (Signal grass)	Suitable for humid areas, good association with stylosanthes gracilis, steep hill side shady areas, up to 1200 m.	Australia, USA
2. Brachiria ruziaiensis (congo signal grass)	Moderately winter resistant, humid areas up to 1200 m.	Australia
3. Cenchrus Ciliaris (Buffel grass) (cvr. molopo, Biloela etc.)	Highly drought resistant, light soil Semi arid region, up to 1000 m.	Australia India
4. Chloris Gavana (Rhodes grass cv. pioneer)	Very resistant to drought loam soil to heavy days, moderately frost resistant up to 1800 m.	Australia
5. Digitaria, decumbens (Pangola grass)	Lighter soils in high rainfall, moderately susceptible to frosts, very growth resistant to droughts, aggressive growth less viable seed up to 2000m.	Australia USA
6. Melinis minutiflora (molasses grass)	Well drained soil, good vegetation cover on dry steep slopes, fairly drought resistant, resistant to light frosts, up to 2000 m.	USA
7. Panicum maximum (Guinea grass cv. Hamil coloniao, gatton)	Shade tolerant, drought resistant, tolerate acid condition on slope, satisfactory winter resistance, up to 1800 m.	Australia
8. Panicum maximum (Var trichoglume green panic)	Tolerant of shading, tolerant to light frosts, humid wet-dry condition, fertile soil, up to 1500 m.	Australia USA
9. Panicum coloratum (Makarikari grass) var. pollock burnett	Heavy clay soils, some tolerance to salinity drought tolerant, up to 1000 m.	Australia
10. Paspalum dilatatum (Dallis grass)	Wide range of environmental condition, resistant to moderate frost, withstands drought, moist heavy soil, 500-2200 m.	Pokhara

TABLE 2.2

(continued)

ecies	Adaptability	Source
11. Paspalum notatum (Bahia grass)	Humid sub-tropics, withstand considerable drought, best suited to sandy soil, moderately frost resistant, up to 1800 m.	USA Australia
12. Paspalum commersoni (scrobic grass)	Sub-tropics, moist soil, sensitive to soil nutrients, moderately winter resistance, up to 1500 m.	USA Australia
13. Pennisetum clandestinum (Kikuyu grass)	Moist soil types, sandy to loamy soil, moderately frost resistant, withstand long dry periods, wider range of adaptability, up to 2000 m.	Australia
14. Pennisetum purporeum (Napier)	Heavy moist soil, sensitive to soil fertility and moisture, best suited to replace native sachrum spp., up to 2000 m.	Nepal/India
15. Setaria anceps (setaria grass) cv. Narok Kazungula Nandi	Most types of soil, very drought resistant, extreme range of moisture environment, moderately winter resistance, up to 2000 m.	Australia
16. Setaria sphacelate (Golden timothy)	Withstand considerable periods of drought, humid sub-tropical, up to 2000 m.	Australia
17. Dicanthium annutatum (Marval) cv. IGFRI selections	Tropical to sub-tropical summer rain fall areas, drought resistant, light soil, up to 1500 m.	India
18. Dicanthium caricosum (Nandi blue grass) IGFRI selections	Moderately drought resistant same as D. Annulatum.	India
19. Eragrostis curvula (weeping lone grass)	Very drought resistant, semi-arid to humid sub-tropical, wide range of well drained soil, up to 2000 m.	U.K.
20. Urochloa mosambicensis (Sabi grass)	Humid sub-tropical, mat forming, up to 1500 m.	
21. Sorghum almum (columbus grass)	Wide variety of soils, sensitive to nutrients, best associated with legumes, humid sub-tropics, up to 1800 m.	Australia
22. Chrysopogan montanus	Humid tropic and sub-tropics, sensitive to frost wide variety of soils, up to 1200 m.	India

TABLE 2.2

(continued)

ecies	Adaptability	Source
Tropical Grass Species Annuals		
23. Sorghum sudanense (Sudan grass)	Wide range of adaptation, very drought resistant, sandy to heavy clay soils up to 1500 m.	India
24. Sorghum vulgare (Sorghum grass)	Withstand long periods of drought and hot, humid tropics responsive to high soil fertility, up to 1500 m.	India
25. Sorghum bicolor (Chari grass)	Arid to semi-arid regions, clay loam to sandy loam, up to 1500 m.	India
26. Euchlaena maxicana (Tusinte grass)	Humid tropics and sub-tropics, rich moist soils, up to 1500 m.	India, Nepal USA
27. Pennisetum pedicillatum (IGFRI selections)	Humid tropics and sub-tropics, well drained soils, up to 1200 m.	India, Pokhara
Temperate Species Perennial		
1. Agrophyron cristatum (Crested wheat grass var. Fairway)	Semi-arid steppe and a wide range of soils, very resistant to drought and low temperature, suitable for Mustang, 2500-4000 m.	USA
2. Agrophron desertorum (desert wheat grass)	Very resistant to intense cold and drought, well drained medium texture soils, 200-300mm. rainfall, suitable for Mustang, 2800-4000 m.	USA
3. Agrophyron trachycaulum (slender wheat grass) var. primar	Well drained sandy loams, tolerant of alkaline condition, drought and cold resistant, 250-400 mm. rainfall.	USA
4. Agrophyron sibiricum (Sibiricum wheat grass)	Cold tolerant, 250-300 mm. rainfall, suited to steppe conditions.	USA
5. Agrostis stolonifera (Creeping bent grass)	Humid temperate, resistant to cold, wide range of soil conditions, 2000-2500 m.	USA
6. Alopecurus Pratensis (Meadow fox tail)	Cool moist temperate climates, resistant to cold, shade tolerant, deep moist fertile soils, withstand high summer temperature, 1800-2500 m.	USA
7. Avena elatior (Tall oat grass)	Well drained soil, moderate cold resistant, sensitive to acid soils, 1800-2200 m.	USA

TABLE 2.2

(continued)

ecies	Adaptability	Source
8. Bronus Catharticus (Praitie grass) var. prieb's perennial	Warm temperate region, moist fertile soils, 2000-2500 m.	USA
9. Dactylus glomerate (Cocks foot)	Wide range of soils, medium moisture and fertility conditions, shade tolerant, humid temperate, drought resistant and withstands high temperatures, long growing season, 1600-2400 m.	
10. Ehrharta Calycina (Perennial veldt grass)	Light soils of moderately low fertility, drought resistant, 350-700 mm. rainfall.	Australia
11. Elymus Junceus (Russian wild rye)	Cold resistant, long growing season, suitable for irrigable pasture in Mustang, 2800-4000 m.	USA
12. Festuca arundinacea (Tall fescue) var. demoter, Alta (Avs), S 170 (UK)	Cool moist temperate climate, wet soil, cold resistant, 2500-3000 m. Var. S 170, 1800-2500 m. (Var Demeter, Alta)	UK, Australia
13. Festuca Ovina (Sheep's fescue) var. Durar, duriuscula, also local selections	Very resistant to cold and drought, suitable for Mustang steppe zone, 350-500 mm. rainfall.	USA
14. Festuca pratensis (meadow fescue)	Wet soils, sensitive to fertility and moisture, 2500-3500 m.	UK
15. Festuca rubra (Red fescue) var. S 59	Dry and moist pasture, poor dry soils upland, withstand close grazing, 3000-4000 m.	UK
16. Lolium perenue (perennial ryegrass) var. victorian, medea, Tasdale Var. S 23, S 24	Milk humid temperate climate, moderately drought and cold resistant, sensitive to moisture, heavy rich moist soil, 1500-3000 m. fairly cold resistant, 2000-3500 m.	Australia, UK
17. Lolium Parennex-multiflorum (Hybrid Ryegrass)	Same as L. Perenne, persist under suitable environmental conditions for up to 5 years.	NZ/Australia/ Nepal
18. Phalaris tuberosa (Toowoomba canary grass) var. Australia, Siroco, Siro Seed master	Wide range of soil types, light to rich loams, extreme moisture and temperature environment, wide tolerance of ph values, 1200-2500 m.	Australia

TABLE 2.2

(continued)

›ecies	Adaptability	Source
19. Phleum Pratense (Timothy grass)	Cool moist-temperate climate heavy deep moist soil, 1800-3000.	UK
20. Poa ampla (Big blue grass) Var. Sherman	Drought and cold resistant, 2500-3500.	USA
21. Poa pratensis (Kentucky Blue Grass)	Humid cool regions, sandy to loamy soils, moist soil, 2500-3500 m.	UK
22. Poa trivalis (Meadow grass)	Partial shade tolerant, cool moist climate, deep rich moist soils, 3000-3500 m.	UK
Temperate Species Annuals		
23. Avena sativa (Oat)	Winter fodder crop, highly responsive to nitrogen and moisture, wide range of soil condition.	Nepal/India
24. Hordeum vulgare (Barley)	Poor soils, suitable for cool temperate environment, 2500-3200 m.	USA/Australia
25. Lolium multiflorum (Italian ryegrass)	Humid sub-tropical or warm temperate zone, moist well drained fertile soils, 1200-2500 m.	USA/Australia
Tropical Legume Species Perennial		
1. Alysicarpus rugosus	Humid sub-tropics, fairly persistent, up to 1400 m.	Australia
2. Calopogonium mucunoides (Calopo)	Equitorial group, hotter, wetter sub-tropics frost sensitive, wet conditions, up to 200 m., wide range of soil textures, pH. 4.5-5, excellent ability to compete with weeds.	Australia
3. Canavalia ensiformis (Sword bean)	Hardy drought resistant annual, up to 1000 m., equitorial group.	Australia
4. Centrosema Puescens (Centro)	Equitorial group, moist conditions with 25-30°C, winter dormancy, frost sensitive, fairly drought tolerant, sandy loams to clays, pH 4.9 to 5.5, up to 800m, shade tolerant.	

TABLE 2.2

(continued)

ies	Adaptability	Source
5. Clitoria tornatea (Butterfly Pea)	Wide range of soil conditions, some tolerance to salinity, low frost tolerance, fairly drought tolerant, up to 1800 m.	Australia
6. Desmodium battbatum (Barbadinho)	Tolerant of cold, stands grazing fire and trampling, up to 800m.	Australia
7. Desmodium canum (Pega Pega)	Sandy to light clay soil, pH 4.0 to 8.0 low fertility soils, wet sub-tropics, 1500 mm to 3000 m. rainfall, up to 1700 m., fairly tolerant of frost, good for soil conservation, stands heavy grazing, little tolerance to fire, shade tolerant.	Australia/ Brazil
8. Desmodium heterocarpas (Syn. D. Ovalfolium)	Poor soils, drought-resistant, thrive under dense shade, up to 1500 m.	Hawaii (USA)
9. Desmodium heterophyllum (Hetero)	Wide range of soil conditions, pH 4.5-5.0, moist condition, 1500 mm. to 4000 mm. rainfall, drought tolerant, up to 900 m. shade tolerant.	Australia
10. Desmondium intortum (Green leaf desmodium) cv. Greenleaf	Light to clay loams, pH over 5.0, humid climate, high rainfall, moderately drought resistant, better on slopes, susceptibility to heavy frosts, 600-2000 m, best associated with pasture grass.	Australia
.1. Galactia striata (Frijolilo)	Deep latosolic soil, up to 1500 m.	Brazil
.2. Glycine wightii (Glucine) cv. Tinaroo, clarence, cooper	Deep fairly drained soil, pH 6-7, 1000-1500 mm. rainfall, reasonably drought to learnt moderately frost tolerant, up to 220 m, can supress weeds.	Australia
.3. Lablab purpurens	Deep sands to heavy clays, pH 5-0 to 7.5, moderate rain, below 2500 mm, drought, up to 1500 m, intercropped with maize.	Australia
.4. Lotononis bainesii (Lotononis)	Moist conditions and loose textured soils, pH 4.0-6.0, fairly drought tolerant, 1125 to 1625 mm rainfall, wide latitudinal range, equite frost tolerant, sensitive to light, up to 1500 m.	Australia
.5. Macroptilium alropurpioreum (Siratro)	Deep sandy loams and light clays, pH 4.5 to 8.0, 600 mm to 1500 mm rainfall, winter resistance, up to 1600 m, extremely drought-tolerant, competes with weeds.	Australia

TABLE 2.2

(continued)

ecies		Adaptability	Source
16.	Macrotyloma axillaris (Archer)	PH. over 5.5, humed sub-tropics, up to 1200 m, drought tolerant.	Australia
17.	Mucung Pruriens (Velvet Bean)	Sands to clays, acid tolerant humid sub-tropics, frost sensitive, up to 1800 m, good cover crop.	Australia
18.	Pueraria phaseoloides (Puero)	Hot humid and high rainfall conditions, wide range of soils, pH 4-5, frost sensitive, drought sensitive, up to 1200 m., tolerant of partial shading.	Australia
19.	Pueraria thun bergiana (Kudza)	Poor soils, drought tolerant, humid tropics to sub-tropics, up to 1000 m.	Australia
20.	Stylosanthes guianensis (cv. oxley five stem.)	Sands and sandy loams, pH 6.5 to 6.7, up to 1500 mm. rainfall, drought tolerant, some degree of frost tolerance, up to 1000 m, shade sensitive, can supress weeds.	Australia
21.	Stylosanthes guinneusis (cv. oxley fine stem) cv. coolk cv. Endeavour	Sands and sandy loams, pH. 6.5 to 6.7, up to 1500 mm rainfall, drought tolerant, some degree of frost tolerance, up to 1000 m. shade sensitive, can supress weed, high rainfall, good winter resistance, long growing season, up to 1800 m. High rainfall, sub-tropics up to 1500 m. early growing.	Australia
22.	Vigha hosei (Vigna)	High rainfall over 2500 mm., wide range of of soil conditions, pH 4.9 or less, humid tropics, up to 1200 m.	Australia
23.	Terumnus uncinatus	Humid sub-tropics, some drought and cold tolerance, low fertility requirement, up to 1500 m.	Australia/ Brazil
24.	Trifolium Semipilosum (Kenya white clover)	Humid sub-tropics, drought resistant, up to 1500 m.	Australia
Tropical Legume Species Annuals			
25.	Cyamopsis tolra gonaboba (Clusterbean)	Semi-arid regions, drought resistant, humid sub-tropics, sandy loam, up to 1200 m.	India

TABLE 2.2

(continued)

›ecies	Adaptability	Source
26. Macroptilium lathyroides (Phasey bean)	Wide range of soil conditions, tolerant to saline conditions, humid sub-tropics, up to 1500 m., best suited to road slopes.	Australia
27. Macro tyloma uniflorum (Leichhardt)	pH 6.0 to 7.5, humid sub-tropics, up to 1000 m, drought tolerant.	Australia
28. Stylosanthes humilis (Tononsuille stylo)	Sandy to sandy loams, pH 4.5-5, 635 to 2500 mm rainfall, susceptible to high water table, drought resistant, up to 1500 m.	Australia
29. Vigna radiatia	Humid sub-tropics, up to 1800 m.	India/Australi.
30. Vigna unguiculata (cow pea)	Wide range of soil conditions and pH medium rainfall 750 to 1000 mm, up to 1500 m, moderate shade tolerant.	India
Temperate Legume Species		
1. Medicago sativa (Lucern)	Low rainfall areas, drought resistant moderately fertile soils, neutral to slightly alkaline conditions, high degree of salt to lesance.	USA/India Australia
cv. Ladak, ranger, nomad.	Suitable for Mustant area, 2500-3500 m.	
cv. Humter, river cancreep	Suitable for warm temperate.	
2. Medicago falcata spp. (Edge worthii (Sickle medic, kote)	Naturalized species in Mustang, cultivated zone.	Nepal(Mustant)
3. Trifolium hybridum (Alsike clover)	Cool moist soil, suitable for cool temperate to sub-alpine zones, 3000-4000m.	UK/USA
4. T. Repens (White clover)	Soils of high fertility, wide range of soil condition, moisture sensitive, 1200-3500 m,. Can establish rapidly on acid soils, high rainfall, fertility requirement 2300-3800 m, moist soils warm to temperate zone.	Australia UK
cv. Grasslands Huia irrigation		
cv. Sivo, 5184, Kensey kent		
cv. Ladino	Excellent ground cover, good for soil conservation, tolerates wetter conditions, 1500-2500 m.	Australia

TABLE 2.2

(continued)

ecies	Adaptability	Source
5. Trifolium fragiferum (Strawberry clover) cv. palestine	Withstands wetter and drier conditions than white colver, moderately resistant to drought, good tolerance of saline conditions and low soil fertility, wide range of pH but no less than 5.5.	Australia/USA
6. Trifolium paratente (Red clover) cv. Grassland hamna Turoa	Persist in hotter weather and lower soil moisture same as white clover.	Australia/ UK/USA
Temperate Legume Species Annuals		
7. Lupinus lutens (Yellow lupin)	Moderately acid, light sandy soils of low fertility, cool weather, sensitive to high rainfall.	USA
8. Lupinus angustifolius (Blue lupin)	Neutral, or slightly acid soils, moderate fertility, summer annuals at warm to cool temerates and winter annuals at sub-tropical.	USA
9. Medicago truncatula (Barrel medic) cv. Hannaford, Borung cyfield	Winter rainfall areas 250-500 mm., sub-tropical zone, up to 1500 m.	Australia
10. Mililotus alba (Bokhara clover)	Withstands cool environment, siutable for watm temperate zone, up to 2000 m.	UK
11. Mulilotus India (Sweet clover)	Sandy soils, winter months at lower midhills up to 1200 m.	India/USA
12. Pisum sativa (Pea)	Associated with outs, up to 2000 m.	Nepal
13. Trifolium sub-terranenw (Sub-terraueum clover) cv. Tallarook, Howard	Low rainfall 500-1000 mm., hot dry summers. Short growing season at upper midhills during summer, winter component at lower midhills.	Australia
14. Trifolium incartum (Crimson clover)	Higher rainfall conditions of the temperate zone, slightly acidic soil condition, sensitive to high allcalinity, well drained sandy loams to clays, susceptible to wet soil condition, suited to slopes, up to 200 m.	Australia/ USA

TABLE 2.2

(continued)

ies		Adaptability	Source
15.	Trifolium alexandrinum	Grown in winter, up to 1500 m., wide range of soil conditions and pH, moisture sensitive.	India
16.	Vicia sativa (common vetch)	Best associated with oats as winter component, up to 2000 m.	UK

be allowed as this will ensure natural reseeding and will even spread the sown species. Renovation of pasture in sub-tropical and warm temperate environments is commonly required, as most of the tropical species show signs of deterioration after 4-5 years.

4. Improved Private Pasture Development

Sub-marginal cultivated land will be transformed into productive pastureland. Millets, maize and buckwheat are grown in sub-marginal and steepy slopes and the return is generally negligible. This faulty cultivation also causes the removal of top soil loss and increases in erosion. Cultivated land requiring intensive soil conservation practices will be immediately put into private pastureland. Nearly 5% of such land in the project area will be put under pasture development during the project period. Phasing of the land in the various catchments and sub-centers (villages) is shown in Appendix 2.2. (The adoption rate assumed to be 20% in the first five years and 55% at the end of second five year period.) Seeds and phosphate fertilizer will be provided to farmers free of cost. There will be a provision for compensation to farmers for pasture establishment in their fields: Rs. 1200/ha during first five years and Rs. 800/ha. and Rs. 600/ha during second and third five year periods respectively.

TABLE 2.3

AREA UNDER IMPROVED PRIVATE PASTURELAND
(Area in hectares)

Catchment Area	First Five Years						2nd Five Year	3rd Five Year	TOTAL
	1	2	3	4	5	Total			
Kulekhani	-	4.0	14.0	28.5	47.0	93.5	97.0	116.5	307.0
Daraundi	-	2.5	11.5	28.5	56.7	99.0	821.5	816.5	1737.0
Kaligandaki:									
Myagdi	-	2.5	10.0	17.0	31.0	60.5	360.5	390.0	811.0
Mustang	-	-	2.3	8.5	14.0	24.8	75.2	85.0	185.0
TOTAL	-	9	38	82	149	278	1354	1408	3040

a. The Growth index value will be optimum for tropical pasture and legume species from June thru October in the sub-tropical to warm temperate ecological zones. Highly productive grass and legume species will be sown and fertilized with phosphates. In upper midhill areas such as Barpark, temperate grass species with suitable clover combinations will be sown. Herbage will be hand-harvested and the excess will be conserved as hay. A dry matter yield of 7-11 mt/ha for temperate species has been reported in the Trishuli Watershed area and 7-9 mt. for sub-tropical grass species at the Pokhara livestock farm. In marginal land, legume species will be preferably sown, grazed or hand-harvested for 2-3 years and then cropped again. This will work as a soil renovating system and the crop yield will increase considerably.

In spite of the high yields of forage and the increase in fertility level of the soil, it will be difficult to convince farmers to adopt these practices. Farmers may initially resist, but the proposed compensation and the availability of forage will accelerate this program over a period of time.

5. Improved Pasture Development on Terrace Risers and Bunds

The practice of chopping the terrace risers to use the chopped material as organic matter is prevalent throughout the whole RCUP area although the chopping intensity differs from place to place. However, farmers utilize terrace walls and bunds for forage production. This will mainly be hand-harvested. Pasture development program on these areas will result in a higher herbage production.

Up to 24% of the cultivated land is reported to consist of terrace walls in the Trishuli Watershed area. In the RCUP area about 15% of the cultivated terrace land is estimated to consist of terrace bunds and risers. Terrace land is estimated to be 50% of the total cultivated land; 75% of the terrace risers and bunds are assumed to be suitable for forage production and 40% of the terrace walls and bunds could be put under improved forage production during the project period. Altogether, 3% of the total cultivated land in the project area will be put under forage. The phasing of the area in various catchments and sub-centers is presented in Appendix 2.3. The adoption rate is expected to be much higher than other pasture development program.

TABLE 2.4

AREA UNDER PASTURE PRODUCTION ON TERRACE WALLS
(Area in hectares)

CATCHMENT AREA	First Five Years						2nd Five Year	3rd Five Year	Total
	1	2	3	4	5	Total			
Kulekhani	-	0.5	3.3	7.4	14.4	25.6	106.8	133.1	265.5
Daraundi	-	0.4	3.3	11.4	28.9	44.0	447	491.	982.2
Kaligandaki									
Myagdi	-	0.6	2.3	8.1	18.6	29.6	244.5	276.3	550.4
Mustang	-	0.5	2.5	4.1	8.2	15.3	36.6	52.0	103.9
TOTAL	-	2	11.3	31.0	70.1	114.4	834.9	952.2	1902.

Grass species such as setaris, Panicum, Chloris, Eragrostis, Dicanthium, etc, and legumes species such as Stylosanthes, and Desmodium will be planted. Seedlings or planting materials will be raised in livestock centers/sub-centers/nurseries and distributed to farmers free of cost. Under good management, 5-6 cuttings at low altitudes and 3-4 cuttings at higher altitudes can be taken. Thus 6-7 m.t. of dry matter/ha can be expected under good management conditions.

6. Forest Pasture Development

Of the 97,064 ha. of barren/scrub grazing land, 6257 ha. will be developed as panchayat forest and half of the panchayat forest area will be used for pasture development activities, i.e., 3.25% of the entire existing grazing land or 11% of the grazing land spread from the tropical to cool temperate zones.

The main feature of forest pasture development will be grassland under trees, a practice similar to orchard savannah in sub-tropical environments. Thus the main components of the program will be:

i) Planting of fodder trees, and

ii) Sowing a balanced mixture of grass and legumes.

The altitudual limitation for forest pasture development will be 3000 m and approximately 75% of this area will be in the sub-tropical to warm temperate ecological zone. The total area that will be under forest pasture during the project period is shown in Table 2.6.

a. Planting of fodder trees.

Selected native species of fodder trees will be planted, initially at the spacing of 3.5 x $3.5M^2$, i.e. 816 trees/ha. After 4 years, trees will be thinned down to 250 trees/ha., leaving an open space of one and half to two times the diameter of the canopy. This will provide sufficient light for forage production. Species of fodder trees that have been recommended for RCUP are given in Table 2.5

b. Grass and legume sowing.

Suitable species of grass and legumes will be sown at the time of fodder-tree transplanting. Undesirable and non-forage plants will be removed and a minumum tillage operation will be done for better germination and early seedling growth. Grass and legume species in the ratio of 1:3 in sub-tropical zones and 1:1 in temperate zone is recommended. Phosphate will be applied.

c. Management and Utilization.

Management of forest pasture will include periodic reseeding to get an even spread of sown species, removal of non-forage plants, and partial fencing. There will be one pasture guard for every 50 ha. of improved pasture. Lopping and harvesting of forage from fodder trees will start after 4-5 years of planting. By this time, grazing will be controlled and only hand-harvesting of pasture forage allowed. This will ensure natural seeding and good ground coverage. Pasture guards will supervise lopping of fodder trees and forage plants. Sheep and goat grazing may be allowed after 3-4 years of establishment but grazing of the large ruminants should not be permitted. The improved forest pasture will be the main area for pasture seed production.

A fee will be charged for grazing of animals or harvesting of forage and the income will be spent for pasture management purposes and fencing. Estimated production potential of various pasture components under different treatments is shown in Appendix 2.6.

7. Pasture Development in Planted Plantation

The pasture development program in planted plantation is similar to the Agrisilviculture system where, in place of food crops, forage crops will be sown in between the rows of planted trees. Legume species have been widely used as a cover crop for new plantations in tropical environments and this practice has helped maintain soil fertility, decrease erosion and leaching, and increase the yield of the main tree crop. For the first five

TABLE 2.5

RECOMMENDED FODDER TREE SPECIES
(L = Leguminous Species)

SPECIES	LOCAL NAME	ADAPTATION	NEPAL
1. Acer oblongum	Phirphire (L)	Low medium range, 1500 2500 m.	Nepal
2. Acacia nilotica (Babul)	(L)	Lateritic soil, humid sub-tropics, up to 1000 m.	India
3. Aeschynimeme americana (Thornless mimosa)	(L)	Shrub, up to 2 m tall, wet conditions, up to 800 m.	Australia
4. Albizia harveyi	(L)	10-15 m tall, deciduous, up to 2000 m.	Kenya
5. Albizia lebbek (Woment's tongue tree)	Siris (L)	Up to 20 m. high, shade tree, diciduous in the dry season, up to 1500 m.	Nepal/Aus.
6. Albizia molis	Rato siris (L)	Well drained soil, up to 1800 m.	Nepal
7. Abizia procera	Seto siris (L)	Humid sub-tropics, up to 1800 m.	Nepal
8. Artocarpus lakoocha	Badhar	Lower midhills, up to 1500	Nepal
9. Bambusa arundinaceal	Nigalo	Sub-tropic to warm temperate, up to 3000 m.	Nepal
.0. Bassia butyraceal	Chiuri	Sub-tropics, up to 1500 m.	Nepal
.1. Bauhinia longifolia	Tanki (L)	Lower midhills, up to 1300 m.	Nepal
.2. Bauhinia variegata	Koirala (L)	Same as above	Nepal
.3. Bauhinia vahilii	Bharla (L)	Climber, sub-tropic to warm temperate.	Nepal
14. Betula alonoides	Saur	Sub-tropics to warm temperates, 1500-3000 m.	Nepal
15. Barssiaopsis hainla	Chuletro	Sub-tropics to warm temperate, up to 2000 m.	Nepal
16. Brassiaopsis glomerulata	Kalochulitro	Warm to cool temperate, 2250 to 3000 m.	Nepal
17. Buddleja asiatica	Bhimsen pati	Sub-tropics to warm temperate.	Nepal
18. Butea frondosa	Dhank	Same as above	Nepal

TABLE 2.5
(continued)

SPECIES	LOCAL NAME	ADAPTATION	NEPAL
9. Castanopsis hystrix	Patle katus	Forest range, warm temperate, 1500-2500 m.	Nepal
0. Caslanopsisindica	Dalne katus	Sub-tropics, up to 1500 m.	Nepal
1. Castanopsis tribuloides	Kalusb	Forest range, 1500-2000m.	Nepal
.2. Atriplex nummularia		Shrub, drought to lerant, low rainfall.	FAO
.3. Atriplex hilimus (Saltbush)		Requirement up to 2000 mm.	
:4. Daphne Papuraceal	Dubdubee	Sub-tropics up to 1500 m.	Nepal
:5. Eurya acuminata	Thulo Jhngane	Sub-tropic to cool temperate.	Nepal
:6. E. japonica	Sano Jhngare	Same as above	
:7. Erythrina, arborescens	Phaledo (L)	Sub-tropics to warm temperate, up to 2000 m.	Nepal
:8. Desmodium discolor (Horse-marmalade)		Well drained soil, warm climates 2.5-3 m. tall, fire resistant, suitable for sub-tropical forest pasture.	India/Thai.
:9. Desmodium distortum		2 m. high, warm sub-tropics, up to 1000 m.	Australia
30. Gliricidia maculata		Warm sub-tropics, 5-15 m high, up to 1000 m.	India/Aus.
31. Ficus ausiculata Syn. F. foveolata	Timilo	Wide range of climate, 1500-2700 m.	Nepal
32. F. bangalensis	Bar	Sub-tropical, shade tree.	Nepal
33. F. cunia	Khanayo	Sub-tropics, up to 1500 m.	Nepal
34. F. hispida	Kharseto	Low medium range, up to 2000m.	Nepal
35. F. glaberrima	Pakhure	Sub-tropics to warm temperate, up to 2000 m.	Nepal
36. F. infectoria sun. F lacor	Kabro	Sub-tropics, up to 1800 m.	Nepal

TABLE 2.5
(continued)

SPECIES	LOCAL NAME	ADAPTATION	NEPAL
37. F. nemoralis	Dudhilo	Sub-tropics to warm temperate, up to 2000 m.	Nepal
38. F. roxburghii	Nimaro	Same as above	Nepal
39. F. semicordata	Khanyo	Sub-tropics, up to 1800 m.	Nepal
40. Leucaena		Wide range of soil conditions.	Nepal
Leucocephala (Leucaena)		pH 5.0 to 8.0, humid tropics to sub-tropics, up to 1000 m.	Australia
41. Fraxinus floribunda	Lankuri	Sub-tropical to warm temperate.	Nepal
42. Grewia oppositifolia	Syalfusro	Sub-tropical to warm temperate.	Nepal
43. Litsea Polyantha	Kutmiro	Humid sub-tropics, up to 1500m.	Nepal
44. Machilus gamblei	Kathe Kaulo	Sub-tropic to warm temperate up to 1500-2500 m.	Nepal
45. Morus alba	Desikimbu	Sub-tropical to warm temperate, up to 2000 m.	Nepal
46. Mulberry		Irrigated area in Mustang, 2500-3500 m.	Afganistan (FAO)
47. Morus indica	Kumbu Kafal	Sub-tropical	
48. Monus nigra	Kimbu	Humid sub-tropics, up to 1600m.	Nepal
49. Mucuna Macrocarpa	Baldhyangro	Sub-tropical to warm temperate.	Nepal
50. Premna integrifolia	Gineri	Sub-tropics, up to 1600 m.	Nepal
51. P. bengalensis	Kalo Gineri	Same as above	Nepal
52. Prunus cerrasoides (cherry)	Painyu	Sub-tropics to warm temperate.	Nepal
53. P. Nepalensis	Arupati	Same as above.	Nepal
54. Quercus incana	Banjh	Dry south facing slopes, sub-tropics, up to 1500 m.	Nepal
55. Q. fenestrata	Arkaulo	Warm temperate, up to 2000 m.	Nepal
56. Q. glauca	Falant	Warm temperate, up to 2000 m.	Nepal
57. Q. lamellosa (Oak)	Thulo falant	Warm to cool temperate 2100-2700 m.	Nepal

TABLE 2.5
(continued)

SPECIES	LOCAL NAME	ADAPTATION	NEPAL
58. Q. Semicarpifolia	Khasru	Warm to cool temperate, 2100-3000 m.	Nepal
59. Salix spp (willow)	Bains	Irrigated land in Mustang, dry Himalayan region, 1500-3000 m.	Nepal
60. Saurauria Nepaulensis	Gogan	Sub-tropics to warm temperate, up to 2000 m.	Nepal
61. Schima wallichi	Chilanne	Sub-tropical forest, up to 1700 m.	Nepal
62. Symplocos Paniculate	Lodh	Sub-tropical to warm temperate, 1500-2500 m.	Nepal
63. Terminalia belerica	Barro	Low land, river valleys, up to 1500 m.	Nepal
64. T. Chebula	Harro	Same as above	Nepal

TABLE 2.6

AREA UNDER FOREST PASTURE DEVELOPMENT
(Area in hectares)

CATCHMENT AREA	First Five Years						2nd Five Years	3rd Five Years	Total
	1	2	3	4	5	Total			
Kulekhani	-	10	25	40	51.5	126.5	240	30	396.5
Daraundi	-	7.5	19.5	41	61.0	129.0	720	581.5	1430
Kaligandaki									
Myagdi	-	5	13	27	41	86	433	302	821
Mustang	-	5.5	14.5	26	37.5	83.5	231.5	196	511
TOTAL	-	28	72	134	191	425	1625	1109	3159

years, forest forage combinations will be limited to sub-tropical zones only. Table 2.7 shows the area proposed for pasture development in planted plantations.

Sod forming grass species, such as Kikuya, Paspalum dilatatum, cenchues ciliaris, Rhodes, etc, and sub-tropical groups of legume species such as Phaseilus, Cassia, Desmodium, Lupinus, Stylosauthes, etc, will be sown with the same techniques as used in forest pasture development*. Forage will be hand-harvested for the first few years of the forest establishment, and then grazing will be allowed. The number of grazing animals will be fixed, according to the carrying capacity of the land.

E. NATIONAL FOREST GRAZING MANAGEMENT

Unmanaged and destructive forest grazing prevails in the mid and low hills. The proposed pasture development program will reduce the encroachment of forest by livestock. Even then 15-20%, of the ruminant livestock will be grazing continuously in forest areas adjoining villages and farmsteads. Forest land requires grazing management, a grazing system involving regrowth of a herbaceous layer and its utilization by grazing animals. The silvipasture system effects a controlled grazing of the forest according to the carrying capacity of the land. The main objective of the silvipasture system is to ensure that the trees and other plants of value are not endangered by grazing animals and that they have ample chance for regrowth or recovery.

Removing of non-forage weedy species such as Eupatrorium spp. and replacing them with more palatable shrubs, grasses or vines, will increase the carrying capacity of forest land. This type of management practice is new in Nepal and will be implemented in the RCUP area at the end of the first five year period.

F. RANGE MANAGEMENT

1. As envisaged in the proposed land use program, farmers will have access to about 59,500 hectare of traditional grazing land or scrubland for community grazing. This kind of land is spread ober sub-tropical to sub-alpine zone in the Kulekhani, Daraundi and Lower Kaligandaki catchments and in the steppe zone of Mustang Distrcit (Table 2.8). Approximately 9% of of such unimproved grazing land will be partially improved through range management during the project period. During the project, about 25% of the unimproved grazing land in tropical to warm temperate zones, 11% in

*Napier and Setaria could be planted successfully.

TABLE 2.7

AREA UNDER PASTURE DEVELOPMENT IN PLANTED PLANTATION
(Area in hectares)

CATCHMENT AREA	First Five Years						2nd Five Years	3rd Five Years	Total
	1	2	3	4	5	Total			
Kulekhani	0	20	30	40	40	130	150	200	480
Daraundi		15	25	30	45	115	150	250	515
Kaligandaki									
Myagdi		15	20	30	40	105	150	250	505
Mustang		-	-	-	-	-	50	50	100
TOTAL		50	75	100	125	350	500	750	1,600

TABLE 2.8

DISTRIBUTION OF PASTURE/RANGE LAND IN VARIOUS ECOLOGICAL ZONES IN RCU PROJECT AREA
(After 15 years of project)
(Area in Hectares)

ECOLOGICAL ZONE	CATCHMENT AREA				
	Kulekhani	Daraundi	Myagdi	Mustang	TOTAL
1. Tropical zone (800-1000 m)	-	866	-	-	
2. Sub-tropical zone (1000-1800 m)	207	1,384	593	19	
3. Warm temperate zone (1800-2450 m)	323	254	1,385	153	
4. Cool temperate zone (2450-3050 m)	-	78	1,258	707	
5. Sub-alpine zone (3050-3950 m)	-	1,899	7,743	7,498	59,480
6. Alpine zone (3950 m)	-	1,666	7,501	5,009	
7. Steppe zone (2450-3950 m)	-	-	-	35,013	
	530	6,147	18,580	48,299	73,556
Total area excluding alpine zone	530	4,481	11,079	43,390	59,480
Unimproved rangeland after 15 years of project.					
1. Ecological zone (103)	398	1,878	1,558	129	
2. Ecological zone (4-5)	-	1,582	8,101	7,385	
3. Ecological zone 6	-	1,666	7,501	5,009	
4. Ecological zone 7	-	-	-	33,263	
TOTAL	398	5,126	17,160	45,786	

cool temperate to sub-alpine zones and 5% in steppe zones will be improved. The area proposed for Range management in the various catchments and ecological zones is presented in Table 2.9 and 2.10.

2. Range management practice will be site specific and will differ between ecological zones. In steppe zones, range management will aim to increase the ground coverage from the existing 10-22% to 30-50% at the end of the project period. An attempt will be made to revegetate the steppe with native species of caragana, Artemisia and other perennial grass species. In the sub-tropical to warm temperate zones, the main activities of range management will be controlled grazing, removal of non-forage plants and reseeding to increase the production petentiality of the rangeland.

The following practices will be adopted to improve the rangeland:

a. Rotation grazing.

Specific sites will be selected for range management. The range to be improved will be demarcated or partially fenced with locally available material, mostly stone. Voluntary cooperation from the local community will be requested. The number of grazing animals will be fixed according to the estimated carrying capacity of the range. Deferred rotation or rest rotation grazing systems will assist the regrowth of forage plants, natural reseeding, and even spread of the palatable species. Control grazing at the time of seed setting and seed ripening will be required.

b. Revegetation.

On steppe range, the ground coverage will be gradually increased by transplanting Caragana spp and Artemisia sp. Suitable species of Agropyron will be sown near the basal surface of cargana plant. Moisture level and soil characteristics will be the main limiting factor for any species introduced in that area. An alternative would be to evenly spread our native forage species which have adapted to these harsh environmental conditions. The physiology of Cargana - Artemisia - Loicera species has to be studied carefully before implementing any revegetation program. These studies will involve seed production, germination and the appropriate season of propagation under natural environment. Atriplex spp, a fodder shrub, should be tried in low rainfall areas.

TABLE 2.9

AREA UNDER RANGE MANAGEMENT IN VARIOUS CATCHMENT AREAS
(Area in hectares)

CATCHMENT AREA	First Five Years						2nd Five Year	3rd Five Year	Total
	1	2	3	4	5	Total			
Kulekhani	-	1.3	4	8	13.2	26.5	46.5	59	132
Daraundi	-	10.3	30.8	61.6	102.1	204.8	298	518.2	1,021
Kaligandaki									
Myagdi	-	14	42	85	142	283	497	640	1,420
Mustang	-	26	78	157	261	522	914	1,177	2,613
TOTAL	-	51.6	154.8	311.6	518.3	1036.3	1755.5	2,394.2	5,186

TABLE 2.10

AREA UNDER RANGE MANAGEMENT IN VARIOUS ECOLOGICAL ZONES
(Area in hectares)

ECOLOGICAL ZONE	First Five Years						2nd Five Year	3rd Five Year	Total
	1	2	3	4	5	Total			
Sub-tropical warm temperate	-	13	40	79	132	264	462	595	1,321
Cool temperate sub-alpine	-	21	63	127	211	422	681	1,012	2,115
Steepe	-	18	52	105	175	350	612	788	1,750
TOTAL	-	52	155	311	518	1,036	1,755	2,395	5,186

c. Reseeding.

Partial reseeding of natural grazing land with legume species and some sod forming pasture species is recommended in sub-tropical to cool temperate zones. Grass and legume species will be similar to the species mentioned for forest pasture development although the sowing technique will differ. Clovers, such as white clover, have already shown positive results in other parts of the country at cool temperate and sub-alpine zones. In some sites, transplanting of rooted material or seedlings may prove more useful than direct sowing.

d. Control of weeds, ferns, poisonous plants and other non-forage plants before and after the grazing season.

To uproot the non-forage plants before the seed ripening stage, weed-killing chemicals should never be used.

e. Control of burning in the grazing land.

Occasional burning of matted grazing land could be regarded as a management practice. Burning of surface mats of dead material fosters quick regeneration or initiation of young shoots and therby encourages an early harves of plants. This practice should be conducted on a limited scale, once every 4-5 years.

f. Provision of drinking water in the grazing land.

Salt blocks will be placed near the livestock water development centers.

G. SEED PRODUCTION

The quantity of seeds required for various pasture development programs is presented in Table 2.11 (Appendix 2.4). 29 m.t. of seeds for forage crops (tropical and temperate pasture species) will be required in the first five years. It will be difficult to import seeds in bulk from any country. Seed availability has in fact hindered pasture development in other projects. For the first two to three years, seeds will be procurred from overseas and then an attempt will be made to produce seeds inside the catchment areas. The necessary facilities will be provided for this purpose by the project.

Nucleus seeds will be produced at the Livestock Centers, such as the Chitlang Sheep Farm, the Mustang Livestock Center, and the pasture research and production centers at Barpark and Pakhapani. Farmers will be encouraged to produce forage crop seeds in bulk and will be offered a good price. Pasture seeds of grasses and legume species will be produced in bulk in forest pastures. Seed production, collection and storage techniques will have to be developed in the Livestock Centers.

TABLE 2.11

SEED REQUIREMENT FOR PASTURE DEVELOPMENT PROGRAM IN RCUP AREA
(Pasture seeds - wt. in Kg.)

Project Period	Forage Crops (Sub-tropical) Spp.	Sub-tropical Species	Temperate Species	TOTAL
1. First Five Years				
Year 1	130	32	-	162
2	910	379.5	294.5	1,584
3	1,885	1,064	866	3,815
4	4,160	2,195	1,747	8,102
5	8,450	3,865	3,037	15,352
TOTAL	15,535	7,535.5	5,944.5	29,015
2. Second Five Years	54,860	31,424	14,176	100,460
3. Third Five Years	98,215	31,566.5	17,537.4	147,319
GRAND TOTAL	168,610	70,526	37,658	276,740

H. IMPROVED PASTURE AND RANGE MANAGEMENT RESEARCH AND STUDY

So far, very little work has been done in forage production and pasture development. Pasture improvement and range management programs will be site specific. The selection of suitable grass and legume species will depend on environmental conditions and its uses. Seasonal growth patterns of grass and legumes will lead to a surplus production during main growing seasons which could be conserved as hay or silage. Efficient utilization of vegetation is a must for pasture management. Optimum productivity of forage species will differ from one environment to another.

The need of research is obivious and it will aim to develop technology for improved pasture production and range management at localized environments.

Research programs will include:

i) Botanical evaluation of native forage species and ecological mapping.
ii) Detail survey of natural grazing lands and feeding resources in various agroclimatic environments.
iii) Screening of introduced species.
iv) Methodology development in reseeding and pasture establishment.
v) Plant succession studies in grazing lands.
vi) Technology development in the field of herbage conservation for winter feeding.
vii) Pasture management and efficient utilization patterns which will include different rotational grazing systems.
viii) Nucleus seed production and storage.

Chitlang sheep farms will be strengthened and will carry on research activities representing sub-tropical to warm temperate environments. Likewise, Mustang Livestock Development Centers will be strengthened to work extensively in steppe range management research. Nearly 20 hectares of grazing land will be partially fenced near Jharkot (Muktinath) and studies will be conducted to increase the ground coverage. The work will concentrate to study the physiology of seed production and regeneration of native forage species such as dwarf shrub *Caragana* spp, *Artemisia* and others. Deferred rotation grazing, rest rotation grazing or no grazing for 3-5 years will be the treatments.

Two more pasture research and seed multiplication centers will be established, one at Barpak (Daraundi) and the other at Pakhapani (Myagdi area). Ten hectares of shrubland or grazing land will be fenced. Work will concentrate on developing suitable technology for Pasture Production and management in temperate to sub-alpine climatic conditions. Screening of introduced species, selection of

native species and seed multiplication will be carried out on a regular basis.

The detailed research program at individual sites will be worked out at the implementation stage.

I. COST COMPONENT

The proposed pasture production projects in the whole RCUP area and in the various catchments have been formulated in detail and are presented in Appendices 2.6.1.1, 2.6.2.1, 2.6.3.1, 2.6.4.1, and 2.6.5.1. The basis for the cost calculation for each proposed project is described in Appendix 2.7.

The major cost falls in the following items:

1. Procurment of quality seeds from abroad or seeds produced inside the country.
2. 50% subsidized rate of forage crop seed distributed to farmers.
3. Raising of seedlings and planting materials at the Livestock Centers and Nurseries.
4. Cost of land preparation, weed control and reseeding in the depleted grazing land or in the forest pasture.
5. Cost of fretilizer, mainly phosphate, needed for efficient pasture production.
6. Compensation to farmers for the establishment of private pasture land. Pasture will replace the cultivation of maize, millet and buckwheat in sub-marginal and steepe land considered to be unsuitable for any other cultivation.
7. Provision for pasture guards in the improved forest pasture lands. Provision is made for one may per year for every 50 hectares of improved pasture.
8. Range and pasture supplies, materials, and purchase of equipment needed for pasture establishment and management.
9. Improved pasture and range management research -- field trials, botanical evaluation of native forage species, ecological mapping, rangeland and pasture production studies, forage conservation, multiplication of nucleus seeds, field demonstration and publications.
10. Establishment of pasture research and production centers, one each in Gorkha and Myagdi districts. Cost includes procurement of land, construction, staffing and material cost.
11. Strengthening the Chitland sheep farm and the Livestock Center in Mustant to make them more efficient in pasture production, conservation, and seed production activities.

J. PROJECT BENEFIT

The proposed range and pasture production program will have the following benefits:

1) Increased forage production.
2) Decrease the forest encroachment of livestock.
3) Decrease soil erosion loss.
4) Better utilization of cropland and sub-marginal land.

1. Increased Forage Production.

With the project, the percentage of feed available to requirement based on the existing animal population will increase from 60% to 91% at the end of the project period (Table 2.13). Increased fodder production with the project is shown in Table 2.12. Forage production will increase after 1-2 years during the establishment period.

Forage value is estimated at Rs. 375/ton or dry matter basis.[1/] The total gross return from the increased forage production is given below:

	First Five Years					Second Five Years	Third Five Years
	1	2	3	4	5		
Gross value (Rs. 000)	6	48	277	964	2,004	86,616	155,017

Increased forage production will help increase the production potentiality of native cross-bred livestock in terms of meat, milk and wool. An introduction of legumes in croplands in rotation with agronomical crops will increase the soil fertility level. Efficient utilization of sub-marginal land will reduce surface runoff and decrease soil erosion loss.

1/ Harrison et al (1979) Soil and Water Conservation Report. RCUP.

TABLE 2.12

INCREASED FODDER PRODUCTION WITH THE PROJECT
(M. Ton DW)

PROGRAM	DM Yield ha.1/	First Five Years					2nd Five Years	3rd Five Years
		1	2	3	4	5		
1. Forage crop development	8	16 2/	128	360	872	1040	33,760	60,440
2. Private pasture development	6.2	-	-	56	292	800	50,592	94,240
3. Pasture production on terrace walls	6.2	-	-	12	81	273	29,450	58,962
4. Range management								
a) Sub-tropical - warm temperate	4	-	-	52	212	528	14,520	26,420
b) Cool temperate-sub-alpine	4	-	-	84	336	844	22,060	42,300
c) Steppe	0.5	-	-	-	9	35	2,405	4,375
5. Pasture development in planted plantation	3	-	-	-	150	375	12,750	24,000
6. Forest Pasture development	6.2	-	-	174	618	1,451	63,570	97,960
7. Forest grazing management	2	-	-	-	-	-	1,869	4,683
TOTAL		16	128	738	2,570	5,346	230,976	413,380

1/ Based on the assumption as shown in Appendix 2.5

2/ Forage could be harvested in the same year of establishment.

TABLE 2.13

TOTAL FEED AVAILABLE TO LIVESTOCK REQUIREMENT WITH THE PROJECT

Project Period	Total TDN Required 1/	Total TDN without Project 3/	Available with Project 2/	% Feed to Requirement			
				Without Project		With Project	
				4/	5/	4/	5/
Year 1	177,083	107,261	107,271	60.58	60.58	60.58	60.58
Year 2	177,551	106,198	107,344	59.97	59.81	60.62	60.46
Year 3	180,759	105,136	107,741	59.37	58.16	60.84	59.60
Year 4	183,856	104,085	108,932	58.18	56.16	61.51	59.25
Year 5	187,109	103,044	110,736	58.19	55.07	62.53	59.18
Second Five Years	986,756	510,068	686,439	57.61	51.69	77.53	69.57
Third Five Years	1086,931	459,061	805,002	51.85	42.95	90.9	75.31

/ Total TDN requirement with an increase in animal population.

2/ Feed available for utilization.

3/ Without Project 1%/year forage reduction because of soil loss. (Harrison et al (1979).

4/ Animal population remaining constant.

5/ Animal population increasing at the annual rate of 2.1%.

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APPENDIX 1.1

KULEKHANI CATCHMENT AREA (MAKWANPUR DISTRICT)
PANCHAYATWISE PASTURE LAND BY ALTITUDE
(1979)

Panchayat	Altitude in Meter				TOTAL
	1200	1200-1800	1800-2400	2400	
1. Palung	-	0.15	0.6	-	0.75
2. Daman	-	0.32	2.0	-	2.32
3. Thahchok	-	0.71	2.16	-	2.87
4. Chitlang	-	3.44	3.66	-	7.10
5. Kulekhani	-	2.34	1.16	-	3.50
6. Sisneri	0.16	0.83	1.28	-	2.27
7. Fakel	-	0.32	2.08	-	2.40

APPENDIX 1.2

PANCHAYATWISE PASTURE LAND BY ALTITUDE IN DARAUNDI CATCHMENT AREA (1979)

(Area in Sq. Km.)

Panchayat	Altitude in Meter						TOTAL
	8-1000	1000-1800	1800-2450	2450-3050	3050-3950	3950	
. Mankana	3.69	0.46	-	-	-	-	4.15
2. Bhogteni	0.68	0.87	-	-	-	-	1.55
3. Deorali	0.48	-	-	-	-	-	0.48
4. Raniswara	-	0.55	-	-	-	-	0.55
5. Bungkot	2.38	1.02	-	-	-	-	3.40
6. Gorkhali	-	0.66	-	-	-	-	0.66
7. Taple	0.63	1.62	-	-	-	-	2.25
8. Nareswer	0.74	1.02	-	-	-	-	1.76
9. Cheprak	1.84	1.52	-	-	-	-	3.36
0. Khanchok	3.20	1.33	-	-	-	-	4.53
1. Pandrung	5.25	1.35	-	-	-	-	6.60
2. Srinathkot	0.52	2.61	-	-	-	-	3.13
3. Taku	3.45	1.33	-	-	-	-	4.78
4. Jaubari	2.13	5.67	-	-	-	-	7.80
5. Muchhek	0.80	5.32	-	-	-	-	6.12
6. Taklung	0.85	0.93	-	-	-	-	1.78
7. Harmi	0.85	0.87	-	-	-	-	1.72
8. Chairung	0.43	1.73	-	-	-	-	2.16
9. Ampipal	0.23	0.52	-	-	-	-	0.75
0. Saurpani	0.12	1.10	0.52	-	-	-	1.74
1. Dhuwakot	0.16	0.72	-	-	-	-	0.88
2. Mirkot	0.66	0.60	-	-	-	-	1.26
3. Taranagar	-	-	-	-	-	-	-
4. Palungtar	0.82	-	-	-	-	-	0.82
5. Gaikhur	0.86	0.18	-	-	-	-	1.04
6. Khoplang	-	0.51	-	-	-	-	0.51
7. Swaran	0.38	5.00	1.64	-	-	-	7.02
8. Simjung	1.52	11.4	2.46	2.35	10.13	6.14	34.00
9. Barpak	-	2.82	5.49	0.59	8.86	10.52	28.28
TOTAL	32.67	52.23	9.59	2.94	18.99	16.16	133.08

APPENDIX 1.3

PANCHAYATWISE PASTURE LAND BY ALTITUDE IN KALIGANDAKI CATCHMENT AREA
(Myagdi District)
(Area in Sq. Km.)

Panchayat	Altitude in Meter						TOTAL
	8-1000	1000-1800	1800-2450	2450-3050	3050-3950	3950	
1. Dana	-	4.19	16.01	26.72	39.71	19.47	105.10
2. Bhagbati	-	0.58	0.98	0.06	-	-	1.62
3. Piple	-	0.94	0.30	-	-	-	1.24
4. Begkhola	-	3.14	2.15	0.55	-	-	5.84
5. Ghata	-	1.26	1.01	-	-	-	2.27
6. Jhee	-	0.17	1.24	-.08	-	-	1.49
7. Pakhapani	-	0.21	1.66	2.77	-	-	4.64
8. Darmija	-	0.26	1.96	2.80	6.31	20.46	31.79
9. Kuine Mangali	-	0.24	2.63	6.0	7.55	20.35	36.77
10. Doba	-	2.62	1.95	1.05	-	-	5.62
11. Barah	-	3.95	4.78	3.85	19.15	13.54	45.27
12. Ramche	-	3.90	8.52	1.08	-	-	13.50
13. Histan Mandali	-	3.36	4.11	2.90	0.36	-	10.73
14. Sikha	-	2.86	8.04	2.46	5.35	1.19	19.90
TOTAL	-	27.68	55.34	50.32	77.43	75.01	285.78

APPENDIX 1.4

PANCHAYATWISE PASTURE LAND BY ALTITUDE IN UPPER KALIGANDAKI CATCHMENT AREA
(Mustang District)
(Area in Sq. Km.)

Panchayat	Altitude in Meter					TOTAL
	1000-1800	1800-2450	2450-3050	3050-3950	3950	
1. Lete	0.34	1.87	4.62	9.26	9.35	25.44
2. Kunje	0.39	3.98	9.13	20.80	9.52	43.82
3. Kobang	-	-	8.03	27.4	12.33	47.76
4. Tukuche	-	-	5.24	17.52	18.89	41.65
5. Marpha	-	-	16.93	41.57	46.97	106.47
6. Jhomsom	-	-	9.78	33.01	9.27	52.51
7. Jharkot	-	-	1.09	17.85	-	18.94
8. Muktinath	-	-	0.16	18.85	-	18.59
9. Kagbeni	-	-	13.64	56.12	3.81	73.57
10. Chhusang	-	-	11.05	108.75	0.12	119.92
TOTAL	0.73	5.85	79.67	350.71	110.71	547.67

APPENDIX 1.5

SOURCE AND QUANTITY OF LIVESTOCK FEED IN UPPER KALIGANDAKI CATCHMENT AREA
(Myagdi District)

S.No. Feeding Resources	Darmija				RAKHU							
	Av. a/u household TDN Regd. (1)	Total TDN available kg. (2)	% Feed to requirement (3)	% Contribution (4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
1. Cropland area												
a. Crop residues	6.77	192	1.8	2.91	3.75	766	12.92	24.45	5.26	479	5.76	9.86
b. Grasses & weeds	10,696	409	3.8	6.22	5,930	345	5.82	11.01	8,313		4.54	7.76
c. Leaf fodder		58	0.54	0.88		77	1.30	2.46			0.92	1.40
d. Others		62	0.94			35	0.58	1.12			0.58	0.98
SUBTOTAL		721	6.74	10.95		1,223	20.62	39.04		972	11.70	20.1
2. Forest/Pasture												
a. Grass & seeds		371	3.47	5.63	-	-					2.23	3.81
b. Leaf fodder		377	3.52	5.72		35	0.59	1.12			2.48	4.24
c. Grazing		5,118	47.85	77.70		1,875	31.62	59.84			42.07	71.95
SUBTOTAL		5,866	54.84	89.05		1,910	32.21	60.96		3,888	46.78	80
GRAND TOTAL		6,587	61.58	100.00		3,133	52.83	100.00		4,860	58.48	100

APPENDIX 1.6

SOURCE AND QUANTITY OF LIVESTOCK FEED IN DARAUNDI CATCHMENT AREA

S.No. Feeding Resources	Av. a/u household TDN Regd. (1)	Deorali Panchayat			CHOPRAK				BARPAK			
		Total TDN available kg. (2)	% Feed to requirement (3)	% Contribution (4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
1. Cropland Area												
a. Crop residues	4.28	738	10.9	17.8	6.3	1,025	10.3	17.7	4.53	254	3.6	5.5
b. Grass and weeds	6,762	742	11.0	18.0	9,954	1,085	10.9	18.7	7,157	487	6.8	10.4
c. Leaf fodder		131	1.9	3.2		149	1.5	2.6		31	0.4	0.7
d. Others		43	0.6	1.0		50	0.5	0.9		45	0.6	1.0
SUBTOTAL		1,654	24.4	40.0		2,309	23.2	39.9		817	11.4	17.6
2. Forest/Pasture												
a. Grass & weed		32	0.5	0.8		209	2.1	3.6		82	1.1	1.8
b. Leaf fodder		321	4.7	7.8		100	1.0	1.8		327	4.6	7.0
c. Grazing		2,123	31.4	51.4		3,175	31.0	54.7		3,425	47.8	73.6
SUBTOTAL		2,376	36.6	60.0		3,484	35.0	60.1		3,833	53.15	82.4
GRAND TOTAL		4,130	61.0	100.		3,793	58.2	100.		4,650	64.9	100.

APPENDIX 1.7

SOURCE AND QUANTITY OF LIVESTOCK FEED IN MUSTANG DISTRICT

S.No. Feeding Resources	Marpha Panchayat				CHARANG PANCHAYAT				MEAN			
	Av. a/u household TDN Regd. (1)	Total TDN available kg. (2)	% Feed to requirement (3)	% Contribution (4)	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
1. Cropland area												
a. Crop residues	9.04	166	1.16	2.20	5.23	92	1.09	2.02	7.18	129	1.14	2.13
b. Grass and weeds	14,280	431	3.02	5.71	8,410	408	4.85	8.94	11,345	420	3.70	6.94
c. Leaf fodder		22	0.15	0.29						11	0.10	0.18
d. Others		70	0.49	0.93		42	0.5	0.92		56	0.49	0.93
SUBTOTAL		689	4.82	9.13		542	6.44	11.88		616	5.43	10.18
2. Forest/Pasture area												
a. Grass and weeds	-	-	-	-	-	-	-	-	-	-	-	-
b. Leaf fodder		22	0.15	0.29						11	0.10	0.18
c. Grazing		6,834	47.86	90.58		4,021	47.81	88.12		5,427	47.84	89.64
SUBTOTAL		6,856	48.01	90.87		4,021	47.81	88.12		5,438	47.93	89.82
GRAND TOTAL		7,545	52.83	100.		4,563	54.25	100.		6,054	53.36	100.

APPENDIX 1.8

TDN AVAILABLE IN FEEDING STUFFS

Feeding Materials	Quantity per Load (kg.)	TDN Content	Estimated TDN utilization %	TDN Available for Consumption (kg.)
Paddy straw	34	41.3	80.0	11.23
Wheat straw	25	47.1	10	1.18
Barley straw	25	48	10	1.20
Maize stalk (green)	30	12.0	75	2.70
Maize stalk (dry)	20	41.0	30	2.46
Maize cols straw	6	40.0	90	2.16
Millet hay	25	50.4	70	8.82
Mustard residues	7	25.0	70	1.23
Buckwheat residues	10	17.0	70	1.19
Pulse residues	14	40.0	75	6.35
Green grasses	25	13.0	95	3.09
Leaf fodder (green)	20	18.1	80	2.90
Wheat bhunsa	8	42.1	80	2.69
Wheat brau		63.0	100	
Rice brau		67.0	100	
Sugarcane		17.0	80	
Pasture grasses		13.0		
Forest (green)		12.0		
Summer grazing l.a.v. 1/		12.0		324
Winter grazing l.a.v. 1/		12.0		172
Grazing				756

1/ 15 kg. gm intake per animal unit during summer grazing for about 180 days.
8 Kg. gm. intake per animal unit during winter grazing for about 180 days.
Alpine zone - 25/kg/day a.v. during main lush season and 10 kg/day during winter.

APPENDIX 1.9

FEED AVAILABILITY - ASSUMPTION[1/]

CROP	Form of Feed	Feed Factor 2/	Yield kg.ha. 2/	TDN Content % 5/	Total TDN Yield kg. ha.	Estimated TDN Utilization 2/ %	Total TDN available for Consumption kg/ha	Grain Used %	Fof Feed TDN %	Total TDN Consumed kg. TDN ha.
Paddy: Local	Straw	1.62	2946	41.3	1217	80	974			
Improved	Straw	1.15	2932	41.3	1211	80	967			
Bran	Bran	0.13	236	67.0	158	100	158			
Maize	Stover	1.84	1640	41.10	672	30 4/	202	4	85	30
Maize cob	Straw	0.13	156	40.0	62	90	56			
Wheat	Straw	2.17	1611	47.1	759	10 3/	76			
Wheat	Bhunsa	0.34	272	42.1	115	80	92			
Wheat	Bran	0.08	59	63.0	37	100	37			
Millet	Straw	1.95	1442	50.4	727	70	509			
Barley	Straw	1.70	1281	48.0	615	10 3/	62	2	78	12
Buckwheat	Residue	0.39	297	30.0	89	70	62			
Sugarcane	Tops + Leaves	0.1	553	17.0	94	80	75			
Mustard	Residue	0.45	247	25.10	62	70	43			
Mustard	Cake	0.55	303	69.0	209	100	209			
Pulse	Residue	0.93	565	40.0	226	75	170			
Naked Barley	Straw	1.81	1574	48.0	756	80	605			

1/ Used for calculation of feed availability from crop sector.

2/ RCUP feeding resources survey.

3/ Wheat and barley straw generally not used for livestock feeding but for roofing except in Mustang District. (estimated utilization 80%)

4/ Only 30% utilized as livestock feed and rest used for bedding and compost making.

5/ Source: Nutritive value of Indian cattle feeds, ICAR (1971).
Draft report of the Indian Livestock Review, Report N. 13/75 IND 23 FAO/World Bank.

APPENDIX 1.10

RUMINANT LIVESTOCK AND FEED REQUIREMENT IN RCUP AREA
(TDN requirement in M. ton)

CLASS OF LIVESTOCK	TDN ton/hd/yr.	Kulekhani		Daraundi		Myagdi		Mustang		Grand Total	
		Stock No.	Total TDN Required	Stock No.	Total TDN Required	Stock No.	Total TDN Required	Stock No.	Total TDN Required	Stock No.	Total TDN Required
Buffalo - males	1.1	162	178.2	590	649.0	644	708.4	-	-	1396	
- females	1.25	2754	3442.5	15635	19543.8	9660	12075.0	-	-	28049	
- young stock	0.65	2484	1614.60	13275	8028.7	5796	3767.4	-	-	21455	
SUBTOTAL		5400	5235.3	29500	28821.5	16100	16550.8	-	-	50900	50542
Cattle - males	1.0	5220	5220.0	33579	33579.0	8954	8594.0	1696 1/	1697	49450	
- females	0.77	5394	4153.4	30303	23333.3	7986	6149.2	4576	3523.5	48259	
- young stock	0.35	6786	2375.1	18018	9806.3	7260	2541.0	2428	849.8	44259	
SUBTOTAL		17400	11748.5	81900	66718.6	24200	17644.2	8701	6070.3	142201	102182
Goat - males	0.30	2280	684.0	6777	2033.1	900	270.0	5676	1702.8	15633	
- females	0.20	11400	2508.0	39156	7831.2	9300	1860.0	5848	1169.6	66844	
- young stock	0.1	9120	912.0	29367	2936.7	4800	480.0	5676	567.6	48963	
SUBTOTAL		22800	4104.0	75300	12801.0	15000	2610.0	17200	3440.0	131440	22955
Sheep - males	0.3			660	198.0	1136	340.8	324	37.8	1922	
- females	0.2			3696	739.2	4260	852.0	864	100.8	8460	
- young stock	0.1			2244	224.4	1704	170.4	612	59.2	4540	
SUBTOTAL		40		6600	1161.6	7100	1363.2	1800	197.8	14922	2723
GRAND TOTAL		46640	21022.8	203300	109502.7	62400	38168.2	27123	9708.1	339463	178402

1/ Including yak, chauri and jhokpa.

APPENDIX 1.11

FEED CONSUMPTION REQUIREMENT OF LIVESTOCK

-Assumption[1/]

CLASS OF LIVESTOCK		Without Project	With Project[2/]
Buffalo:	males	1.1	1.38
	females	1.25	1.56
	young stock	0.65	0.81
Cattle:	males	1.0	1.10
	females	0.77	0.96
	young stock	0.35	0.44
Goat/ Sheep:	males	0.3	0.3
	females	0.2	0.2
	young stock	0.1	0.1
Pig		0.4	0.4
Poultry		0.02	0.02
Donkey		0.03	0.3
Horse, mules, ponies		0.7	0.7
1 a.v.		1.58	

1/ Based on live weight and performance.

2/ 25% of cattle and 50% of buffalo assumed to be crossbreed after 15 years of project.

APPENDIX 2.1

AREA UNDER FORAGE CROPS IN RCU PROJECT AREA
(Area in Hectares*)

LIVESTOCK SUB-CENTER	Total Area	Year of Establishment	First Five Years						Second Five Years	Third Five Years
			1	2	3	4	5	Total		
A. Kulekhani Catchment Area										
1. Kulekhani	158	1	0.8	4.7	7.9	18.8	36.6		94.8	158.1
2. Daman	156	2	-	0.8	4.7	10.8	20.6		78.0	156
3. Phakel	60	3	-	-	0.3	1.8	8.0		24.0	60
SUBTOTAL	374		0.8	5.5	12.9	31.4	65.2	115.8	196.8	374
B. Daraundi Catchment Area										
1. Chhoprak	127	1	0.6	3.8	6.4	12.7	25.4		76.2	127
2. Barpak	47	2	-	0.2	1.4	2.3	5.7		23.5	47
3. Palungtar	254	2	-	1.3	7.7	13.0	30.9		129.5	259
4. Jaubari	193	3	-	-	1.0	5.8	9.6		77.2	193
5. Deorali	134	3	-	-	0.7	4.0	8.7		53.6	134
6. Raniswar	207	4	-	-	-	1.0	8.2		62.1	207
7. Mankamana	202	4	-	-	-	1.0	6.0		60.6	202
8. Taku	280	5	-	-	-	-	1.4		84.0	280
SUBTOTAL	1449		0.6	5.3	17.2	39.8	95.9		566.7	1449
C. Upper Kaligandaki Catchment Area (Myagdi District)										
1. Jhee	145	1	0.7	4.3	9.2	18.5	34.6		87.0	145
2. Darmija	126	2	-	0.6	3.8	9.3	10.6		63.0	126
3. Dana	84	3	-	-	0.4	4.5	8.2		33.6	84
4. Rakhubhagrati	118	4	-	-	-	2.2	8.5		35.4	118
5. Sikh	202	5	-	-	-	-	3.0		60.6	202
SUBTOTAL	675		0.7	4.9	13.4	34.5	70.9		279.6	675
D. Upper Kaligandaki Catchment Area (Mustang District)	96		0.1	0.7	1.6	3.4	7.2		39.6	96
GRAND TOTAL	2594		2.2	16.4	45.1	109.1	239.3		1044.6	2594

* Cumulative figure.

APPENDIX 2.2

AREA UNDER IMPROVED PASTURE LAND (PRIVATE OWNERSHIP) IN THE RCU PROJECT AREA
(Area in Hectares)

LIVESTOCK SUB-CENTER	Total Area	Year of Establishment	First Five Years						Second Five Years	Third Five Years
			1	2	3	4	5	Total		
A. Kulekhani Catchment Area										
1. Kulekhani	158.5	1	-	2.5	9	18	27	56.5	50	52
2. Daman	101.0	2	-	1.5	4.5	9	17	32	30	39
3. Phakel	47.5	3	-	-	0.5	1.5	3	5	17	25.5
SUBTOTAL	307			4.0	14	28.5	47	93.5	97	116.5
B. Daraundi Catchment Area										
1. Chhoprak	151	1	-	1.25	4.50	9.0	13.5	29.25	54.0	69.0
2. Barpak	56	2	-	0.25	0.75	1.5	3.0	5.5	25.5	25.0
3. Palungtar	311	2	-	1.0	4.5	9.25	18.75	32.5	137.0	140.0
4. Jaubari	232	3	-	-	1.0	3.5	7.0	11.5	116.5	104.0
5. Deorali	161	3	-	-	-	2.5	5.0	8.25	80.25	72.5
6. Raniswara	248	4	-	-	-	1.25	3.75	5.0	131.0	112.0
7. Manakamana	242	4	-	-	-	1.25	3.75	5.0	128.0	109.0
8. Taku	336	5	-	-	-	-	2.0	2.0	149.0	185.0
SUBTOTAL	1737			2.5	11.5	28.25	56.75	99.5	821.25	816.5
C. Upper Kaligandaki Catchment Area (Myagdi District)										
1. Jhee	173	1	-	1.75	6.25	10.5	15.5	34.0	61.25	78.0
2. Darmija	152	2	-	0.75	3.25	4.5	9.0	17.5	66.5	68.0
3. Dana	101	3	-	-	0.5	1.5	3.0	5.0	50.0	46.0
4. Rakhubhagwati	142	4	-	-	-	0.75	2.25	3.0	75.0	64.0
5. Sikh	243	5	-	-	-	-	1.25	1.25	105.75	134.0
SUBTOTAL	811			2.5	10.0	17.25	31.0	60.75	360.5	390
D. Upper Kaligandaki Catchment Area (Mustang District)										
1. Jhomsom	85.5	1	-	-	0.75	5.5	8.0	14.25	31.25	40
2. Lete	99.5	2	-	-	1.5	3.0	6.0	10.0	44.0	45.0
3. Lamtang	-	3	-	-	-	-	-	-	-	-
4. Chhusang	-	4	-	-	-	-	-	-	-	-
5. Charang	-	4	-	-	-	-	-	-	-	-
SUBTOTAL	185				2.25	8.5	14.0	24.75	75.25	85.0
GRAND TOTAL	3040			9.0	37.75	82.5	148.75	278	1354	1408

APPENDIX 2.3

PASTURE PRODUCTION ON TERRACE WALLS IN THE RCU PROJECT AREA
(Area in Hectares)

LIVESTOCK SUB-CENTER	Total Area	Year of Establishment	First Five Years						Second Five Years	Third Five Years
			1	2	3	4	5	Total		
A. Kulekhani Catchment Area										
1. Kulekhani	112.5	1	-	0.5	2.8	4.5	9.0	16.8	39.4	56.3
2. Daman	110.3	2	-	-	0.5	2.7	4.4	7.6	47.4	55.3
3. Phakel	42.7	3	-	-	-	0.2	1.0	1.2	20.0	21.5
SUBTOTAL	265.5			0.5	3.3	7.4	14.4	25.6	106.8	133.1
B. Daraundi Catchment Area										
1. Chhoprak	86.4	1	-	0.4	2.1	3.5	7.0	13.0	30.2	43.2
2. Barpak	31.6	2	-	-	0.2	0.8	1.3	2.3	13.6	15.7
3. Palungtar	175.6	2	-	-	0.9	4.5	7.0	12.4	75.5	87.7
4. Jaubari	131.4	3	-	-	-	0.7	3.3	4.0	61.8	65.6
5. Deorali	90.9	3	-	-	-	0.5	2.3	2.8	42.7	45.4
6. Raniswar	140.0	4	-	-	-	0.7	3.5	4.2	65.8	70.0
7. Mankamna	136.6	4	-	-	-	0.7	3.5	4.2	64.0	68.4
8. Taku	189.7	5	-	-	-	-	1.0	1.0	93.9	94.8
SUBTOTAL	982.2			0.4	3.2	11.4	28.9	43.9	447.5	490.8
C. Upper Kaligandaki Catchment Area (Myagdi District)										
1. Jhee	118.1	1	-	0.6	1.8	4.7	9.5	16.6	41.3	60.2
2. Darmija	102.5	2	-	-	0.5	2.6	4.1	7.2	44.1	51.2
3. Dana	68.5	3	-	-	-	0.3	1.7	2.0	32.2	34.3
4. Rakhubhagwati	96.4	4	-	-	-	0.5	2.5	3.0	45.3	48.1
5. Sikh	164.9	5	-	-	-	-	0.8	0.8	81.6	82.5
SUBTOTAL	550.4			0.6	2.3	8.1	18.6	29.6	244.5	276.3
D. Upper Kaligandaki Catchment Area (Mustang District)	103.9			0.5	2.5	4.1	8.2	15.3	36.6	52.0
GRAND TOTAL	1902.0			2.0	11.3	31.0	70.1	114.4	835.4	952.2

APPENDIX 2.4

SEED REQUIREMENT FOR PASTURE PRODUCTION PROGRAM IN RCU PROJECT AREA
(Wt. in Kg.)

PASTURE COMPONENTS	First Five Years						Second Five Years	Third Five Years	Total (M.T.)
	1	2	3	4	5	Total			
1. Forage Crops	130	910	1,885	4,160	8,450	15,535	54,860	98,215	168,610
2. Sub-tropical species (Improved pasture, private)	32	120	304	656	1,192	2,304	10,832	11,264	24,400
3. Sub-tropical/Temperate species (3:1) (terrace slopes)	-	18	120	348	792	1,278	9,804	11,118	22,200
4. Range Management									
a) Sub-tropical species	-	78	240	474	792	1,584	2,772	3,570	7,872
b) Temperate species	-	234	690	1,392	2,316	4,632	7,758	10,800	23,190
5. Improved Pasture (Community) Sub-tropical/temperate species (3:1)	-	224	576	1,072	1,528	3,400	13,000	8,872	25,272
6. Forest Pasture Sub-tropical/temperate (1:1)	-	-	-	-	282	282	1,434	3,480	5,196
TOTAL	162	1,584	3,815	8,102	15,352	29,015	100,460	147,319	276,740

APPENDIX 2.5

PRODUCTION POTENTIAL OF VARIOUS PASTURE COMPONENTS

Pasture Components	M.T.D.M/ha.
. Sub-tropical - warm temperate pasture land	
a) Under existing grazing system	1.2[1/]
b) Deferred rotation grazing	2.0
c) Enclosure and hand cutting	3.0
d) Partial reseeding and management (b and c)	4.0
e) Complete reseeding and management (b and c)	6.2
. Cool temperate - sub-alpine pasture land	
a) Under existing grazing system	2.0
b) Deferred rotational grazing	3.0
c) Partial reseeding and management (b)	4.0
d) Complete reseeding and management	6.5
. Steepe pasture (transhimalayan environment)	
a) Under existing grazing system (12 - 22% ground vegetation coverage)	0.12[4/]
b) Deferred rotational grazing	0.15
c) Under good management (b) and revegetation, increasing ground cover to 25 - 30%	0.18
d) Under good management (b) and revegetation, ground coverage 30 - 50%	0.5
. Alpine meadows	
a) Under existing grazing system	3.2[3/]
b) Deferred rotational grazing	4.0
. Scrubland and forest grazing	
a) Under existing grazing system	0.5[2/]
b) Partial patchy reseeding, enclosure/deferred rotational grazing	2.0

/ Van Swinderen, H. (1978), FAO.

/ Fleming, W.W. (1978), Fewatal Catchment.

/ Wormld, T.J., (1976), Lumle Ag. Centre.

/ Alirol, P., (1979), IHDP/SATA.

/ RCUP Survey (1979).

APPENDIX 2.5
(continued)

PRODUCTION POTENTIAL OF VARIOUS PASTURE COMPONENTS

Pasture Components	M.T.D.M/ha.
. Forage Crops	
a) Summer forage crops	9
b) Winter forage crops	6
c) Perennial forage crops	16
'. Pasture production on terrace slopes	
a) Under existing vegetation	2 4/
b) Under good management and replacement of native species with highly productive grass and legumes	7
	Kg.D.M./tree
3. Fodder production from trees	
a) Leaf fodder excluding twigs	8 5/, 4/
b) Under good management (lopping)	10

:/ RCUP Survey (1979).

›/

APPENDIX 2.6 (1.1)

PROPOSED PASTURE PRODUCTION PROGRAM IN RCU PROJECT AREA
(Area in nearest hectare)

PROPOSED PROGRAM	First Five Years						Second Five Years	Third Five Years	TOTAL
	1	2	3	4	5	Total			
1. Annual forage crop development	2	14	29	64	130	239	844	1511	2594
2. Improved pasture development (private ownership)		9	38	82	149	278	1354	1408	3040
3. Improved pasture development on terrace and bunds		2.0	11	31	70	114	835	953	1902
4. Range management risers		(32)	(155)	(311)	(518)	(1036)	(1755)	(2395)	(5186)
a) Sub-tropical-warm temperate		13	40	79	132	264	462	595	1321
b) Cool temperate-sub-alpine		21	63	127	211	422	681	1012	1321
c) Steppe		18	52	105	175	350	612	788	1750
5. Improved pasture development in panchayat forests		28	72	134	191	425	1625	1109	3159
6. Management of national forest grazing					47	47	139	280	466
7. Pasture development in panchayat forests and planted plantation		50	75	100	125	350	500	750	1600
TOTAL	2	155	380	722	1230	2489	7052	10259	21647

APPENDIX 2.6 (1.2)
(continued)

PROPOSED PASTURE PRODUCTION PROGRAM IN RCU PROJECT AREA
(Area in nearest hectare)

1-Unit of work to be done

2-Cost in thousand rupees

PROPOSED PROJECT IN RCU PROJECT AREA	First Five Year Program											Second Five Years		Third Five Years		TOTAL
	Year 1		Year 2		Year 3		Year 4		Year 5		Total					
	1	2	1	2	1	2	1	2	1	2		1	2	1	2	
1. Annual forage crop development 2594 ha. @ R. 260	2	5	14	3.6	29	7.6	64	16.6	130	33.8	62.1	844	219.4	1511	392.9	674.4
2. Improved pasture development (Private ownership) 3050 ha. @ R. 1700			9	15.3	38	64.6	82	139.4	149	253.5	472.6	1354	1760.2	1408	1548.0	3798.6
3. Improved pasture development on slopes, 3700 ha. @ Rs. 500			2	1.0	11	5.5	31	15.5	70	35	57	835	417.5	953	476.5	951.0
4. Range management 5186 ha. @ R. 900			52	46.8	155	139.5	311	279.9	518	466.2	932.4	1755	1579.5	2395	2155.5	4667.4
5. Improved pasture i) development in panchayat forest 3159 ha. @Rs.1600				44.8	77	115.2	134	214.4	191	305.6	680.0	1625	2600	1109	1774.4	5054.4
ii) Pasture guards (50% voluntary) @ 75 ha. Yr.				2.1		7.5		17.6		31.9	59.1		153.8		237	449.9
6. Management of forest grazing land 466 ha. @ Rs. 600 ha									47	28.2	28.2	139	83.4	280	168	279.6

APPENDIX 2.6 (1.2)
(continued)

PROPOSED PASTURE PRODUCTION PROGRAM IN RCU PROJECT AREA
(Area in nearest hectare)

1-Unit of work to be done. 2-Cost in thousand rupees

PROPOSED PROJECT IN RCU PROJECT AREA	First Five Year Program											Second Five Years		Third Five Years		TOTAL
	Year 1		Year 2		Year 3		Year 4		Year 5		Total					
	1	2	1	2	1	2	1	2	1	2		1	2	1	2	
7. Pasture development in panchayat forest and planted plantation. 400 ha. @ R. 900			50	45	75	67.5	100	90	125	112.5	315	500	450	750	675	1440
8. Improved pasture and range management research		40		110		200		200		200	750		750		750	2250.0
i) Establishment of pasture units (Myagdi & Daraundi)		380		130		130		130		130	900		190		190	1280.0
9. Pasture production studies in panchayat forest and planted plantation						5		10		10	25		15		15	55.0
10. Range and pasture supplies, materials		10		30		80		100		150	370		230		-	600.0
11. Salt mineral blocks 10,000, 2 Kg. blocks @ R. 10	545	5.5	573	5.7	600	6	628	6.3	655	6.5	30	3001	30	3998	40	100.0
SUBTOTAL		442.8		400		765.4		1143.2		1681.5	4432.9		8518.3		8468.1	21,419.3
10% Contingency		44.3		40		76.5		114.2		168.2	443.3		851.8		846.8	2,141.9
TOTAL		487.1		440		841.9		1257.5		1849.7	4876.2		9370.1		9314.9	23,561.23

APPENDIX 2.6. (2.1)

PROPOSED PASTURE PRODUCTION PROGRAM IN KULEKHANI CATCHMENT AREA

(areas in nearest hectare)

PROPOSED PROJECTS	First Five Years						Second Five Years	Third Five Years	Total
	1	2	3	4	5	Total			
1. Improved forage crop development	0.8	4.7	7.4	18.5	33.8	65.2	131.6	177.2	374
2. Improved pasture development (private ownership)		4	14.0	28.5	47.0	93.5	97.0	116.5	307
3. Improved pasture development on terrace slopes		0.5	3.3	7.4	14.4	25.6	106.8	133.1	265.5
4. Range management a) sub-tropical-warm temperate b) cool temperate-sub-alpine		1.3	4.0	8.0	13.2	26.5	46.5	59	132
5. Improve pasture development in panchayat forest		10	25	40	51.5	126.5	240	30	396.5
6. Management of forest grazing					6	6	18	36	60
7. Pasture development in panchayat forest and planted plantation		20	30	40	40	130	150	200	480
GRAND TOTAL	0.8	40.5	83.7	142.4	205.9	473.3	789.9	751.8	2015

APPENDIX 2.6 (2.2)

PROPOSED PASTURE PRODUCTION PROGRAM IN KULEKHANI CATCHMENT AREA

1-Unit of work to be done in hectares, 2-Cost in thousand rupees

PROPOSED PROJECTS IN KULEKHANI CATCHMENT AREA	First Five Year Program											Second Five Years		Third Five Years		TOTAL
	Year 1		Year 2		Year 3		Year 4		Year 5		Total					
	1	2	1	2	1	2	1	2	1	2		1	2	1	2	
1. Forage crop development. 374 ha. @ Rs. 260	0.8	0.2	4.7	1.2	7.4	1.9	18.5	4.81	33.8	8.79	16.95	131.6	34.2	177.2	46.1	97.3
2. Improved pasture development (private ownership) 310 ha. @ R. 1700, 1300: 1100			4	6.8	14	23.8	28.5	48.5	47	79.9	158.9	97	126.1	116	127.6	412.6
3. Improved pasture development of terrace slopes. 265.5 ha. @ R. 500	-	-	0.5	0.3	3.3	1.6	7.4	3.7	14.4	7.2	12.8	106.8	53.4	133.1	66.6	132.8
4. Range management 132 ha. @ R. 1600	-	-	1.3	1.2	4	3.6	8	7.2	13.2	11.9	23.9	46.5	41.9	59	53.1	118.9
5. Improved pasture development in panchayat forest 396.5 ha. @ R. 1600	-	-	10.	16	25	40	40	64	51.5	82.4	202.4	240	384	30	48	634.4
i) Pasture guards (50% voluntary @ R. 75 ha.)	-	-		0.8		2.7		5.7		9.6	18.8		27.6		29.9	48.7
6. Management of forest grazing 60 ha. @Rs.600	-	-	-	-	-	-	-	-	6	3.6	3.6	18	10.8	36	21.6	36
7. Pasture development in panchayat forest and planted plantation. 80 ha. @R. 900	-	-	20	18.0	30	27.	40	36	40	36	117	150	135	200	180	432

APPENDIX 2.6 (2.2)
(continued)

PROPOSED PASTURE PRODUCTION PROGRAM IN KULEKHANI CATCHMENT AREA

1-Unit work to be done in hectares. 2-Cost in thousand rupees.

PROPOSED PROJECTS IN KULEKHANI CATCHMENT AREA	First Five Year Program											Second Five Years		Third Five Years		TOTAL
	Year 1		Year 2		Year 3		Year 4		Year 5		Total					
	1	2	1	2	1	2	1	2	1	2		1	2	1	2	
8. Improved pasture and range management research		20.0		30.0		40.0		40.0		40.0	170.0		150.0		150.0	470.0
9. Pasture production studies in panchayat forest and planted plantation						2		3		3	8		4		4	16
10. Range and pasture supplies, materials		5.0		10.0		20.0		25.0		30.0	90.0		60.0		-	150.0
11. Salt-mineral blocks 1057 Kh. @ R. 10	50	0.5	60	0.6	63	0.6	68	0.7	76	0.8	3.2	317	3.2	423	4.2	10.6
TOTAL		25.7		84.9		163.2		238.61		313.9	826.31		1030.2		7311	2587.61

PROPOSED PASTURE PRODUCTION PROGRAM IN DARAUNDI CATCHMENT AREA

(Area in Hectare)

PROPOSED PROGRAM	First Five Years						Second Five Years	Third Five Years	TOTAL
	1	2	3	4	5	Total			
1. Improved forage crop production	0.6	4.7	11.9	22.6	56.1	95.9	470.8	882.3	1449
2. Improved pasture development (private ownership)		2.5	11.5	28.3	56.7	99.0	821.3	816.5	1737
3. Improved pasture development on terrace slopes	-	0.4	3.3	11.4	28.9	44.0	447.0	491.0	982
4. Range management		(10.3)	(30.8)	(61.4)	(102.1)	(204.8)	(298)	(518.2)	(1021)
a. sub-tropical-warm temperate	-	6.3	18.8	37.6	62.6	125.3	219.0	281.7	626
b. cool temperate-sub-alpine	-	4.0	12.0	24.0	39.5	79.5	79.0	236.5	395
5. Improved pasture development in panchayat forest	-	7.5	19.5	40.5	61.5	129.0	720	581.5	1430.5
6. Management of forest grazing	-	-	-	-	18	18	53	106	177
7. Pasture development in panchayat forest and planted plantation	-	15	25	30	45	115	150	250	515
GRAND TOTAL	0.6	40.4	102	194.4	368.3	705.7	2960.1	3645.5	7311.5

APPENDIX 2.6 (2.3)
(continued)

PROPOSED PASTURE PRODUCTION PROGRAM IN DARAUNDI CATCHMENT AREA
(Area in Hectares)

1-Unit of work to be done in hectares. 2-Cost in thousand rupees.

PROPOSED PROJECTS	First Five Year Program											Second Five Years		Third Five Years		TOTAL
	Year 1		Year 2		Year 3		Year 4		Year 5							
	1	2	1	2	1	2	1	2	1	2	Total	1	2	1	2	
1. Forage crop development. 1449 ha. @R.260	0.6	0.2	4.7	1.2	11.9	3.1	22.6	5.9	56.1	14.6	24.9	470.8	122.4	882.3	229.4	376.8
2. Improved pasture development (private ownership) 1739 ha. @ R. 1700; 1300;1100	-	-	2.5	4.2	11.5	19.6	28.3	48.1	56.7	172.1	244.0	821.3	1067.7	816.5	898.2	2209.9
3. Improved pasture land on terrace slopes 982 ha. @ R. 500	-	-	0.4	.2	3.3	1.7	11.4	5.7	28.9	14.5	22.1	447	223.5	491	245.5	491.1
4. Range management 1021 ha. @ R. 900	-	-	10.3	9.3	30.8	27.8	61.6	55.4	102.1	91.9	183.3	298	268.2	518.2	466.4	919
5. Improved pasture development in panchayat forest, 1430.5 ha. @ R. 1600	-	-	7.5	12	19.5	31.2	40.5	64.8	61.5	98.4	206.4	720	1152	581.5	930.4	2288.8
i) pasture guards (50% voluntary) @ 75 ha. yr.	-	-	-	0.6	-	2.1		5.1		9.7	17.5		63.7		107.3	188.5
6. Management of forest grazing land, 177 ha. @ R. 600	-	-	-	-	-	-	-	-	-	10.8	10.8	53	31.8	106	63.6	106.2
			2	27.5		85.5		185		412	710		2929.3		2940.8	6580.1

APPENDIX 2.6 (2.3)
(continued)

PROPOSED PASTURE PRODUCTION PROGRAM IN DARAUNDI CATCHMENT AREA
(Area in Hectares)

1-Unit of work to be done in hectares. 2-Cost in thousand rupees

PROPOSED PROJECTS	First Five Year Program											Second Five Years		Third Five Years		TOTAL
	Year 1		Year 2		Year 3		Year 4		Year 5		Total					
	1	2	1	2	1	2	1	2	1	2		1	2	1	2	
7. Pasture development in panchayat forest and planted plantation. 170 ha. @R 900	-	-	15	13.5	25	22.5	30	27	45	40.5	103.5	15.0	135.0	250	225.0	463.5
8. Improved pasture and range management research	-	5		25		50		50		50	180		200		200	580
i) Establishment of pasture unit		190		65		65		65		65	450		95		95	640
9. Pasture production studies in panchayat forest and planted plantation						1		3		3	7		4		4	15
10. Range and pasture supplies, materials		1		5		20		25		40	91		50		-	141
11. Salt minerals blocks 4379 kg. @ R. 10	240	2.4	250	2.5	265	2.6	275	2.8	284	2.8	13.1	1314	13.2	1751	17.5	43.8
TOTAL		198.4		111		161.1		172.8		201.3	844.6		497.2		541.5	1883.3

APPENDIX 2.6. (4)

PROPOSED PASTURE PRODUCTION PROJECTS IN UPPER KALIGANDAKI CATCHMENT AREA (MYAGDI DISTRICT)
(Area in hectares)

PROPOSED PROJECTS	First Five Years						Second Five Years	Third Five Years	Total
	1	2	3	4	5	Total			
1. Annual forage crop development	0.7	4.2	8.5	21.1	36.4	70.9	208.7	395.4	675
2. Improved pasture development (private ownership)		2.5	10	17.0	31.0	60.5	360.5	390	811
3. Improved pasture development on terrace slopes	-	0.6	2.3	8.1	18.6	29.6	244.5	276.3	550.4
4. Range management		(14)	(42)	(85)	(142)	(283)	(497)	(640)	(1420)
a. sub-tropical warm temperate		5	15	31	52	103	182	235	520
b. cool temperate sub-alpine		9	27	54	90	180	315	405	900
c. steppe	-	-	-	-	-	-	-	-	-
5. Improved pasture development in panchayat forest		5	13	27	41	86	433	302	821
6. Management of forest grazing		-	-	-	18	18	55	112	185
7. Pasture development in panchayat forest and planted plantation		15	20	30	40	105	150	250	505
GRAND TOTAL	0.7	41.3	95.8	188.2	327	652.9	1948	2365.7	4966.6

APPENDIX 2.6 (4)
(continued)

PROPOSED PASTURE PRODUCTION PROGRAM IN UPPER KALIGANDAKI CATCHMENT AREA (MYAGDI DISTRICT)
(Area in Hectares)

1-Unit of work to be done in hectares. 2-Cost in thousand rupees

PROPOSED PROJECTS	First Five Year Program											Second Five Years		Third Five Years		TOTAL
	Year 1		Year 2		Year 3		Year 4		Year 5		Total					
	1	2	1	2	1	2	1	2	1	2		1	2	1	2	
1. Forage crop development, 675 ha. @Rs.260	0.7	0.2	4.2	1.1	8.5	2.2	21.1	5.5	36.4	9.5	18.4	208.7	54.3	395.4	102.8	175.6
2. Improved pasture development (private ownership) 811 ha. @R. 1700; 1300; 1100			2.5	4.2	10	17.0	17.3	29.4	31	32.7	102.8	360.5	468.7	390	429	1000.5
3. Improved pasture development on terrace slopes. 550.4 ha. @Rs. 500	-	-	0.6	0.3	2.3	1.2	8.1	4.1	18.6	9.3	14.9	244.5	122.3	276.3	138.2	275.4
4. Range management 1420 ha. @ Rs. 900																
5. Improved pasture development in panchayat forest. 821 ha. @ R. 1600	-	-	5	8	13	20.8	27	43.2	41	65.6	137.6	433	692.8	302	483.2	1313.6
i) Pasture guards (50% voluntary) @ R 75 ha.				0.4		1.4		3.4		6.5	11.7		39		61.6	112.3
6. Management of forest grazing land. ha. @R 600	-	-	-	-	-	-	-	-	18	10.8	10.8	55	33	112	67.2	111.0
7. Pasture development in panchayat forest and planted plantation. 120 ha. @R. 900	-	-	15	13.5	20	18.0	30	27.0	40	36.0	94.5	150	135	250	225.0	454.5

APPENDIX 2.6 (4)
(continued)

PROPOSED PASTURE PRODUCTION PROGRAM IN UPPER KALIGANDAKI CATCHMENT AREA (MYAGDI DISTRICT)
(Area in Hectares)

1-Unit of work to be done in hectares. 2-Cost in thousand rupees

PROPOSED PROJECTS	First Five Year Program											Second Five Years		Third Five Years		TOTAL
	Year 1		Year 2		Year 3		Year 4		Year 5		Total					
	1	2	1	2	1	2	1	2	1	2		1	2	1	2	
8. Improved pasture and range management research		5		25		50		50		50	180		200		200	580.0
i) Establishment of pasture unit		190		65		65		65		65	450		95		95	640.0
9. Pasture production studies in panchayat forest and planted plantation		-		-		1		2		2	5		4		4	13.0
10. Range and pasture supplies, materials		1		5		20		25		40	91		50		-	141.0
11. Salt mineral block 2148 Kg. @ R. 10	120	1.2	123	1.2	127	1.3	135	1.3	140	1.4	6.4	645	6.5	858	6.6	21.50
TOTAL		197.4		140.8		235.7		332.4		476.6	1382.9		2348.6		2390.7	6122.2

APPENDIX 2.6. (5)

PROPOSED PASTURE PRODUCTION PROJECTS IN UPPER KALIGANDAKI CATCHMENT AREA (MUSTANG DISTRICT)
(Area in hectares)

PROPOSED PROJECTS	First Five Years						Second Five Years	Third Five Years	Total
	1	2	3	4	5	Total			
1. Annual forage crop development	0.1	0.6	0.9	1.8	3.8	7.2	32.4	56.4	96
2. Improved pasture development (private ownership)			2.3	8.5	14.0	24.8	75.2	85.8	185
3. Improved pasture development on terrace slopes		0.5	2.5	4.1	8.2	15.3	36.2	52	103.5
4. Range management		(26)	(78)	(157)	(261)	(522)	(914)	(1177)	(2613)
a. sub-tropical warm temperate	-	0.5	1.5	3.0	4	9.0	15	19	43
b. cool temperate sub-alpine	-	8	24	49	82	163.0	287	370	820
c. steppe	-	17.5	52.5	105	175	350.0	612	788	1750
5. Improved pasture development in panchayat forest	-	5.5	14.5	26.0	37.5	83.5	231.5	196.0	511
6. Management of forest grazing	-	-	-	-	5	5	13	26	44
7. Pasture development in panchayat forest and planted plantation	-	-	-	-	-	-	50	50	100
GRAND TOTAL	0.1	32.6	98.2	197.4	239.5	657.8	1352.3	1642.4	3653.5

APPENDIX 2.6 (5)
(continued)

PROPOSED PASTURE PRODUCTION PROGRAM IN UPPER KALIGANDAKI CATCHMENT AREA (MUSTANG DISTRICT)
(Area in Hectares)

1-Unit of work to be done in hectares.

2-Rupees ('000)

PROPOSED PROJECTS	First Five Year Program											Second Five Years		Third Five Years		TOTAL
	Year 1		Year 2		Year 3		Year 4		Year 5							
	1	2	1	2	1	2	1	2	1	2	Total	1	2	1	2	
1. Forage crop development. 96 ha. @ 260	0.1	0.03	0.6	0.2	0.9	0.2	1.8	0.5	3.8	1	0.93	32.4	8.4	56.4	14.7	25.03
2. Improved pasture development (private ownership) 190 ha. @ R. 1700;1300;1100					2.3	3.9	8.5	14.4	14.0	23.8	42.2	75.2	97.8	85.5	94.1	234.1
3. Improved pasture development on terrace slopes 1902 ha. @ R. 500	-	-	0.5	3	2.5	1.2	4.1	2.0	8.2	4.1	7.6	36.2	18.1	52	26.0	51.7
4. Range management 2613 ha. @ R. 900	-	-	26	23.4	78	70.2	157	141.3	261	234.9	469.8	914	822.6	1177	1059.3	2351.7
5. Improved pasture development in panchayat forest 511 ha. @ R. 1600	-	-	5.5	8.8	14.5	23.2	26	41.6	37.5	60.0	133.6	231.5	370.5	196	313.6	817.6
i) Pasture guards (50% voluntary) @ R. 75 ha.				0.4		1.5		3.5		6.3	11.7		23.7		38.4	73.8
6. Management of forest grazing. 44 ha. @R.600									5	3	3	13	7.8	26	15.6	26.4
7. Pasture development in panchayat forest and planted plantation. 30 ha. @ R.900												50	45.0	50	45.0	90

APPENDIX 2.6 (5)
(continued)

PROPOSED PASTURE PRODUCTION PROGRAM IN UPPER KALIGANDAKI CATCHMENT AREA (MUSTANG DISTRICT)
(Area in Hectares)

2-Unit of work to be done in hectares. 3-Cost in Rupees ('000)

PROPOSED PROJECTS	First Five Year Program											Second Five Years		Third Five Years		TOTAL
	Year 1		Year 2		Year 3		Year 4		Year 5		Total					
	1	2	1	2	1	2	1	2	1	2		1	2	1	2	
8. Improved pasture and range management research		10		30		60		60		60	220		200		200	620
9. Pasture production studies in panchayat forest and planted plantation						1		2		2	5		5		4	12
10. Range and pasture supplies, materials		3		10		20		25		40	98		70		-	168
11. Salt mineral blocks, 2416 Kg. @R. 10	135	1.4	140	1.4	145	1.4	150	1.5	155	1.5	7.2	725	7.3	966	9.7	24.2
SUBTOTAL																5340.53
Contingency 10%																534
GRAND TOTAL																5874.5
		17.7		74.6		182.6		291.8		436.6	1000		1674.1		1820.4	4494.8

APPENDIX 2.7

COST CALCULATION FOR PROPOSED PROJECTS

1. Annual forage crops

   40% summer forage crops + 60% winter forage crops seed rate 65 kg/ha @ Rs. 8.00. Seed will be made available to the farmers at 50% subsidized rate. Project cost involvement will be Rs. 260/ha.

2. Improved pasture development (private ownership)

   Cost of seed and fertilizer @ Rs. 500/ha.
   Compensation to the farmers Rs. 1200/ha during first five year program; Rs. 800/ha during second five year and Rs. 600/ha during third five year program.

3. Improved pasture development on terrace slopes

   Seedlings or planting materials will be raised in Livestock Center/Sub-Center/ Nursery. Cost of seeds and planting materials @ Rs. 500 ha.

4. Range management

   a. Cost of land preparation and partial reseeding in the depleted grasslands @ Rs. 600 ha.
   b. Cost of fertilizer and uprooting noxious plants @ Rs. 300 ha.

5. Improved pasture development in panchayat forest

   a. Cost of land preparation and seeding @ Rs. 950 ha.
   b. Cost of fertilizer application and uprooting undesirable plants @ Rs. 650 ha.
   c. Pasture guards: 730 man days/year for 50 ha and 50% voluntary service from village panchayat. Cost involved @ Rs. 75 ha. yr.

6. Management of forest grazing land

   Cost of partial reseeding in depleted forest grazing area with minimum land preparation @ Rs. 600 ha.

7. Pasture production

   In panchayat forest and planted plantation. Partial reseeding + cost of land preparation in planted forest land @ Rs. 600 ha.

8. i) Improved pasture and range management research

   Cost involved in conducting field scale trials of grasses and legumes both native and introduced. Botannical evaluation of native species and ecological mapping. Evaluation of potential productivity of native and introduced

species with or without environmental modifications, rangeland and pasture production studies, forage conservation, multiplication of nucleus seeds and field demonstrations.

ii) Establishment of pasture research

Seed multiplication unit (2) at Barpak (Gorkha district) and Pakhapani (Myagdi district)

		RUPEES
a.	land 10 ha. unit @ Rs. 5000 ha. (uncultivated land)	50,000
b.	fencing with locally available material	25,000
c.	residential quarter for 2	35,000
d.	thatched house for Chaukidar	10,000
e.	store house cum office (3 room)	20,000
f.	range and pasture supplies	5,000
Operating cost	Construction -- Sound	
Staffing		
Junior technician	(NG I) - 1	35,000
Field assistant		
Chaukidar	(NG III) - 1	
	- 2	
Seeds, labor, etc.		30,000

9. Pasture production studies in panchayat forest and planted plantation. Cost includes studying the herbage supply from newly planted forest land.

10. Range and pasture supplies, materials.
Purchase of equipment such as scales, clippers, seed sowing machines, printed materials for demonstration, etc. 75% imported.

11. Salt mineral blocks
2 Kg. blocks @ Rs. 10 imported from India or abroad for first two years and then locally prepared.