

ANNEXES

Annex - 1

Table - 1: Some Negative Changes as Indicators of the Unsustainability of Mountain Agriculture in Tauthali Sub-Watershed by Study Site (Sindhupalchok District)

Indicators	Time Frame/ Year	Unit	Study Site			Sub- Watershed Area	Method of Investi- gation
			Chhipi gaun	Gahiri gaun	Tauthali gaun		
A. RESOURCE BASE							
1. Visible Changes							
- Increased landslides	1954 1978 1991 C	No. " " %	1 2 2 +50	- 4 4 +400	1 4 4 +300	2 10 10 +400	a,b,c
	1954 1978 1991 C	ha " " %	2 5 6 +200	- 11 13 +1300	5 7 10 +100	7 23 29 +300	a,b,c
- Increased soil erosion	A B C	mm/yr " %	2.5 3.0 +20	2.5 3.5 +40	2.0 2.5 +25	2.3 3.0 +30	a,d d,e
- River cutting	1954 1978 1991 C	ha " " %	2 3 4 +100	- 5 7 +700	6 9 11 +83	8 17 22 +175	a,b, c,d
- Gully formation	1954 1991 C	No. " %	- 6	- 4	- 3	- 13	b,c
- Abandonment of land due to low fertility	A B C	ha " %	- - -	5 2 -60	- 5	5 7 +40	a,b, c,d
- Abandonment of land due to landslides	A B C	ha " %	- 2	- 9	- 4	- 15	a,b,c,d
- Stone/rocks on cultivated land	A B C	% of total cult. land %	5 25 +400	- 10	- 10	1 15	c,d
- Decreased size of livestock holding per farm	A B C	LSU LSU %	6.8 2.8 -60.0	8.3 2.6 -70.0	5.6 3.0 -45.0	6.6 2.8 -55.0	g
- Change in herd structure	A B C	ratio of large & small ruminants	45:55 40:60	60:40 45:55	66:33 40:60	60:40 40:60	g
- Increased livestock population							g
cattle	C	%	-20	-40	-15	-25	
bullocks	C	%	-15	-30	+65	+20	
buffaloes	C	%	-65	-65	-70	-65	
sheep	C	%	-100	-80	-50	-70	
goat	C	%	+5	+65	+140	+85	

Note: 1. A = Past (30 or 40 years ago); B = Present; C = Change between A and B
 2. Some of the indicators have appeared in more than one broad category (e.g. resource, base, production flow, utilisation/management) of indicators. It is so because of their relevance in various categories.

Indicators	Time Frame/ Year	Unit	Study Sites			Sub-Watershed Area	Method of Investigation
			Chhipi gaun	Gahiri gaun	Tauthali gaun		
- Decreased area under • forest • pasture/grazing land • forest/pasture	1954	ha	159	55	6	200	a,b,c
	1978	"	106	20	-	126	
	1991	"	40	15	-	55	
	C	%	-75	-75	-100	-75	
	1954	ha	38	227	103	368	a,b,c
	1978	"	12	134	73	219	
	1991	"	-	-	30	30	
	C	%	-100	-100	-70	-90	
	1954	ha	197	282	109	588	a,b,c
	1978	"	118	154	73	345	
	1991	"	40	15	30	85	
	C	%	-80	-95	-70	-85	
- Reduced level of vegetative cover of CPRs	A	%	70	80	90	80	a,c,d
	B	"	55	50	65	55	
	C	"	-20	-35	-30	-30	
- Reduced level of bio-diversity • in CPRs - fodder trees - fuelwood - timber - green cut grasses • in farmland crops (in terms of varieties) - paddy - maize - wheat - millet • fodder trees	A	No. of types	8	7	6	7	g
	B		3	3	2	3	
	C		-60	-60	-65	-60	
	A	No. of types	10	8	10	9	g
	B		2	-	5	3	
	C		-80	-100	-60	-65	
	A	No. of types	8	5	10	8	g
	B		5	3	4	4	
	C		-35	-40	-60	-50	
	A	No. of types	5	5	5	5	g
	B		3	3	3	3	
	C		-40	-40	-40	-40	
		%	-20	-30	-33	-30	g
	C	%	-10	-50	-10	-20	
	C	%	-75	-75	-50	-65	g
	C	%	-66	-50	-	-40	
	C	%	-70	-70	-	-50	g
	C	%					
	A	ha	7	5	4	16	c,d
	B	"	5	2	3	10	
	C	%	-30	-60	-25	-35	

Indicators	Time Frame/ Year	Unit	Study Site			Sub-Watershed Area	Method of Investigation
			Chhipi gaun	Gahiri gaun	Tauthali gaun		
- Reduced level of water resources							
no. of water mills (<i>ghatta</i>) in operation	A	no.	7	5	4	16	c,d
	B	"	5	2	3	10	
	C	%	-30	-60	-25	-35	
no. of months of operation of <i>ghatta</i>	A	no.	6	6	6	6	c,d
	B	"	6	6	5	6	
	C	%	-	-	-15	-	
conversion of <i>khet</i> into <i>bari</i>	A	ha	-	-	-	-	c,d
	B	"	-	-	-	-	
	C	%	-	-	-	-	
- Increased human population	C	%	+30	+40	+50	+40	d,e
- New land under cultivation between 1954-1991	C	%	+200	+800	+100	+240	c,d
2. Concealed changes							
- Increased fragmentation of land	A	no.	2-8	2-10	2-50	2-50	g
	B	"	3-13	3-50	3-110	3-110	
	C	%	+50	+20	+25	+30	
- Reduced size of land parcels	A	ropani	2-8	2-10	2-50	2-50	g
	B	"	3-13	3-50	3-110	3-110	
	C	%	+50	+20	+25	+30	
- Increased distance to a parcels of land from homestead	c	%	+20	+20	+30	+25	g
- Decreased in proportion of households producing enough foodgrains for their consumption	A	%	15	20	12	15	g
	B	%	10	12	3	6	
	C	%	-50	-40	-60	-60	
- Bending of bottom sections of forest trees	C	status					c
- Increased rate of out-migration permanent	C	HH	20 20% of total HHs	9 2% of total HH	5 1% of total HH	34 about 5% of total HH	g
temporary (seasonal)	C	increased frequency	high	medium	very high	high	g
- Reduced level of foodgrain supply from their own production which is enough for a specified no. of months	A	months	7.0	8.0	7.0	7.3	g
	B	"	6.5	7.0	5.5	6.4	
	C	%	-7.0	-12.0	-20.0	-15.0	

Indicators	Time Frame/ Year	Unit	Study Sites			Sub- watershed Area	Method of Investi- gation	
			Chhipi Gaun	Gairi Gaun	Tauthali Gaun			
B. PRODUCTION FLOW								
1. Visible Changes								
- Declined level of crop yields o paddy o maize o wheat o millet	A	kg/ha	1330	1430	1250	1340	g	
	B	"	1730	1340	1280	1450		
	C	%	+30	-6	+2	+8		
	A	kg/ha	1480	1200	1185	1288	g	
	B	"	1460	1200	1080	1246		
	C	%	-1	0.0	-9	-3		
	A	kg/ha	1010	1050	1050	1036	g	
	B	"	960	820	960	913		
	C	%	-3	-22	-9	-12		
	A	kg/ha	1050	830	800	893	g	
	B	"	1450	1000	700	1050		
	C	%	+38	+20	-72	+18		
	- Stagnant/Declined level of livestock productivity o milk yield - cows - buffaloes o body wt (buffaloes) o egg production o wool production	A	litre/lactation	225	300	250	250	g
		B		150	150	140	150	
		C	%	-33	-50	-40	-40	
A		litre/lactation	525	685	600	600	g	
B		%	500	575	500	500		
C		%	-5	-25	-15	-15		
C		%	-20	-20	-20	-20	g	
C		%	-	-	-	-	g	
C		%	-	-50	-50	-50	g	
C		%	-20	-20	-25	-20	g	
- Change in livestock production parameters o Total no. of breeding animals - cows - buffaloes		A	no.	6	6	6	6	g
		B	"	4	4	4	4	
		C	%	-50	-50	-50	-50	
		A	no	7	8	6	7	g
		B	"	5	5	4	5	
	C	%	-30	-35	-50	-30		

Indicators	Time Frame/ Year	Unit	Study Sites			Sub-watershed Area	Method of Investigation
			Chhipi Gaun	Gairi Gaun	Tauthali Gaun		
o age at first calving - cows	A	year	4.5	4.5	5.0	4.5	g
	B	"	5.0	4.5	5.0	4.5	
	C	%	-10	-	-	-	
- buffaloes	A	year	4.5	4.5	5.0	4.5	g
	B	"	4.5	5.0	5.0	4.5	
	C	%	-	+10	-	-	
o calving interval - cows	A	month	20	20	20	20	g
	B	"	22	22	22	22	
	C	%	+10	+10	+10	+10	
- buffaloes	A	month	18	20	20	19	g
	B	"	18	20	20	19	
	C	%	-	-	-	-	
o birthing age - goat	A	year	1.2	1.5	1.5	1.4	g
	B	"	1.5	1.5	1.5	1.5	
	C	%	+25	-	-	+10	
- sheep	A	year	-	2.5	-	2.5	g
	B	"	-	2.5	-	2.5	
	C	%	-	-	-	-	
o birthing interval - goat	A	month	6	6	7	6	g
	B	"	7	7	8	7	
	C	%	+15	+15	+15	+15	
- Reduced quantity of compost, manure application							
o per land cultivated	A	mt/ha	12.8	10.5	7.1	10.1	g
	B	"	8.7	6.6	4.6	6.6	
	C	%	-32.0	-38.0	-35.0	-35.0	
- Decreased level of fodder and other animal feed supplies from CPR							
o private land	A	% of total supply	50	50	15	40	g
	B	"	80	95	35	70	
	C	%	+60	+90	+130	+75	
o common land	A	% of total supply	50	50	85	60	g
	B	"	20	5	65	30	
	C	%	-60	-90	-25	-50	
- Increased inputs need for the same level of agri. production	C	Intensity of increase	medium	high	medium	high	g
- Higher intensity of disease and pest infestation	C	Intensity of increase	high	medium	low	medium	g
- Increased demand for labour in food grain prod. without much increase in productivity.	A B C		increased	increased	increased	increased	g

Indicators	Time Frame/ Year	Unit	Study Site			Sub- Water- shed Area	Method of Investi- gation
			Chhipi Gaun	Gairi Gaun	Tauthali Gaun		
2. Concealed Changes							
- Breakdown of linkages among components of farming system	C	intensity of breaking down	high	very high	medium	high	g
- Increased rate of crop by-product use	A B C	% of total firewood used %	10 20 +100	2 10 +400	- 10 +1000	4 13 +230	g
- Increased level of foodgrain supply from outside the farm (either through food aid programme or purchased from markets)	A B C	% % %	10 20 +100	10 20 +100	20 30 +50	10 20 +50	g
- Increase in time needed to fetching biomass from forest							
o fodder/compost	A B C	HRS/load " %	3 6 +100	1 3 +200	0.5 5.0 +900	1.5 4.5 +200	g
o fuelwood	A B C	HRS/load " %	4 8 +100	4 8 +100	0.5 not available now	4 8 +100	g
o drinking water	C	HRS/ bucket %	no change	no change	no change	no change	g

Indicators	Time Frame/ Year	Unit	Study Sites			Sub-Watershed Area	Method of Investigation
			Chhipi Gaun	Gairi Gaun	Tauthali Gaun		
C. UTILISATION & MANAGEMENT PRACTICES							
1. Visible Changes							
- Open and haphazard grazing practices on forests/pastures	A B	Status	Quite systematic to haphazard	Quite systematic to haphazard	Quite systematic to haphazard	Quite systematic to haphazard	g
- Increased rate of crop by-product use	A B C	% of total firewood used	10 20 +100	2 10 +400	- 10 +100	4 13 +230	g
- Utilisation of " <i>Banmara</i> " plants (<i>Eupatorium</i> sp.) as firewood	A B C	% of total firewood utilised	- 2 +100	- 40 +100	- - -	- 14 +100	g
- Emphasis on monocropping (e.g., cereal crops)	C	Intensity of increase	high	high	medium	high	g
- Steep slope cultivation practice (above 30 degrees)	A B C	ha " %	- 2	- 9	- 4	- 15	a,b,c
- Increased depth of terrace wall slicing	A B C	inch " %	1 2 +100	1 2 +100	1.0 1.5 +50	1 2 +100	c,d
- Increased presence of trees on forest or shrubland							
o pine trees	C	%	+50	+50	+10	+20	c,d
o <i>Eupatorium</i> sp.	C	%	+30	+50	+30	+40	c,d
- Increased area under cult. land through the conversion of marginal land	C	%	+10	+15	+20	+15	

Footnotes on Method of Investigation

- Aerial Photographs, 1978, HMG/Nepal
- Topo Sheet Map, 1954, HMG/Nepal
- Field Observation, 1991, ICIMOD
- Farmers' Discussions, 1991, ICIMOD
- Gilmour D.A. (1984) - People, Forests, and Erosion: Experiences from the Middle Hills of Nepal, Keynote address in IUFRO Symposium on "Effects of Forest and Land Use on Erosion and Slope Stability". University of Hawaii, May 7-11.
- Population Census, 1981, CBS, Nepal
- Rapid Rural Appraisal, 1991, ICIMOD

Annex - 1

Table - 2: Some Negative Changes as Indicators of Unsustainability of Mountain Agriculture in Singhuwa Sub-Watershed (Dhankuta District) by Study Site

Indicators	Time Frame/ Year	Unit	Study Sites			Sub-Watershed Area	Method of Investigation
			Ghame	Muga	Deurali		
A. RESOURCE BASE							
1. Visible Changes							
- Increased landslides	1954 1978 1991 C	ha ha ha %	- 12 23 +100	- - 1 -	- - 1 -	- 12 25 +100	a,b,c
- Increased soil erosion	A B C	mm/yr mm/yr %	2.5 3.0 +20.0	2.0 2.5 +15.0	1.5 1.7 +15.0	2.0 2.4 20.0	a,b,c d,e
- River cutting	1954 1978 1991 C	ha ha ha %	0.0 12.0 15.0 +25	- - - -	- - - -	0.0 12.0 15.0 +25	a,b c,d
- Gully formation	C	Intensity of increase	high	medium	low	medium	c
- Abandonment of land due to low fertility	A B C	ha ha %	- - -	- 10 +100	5 20 +300	35 ha (3% of total cult.land)	a,b c,d
- Abandonment of land due to landslides	A B C	ha ha %	- 10 -	- 10 -	- 10 -		b,c
- Stone/rocks on cultivated land	A B C	% of total cult. land % %	20 80 +300	- 10 +100	- - -	10 30 +200	c,d
- Decreased size of farm	C	%	-30	-20	-30	-30	g
- Decreased size of livestock holding	A B C	LSU LSU %	5.6 7.2 +75.0	2.5 1.5 -40.0	9.0 5.5 -40.0	5.7 4.7 -20.0	g
- Change in herd structure	A B	ratio of large and small ruminants	2:3 2:3	2:1 1:9	2:1 1:1	45:55 40:60	g
- Increased livestock population							g
cattle	C	%	+89	10	+36	+45	
bullocks	C	%	-	-	-15		
buffaloes	C	%	+150	-50	-65	+50	
sheep	C	%	-	-100	-100	-100	
goats	C	%	+100	0	+170	+135	

Note: A = Past (30 or 40 years ago); B = Present; C = Change between A and B

Indicators	Time Frame/ Year	Unit	Study Sites			Sub-Watershed Area	Method of Investigation
			Ghame	Muga	Deurali		
- Decreased area under forest	1954	ha	291	467	23	781	a,b,c
	1978	ha	268	404	4	676	
	1991	ha	262	384	3	649	
	C	%	-10	-20	-85	-20	
- pasture/grazing land	1954	ha	n.a.	n.a.	n.a.	n.a.	a,b,c
	1978	ha	17	6	12	35	
	1991	ha	12	4	10	26	
	C	%	-30	-50	-20	-25	
- forest/pasture	1954	ha	291	467	23	781	a,b,c
	1978	ha	285	410	16	711	
	1991	ha	253	388	13	675	
	C	%	-15	-20	-45	-15	
- Reduced level of vegetative cover of CPRs	A	%	75	75	90	80	c
	B	%	55	55	70	60	
	C	%	-25	-25	-20	-25	
- Reduced level of bio-diversity	C	%	-40	-50	+20	-50	a,b,c
o in CPRs							
- fodder trees	C	%	-40	-50	+20	-25	
- on farmland	A	no	8	6	6	8	
- crops	B	no	11	6	7	11	
	C	%	+35	0	+15	+35	
- fodder trees	C	%	+10	+20	+20	+15	
- Siltation of cult. land by river bank	C	ha	5-10	-	-	5-10	c
- Reduced level of water resources							c,d
- no. of water mills (ghatta) in operation	A	no.	-	2	-	2	
	B	no	-	1	-	1	
	C	%	-	-50	-	-50	
- no. of months of operation of ghatta	A	month	-	6	-	6	
	B	month	-	4	-	4	
	C	%	-	-50	-	-50	
- conversion of khet into bari	A	ha	-	-	-	-	
	B	ha	3.5	7.5	-	11.0	
	C	%					
- Increased human population	C	%	+50	+50	+95	65	d,e
- New land under cultivation between (1954-1991)	C	%	+10	+20	+5	+15	c,d

Indicators	Time Frame/ Year	Unit	Study Sites			Sub- Watershed Area	Method of Investi- gation
			Ghame	Muga	Deurali		
2. Concealed Changes							
- Increased fragmentation of land	C	%	+20	+35	+10	+20	g
- Reduced size of land parcels	C	%	-10	-30	-10	-20	g
- Increased distance to a parcel of land from homestead	C	%	+50	+100	+50	+60	g
- Decrease in proportion of households producing enough foodgrains for their own consumption	A	%	20	10	-	10	g
	B	%	30	20	30	30	
	C	%	+50	-50			
- Bending of bottom sections of forest trees	C	Status	Little	High	Little	Medium	c
- Increased rate of out-migration o permanent	C		6HH migrated 20 or 25 yrs ago since then none	None	6HH migrated 17/18 yrs ago since then no migration		g
o temporary (seasonal)	A		frequent	Frequent	Frequent	Frequent	g
	B		none	Frequent	No More	Decreased a little bit	
- Reduced level of foodgrain supply from their own production which is enough for a specified no. of months	A	month	6	8	6	6.5	g
	B	month	8	6	7	7.0	
	C	%	+30	-25	+15	+10.0	
B. PRODUCTION FLOW							
1. Visible Changes							
- Decline in crop yields							e
o paddy	C	%	+10	-33	+10	-5	
o maize	C	%	+15	-50	+40	+5	
o wheat	C	%		-60	+15	-20	
o millet	C	%	-20	-50	+10	+5	
o soyabean	C	%	+15	-10	-5	-5	
o mustard	C	%	-5	-10	-10	-10	
o others	C	%	-5	-10			

Indicators	Time Frame/ Year	Unit	Study Sites			Sub-watershed Area	Method of Investigation
			Ghame	Muga	Deurali		
- Stagnant/Declined level of livestock productivity							
o milk yield							
- cow	A	litre/lact-	430	300	360		
	B	ation	360	400	400		
- buffaloes	C	%	+20	-25	-10		
	A	litre/lact-	960	1030	600		
	B	ation	700	1030	750		
o body wt	C	%	+35	0.0	-20		
- cows							
- buffaloes	C	%	-10	-10	-10		
o meat	C	%	-10	-10	-10		
- castrated goats							
	A	kg/	30	30	30		
	B	head	40	40	37		
o egg production	C	%	-25	-25	-20		
	A	no./	50	50	50		
	B	bird	30	30	30		
o manure production	C	%	+66	+66	+66		
	C	%	+10	+10	+10		
o power generation by draught animals	C	%	+10	+10	+10		
- Change in livestock production parameters							
o age at first calving (cattle)	A	year	5.0	4.5	5.0		g
	B	year	5.0	5.0	5.5		
	C	%	0.0	+10.0	+10.0		
o calving interval (cattle)	A	month	19.0	20	20		g
	B	month	18.0	22	21		
	C	%	-5.0	+10	+5		
o age at first birthing (goats)	A	month	12.0	12	12		g
	B	month	12.0	15	14		
	C	%	0.0	+25	+15		
o birthing interval (goat)	A	month	8.0	7	8		g
	B	month	7.0	9	9		
	C	%	-15.0	+25	+15		
- Decreased level of fodder and other animal feed supplies from CPR							
o private land	A	%	30	25	30	30	e
	B	%	70	75	70	70	
	C	%	+130	+200	+130	+130	
o common land	A	%	70	75	70	70	e
	B	%	30	25	30	30	
	C	%	-55	-66	-55	-60	
- Increase in inputs needed for the same level of agri. production	C	status	medium	high	medium	medium	g
- Higher intensity of disease and pest infestation	A	status	little increasing	little increasing	little increasing	little increasing	c
	B						

Indicators	Time Frame/ Year	Unit	Study Site			Sub-watershed Area	Method of Investigation
			Ghame	Muga	Deurali		
- Increased demand for labour in foodgrain prod. without much increase in prod.	C	increased	medium	high	medium	medium	g
- Reduced quality of available compost and manure	A	mt	3.6	2.1	6.7	4.1	g
o fresh manure/HH	B	mt	5.3	1.3	3.9	3.5	
	C	%	+45.0	-35.0	-40.0	-15.0	
o compost/HH	A	mt	10.9	6.2	20.0	8.8	g
	B	mt	13.2	3.3	9.7	8.4	
	C	%	+20.0	-45.0	-50.0	-5.0	
o compost/ha cultivated land	A	mt	12.0	5.1	8.8	8.7	g
	B	mt					
	C	%					g
2. Concealed Changes							
- Breakdown of linkages among components of the farming system	C	Intensity of increase	medium	high	low	medium	g
- Increased rate of crop by-product use firewood	C	-	-	-	-	-	
- Increased level of foodgrain supply from outside the farm (either through food aid programmes or from markets)	C	Intensity of increase	medium	high	low	medium	g
- Increase in time needed to fetch biomass from forest, etc.							
o fodder	A	hrs/load	3-4	*	1	1-4	g
	B	"	5-6	*	3	3-6	
	C	%	+50	*	+200	+50	
o fuelwood	A	hrs/load	5-6	5-10	3	3-6	g
	B	"	7-8	"	5	5-8	
	C	%	+35	-	+65	+45	
o other biomass (e.g., compost, bedding materials, etc)	A	hrs/load	3-4		1	1-4	g
	B	"	5-6		3	3-6	
	C	%	+50		+65	+50	
o drinking water		hrs/bucket	20-30		20-30	5-30	g
		"	10-15		20-30	10-30	
		%	-50				

Indicators	Time Frame/ Year	Unit	Study Sites			Sub- Watershed Area	Method of Investi- gation
			Ghame	Muga	Deurali		
C. UTILISATION & MANAGEMENT PRACTICES							
1. Visible Changes							
- Open and haphazard grazing practices in forest/pasture	C	Status	hap-hazard	hap-hazard	relatively controlled now		c,d
- Utilisation of "Banmara" plants (<i>Eupatorium</i> sp.) as o compost	A B C		- -	- -	From Titepati to Banmara		c,d c,d
o fodder	A B C				From Titepati to Banmara for goats		
- Conversion of marginal and sub-marginal land into cult. land	C	ha	10	20	10	40	g
- Practice of cultivation on steep slopes	1954 1991 C	ha " %	- 3	- 4	- 1	- 8	a,b,c
- Increased depth of terrace wall slicing	A B C	inch " %	1.0 1.5 +50	1 2 +100	1.0 1.5 +50	1.0 1.5 +50	g
- Decreased fallowing period in cult. land	A B C	month " %	6 3 -50	6 3.5 -40	6 3.5 -40	6 3.5 -45	g
- Increased presence of trees on forest or shrub land o pine trees o <i>Eupatorium</i> sp. o lantana	C C C				From Broad leaves to Titepati to <i>Eupatorium</i> sp. now		
- Shortened interval period between two cultivations in "shifting" cultivation practice	A B C	year " %	- - -	- - -	5-6 3-4 -35	5.5 3.5 -35	d

Note: Star (*) denotes that there is no system for collecting biomass from the forest at the Muga site due to degradation of forests.

Footnotes on Method of Investigation

- Aerial Photographs, 1978, HMG/Nepal
- Topo Sheet Map, 1954, HMG/Nepal
- Field Observation, 1991, ICIMOD
- Farmers' Discussions, 1991, ICIMOD
- Gilmour D.A. (1984) - People, Forests, and Erosion: Experiences from the Middle Hills of Nepal, Keynote address in IUFRO Symposium on "Effects of Forest and Land Use on Erosion and Slope Stability" University of Hawaii, May 7-11.
- Population Census, 1981, CBS, Nepal
- Rapid Rural Appraisal, 1991, ICIMOD

Table 1: Potential Technology Options Contributing to Sustainable Mountain Agriculture

Serial No.	Technology Option	Type of Technology	Primary Focus of Technology	Major Attributes (Compared to existing var.)	Resource Implication	Categories of Farmers who benefit most
1.	Rice-Chhomorong	M	Increased biomass	more (20-30%) grain and straw yields	No need of external inputs	Small-holders
2.	Maize-Pool 9A, Manakamana-1	M	Increased biomass	more (15-20%) grain and straw yields	No need of external inputs	Small-holders
3.	Millet-Okhle 1	Mo	Increased biomass + cash crop	grain-15% more straws-32%	No need of external inputs	Resource poor farmers
4.	Barley-Bonus and Soluwa	M	Increased biomass	grains-40% more straws-20%	No need of external inputs	Resource poor farmers
5.	Wheat-Annapurna-3 Nepal-251	M	Increased biomass	grains-3MT/ha Fodder green-(1.3-7.0 MT/ha) dry-(3.5MT)	Requires test	large, medium
6.	Lentil-Sikhar	M	Increased biomass + cash crop	high level of grains + straws fixation-124N kg/ha	No need of external inputs	Resource poor farmers
7.	Sarson-Ghorlikharka	L	Cash crop	highest oil content (57%) in the world yield-1.5 MT/ha	No need of external inputs	Resource poor farmers + all
8.	<i>Asuro (Adhoda vatica)</i> <i>Siris (Albizia lebbek)</i> <i>Titepati (Artemisia vulgaris)</i>	L	Indigenous green manure	Increases grain yields by about 40%	No need of external inputs	Resource poor farmers + all
9.	Local fodder trees	L	Biomass	Biomass	No need of external inputs	Resource poor farmers + all
10.	Crop/vegetable system		Cash	Cash crop + grains	No need of external inputs	Resource poor farmers + all

Note: Information contained in the above table are extracted from "Inventory of Potential Options" by S.P. Chand, 1992, Unpublished Report

M = Modern
Mo = Modified
L = Local