Annexures

This section contains information collected during field surveys to document the impact of climate change in Uttarakhand. The surveys were conducted by the Peoples Science Institute with the financial support of Himmothhan.

Field Survey: Bhagirathi Valley

Dates of survey: 06 to 12 October 2009

Survey Team: Shresthanand, Bhuvan Joshi, Chicu Lokgariwar

Villages Visited:

Sr.No	Village	Population	Remarks
1	Dharali	594	Apple producing village, tourism, north facing
2	Mukhawa	170	Farming village, south facing
3	Jaspur	195	Farming village, south facing

Detailed surveys were carried out in these three villages. In addition, Bagori and Harsil were visited for information about pastoralism and apple production.

Survey Reports:

1. Dharali *(Altitude: 2450 msl, pop.594)*

Spring Discharge

Spring no	Local name	Flow (lpm)	Months of flows	Use
1	Agyari Dhara		Perennial	Drinking
2	Agyari Dhara		Perennial	Drinking
3	Chauriya Dhara	3 lpm	Perennial	Drinking

Remarks:

The water from Agyari Dhara 2 is preferred for drinking for its purity. Also, it is lukewarm in winter.

Ground Freezing

	First freeze	Number of incidents
Last Year		0
5 years ago	End of October	
10 years ago	October	Frozen all winter

Snowfall

	First snowfall	Number of days snowed	Last snow	Max depth
Last Year	October and then none in November. Finally in last part of December	5 times	February	6” in the market and 18” in the village
5 years ago	November	Till March	March	2’6” to 3’
20 years	1st week of October		June	4’ in the village

ago	

Remarks:

- Snow in Dharali lasts longer than elsewhere since it is located on the shadow side.
- Elections were held in February 2002. The snow was so deep that the officials could not make it in to the village on the appointed day. The next day, they borrowed snowshoes from the army and walked in.

Weather Patterns

The year is divided into four seasons. These are grouped as below;

Chaitra	Baisakh	Jyeshtha	Aashad	Shravan	Bhado	Asooj	Kartik	Mangsheer	Poush	Magh	Phalgun
Bhada			Chaumasa			Harde			Hind		

Agricultural Impacts:

Pests

Crop affected	Name of pest	Time of attacks	First known occurrence
Phaphra	Eats leaves	Bhado	
Cholai	Eats leaves	Aashad	
Potatoes	Eats potatoes		
Apples	Eats flowers	During flowering	15 years ago

Crop Cycle (interview with Shivraj Singh Pawar's family)

Month	Activity
Chaitra	Return on the 15th day of Chaitra
Baisakh	Repairs to house and farm, ploughing for potatoes
Jyeshtha	Cholai, Rajma
Aashad	Cheena, Phapar
Shravan	Sarson, cutting of grass, weeding
Bhadrapad (bhado)	Grass cutting
Ashwin (Asooj)	Harvesting of cheena, phapar, rajma, potatoes, sarson, apples
Kartik	Spraying, packing
Aghain (mangsheer)	Travel
Poush	Away from farm
Magh	Away from farm
Phalgun	Away from farm

This is the calendar that is normally followed from earlier times, without much change.

Crop production

(Shivraj's family)

Name of crop	Area Cultivated	Production
Rajma	5 naali (intercropped with apples)	200 Kg
Potatoes	10 naali	400 Kg
Phapar	1 naali	3 Kg
Cholai	1.5 naali	2.5 Kg
Vegetables (mainly brassicas)	2 naali	40 kg
Apples	10 naali	10 boxes (7000/-)

Crop calendar (Focus group discussion with Charan Singh etc in the market)

Month	Stage of cultivation
Chaitra	Spraying of apples
Baisakh	Flowering of apples, all people return, ploughing, sowing of potatoes
Jyeshtha	Rajma sowing
Aashad	*godai*
Shravan	Removing potatoes
Bhadrapad (bhado)	Cholai if at all
Ashwin (Asooj)	Rajma, harvesting shrawan apples
Kartik	Harvesting apples, first weeding
Aghain	Pruning, spraying
Poush	Dormant
Magh	Dormant
Phalgun	dormant

Remarks:

1600 hours of freezing is necessary for apples. This needs to be when they are dormant. Last year, freezing occurred after flowering. Therefore, the flowers burnt off and the crop was poor.

(Focus group discussion with Charan Singh etc in the market)

Name of crop	Area Cultivated		
	today	**5 years ago**	**10 years ago**
Rajma			
Tomatoes			Started 8-10 yrs ago
Vegetables, brassicas			
Phapar	Now none		Popular earlier
Cholai	Practically none		
Cheena	none		
Potatoes	Personal use		
Apples	80 boxes each	average	average

Remarks:

The apple plant requires 10 years to start producing properly. After that, it continues to be productive for 90 years.

Time of Apple flowering (Focus group discussion with Charan Singh etc in the market)
Apples normally flower in the second week of April. 10 ears ago, the usual time of flowering was between the second and third weeks of April. Last year, flowering occurred 10 days early (i.e end of March).

Pests affecting apples (Focus group discussion with Charan Singh etc in the market)

Name of pest	Remarks
Thrips	Also pollinators. These increase in warm weather
Scale	Insects
Mites	First occurrence 4 years ago
Scape- fungus	This increases with humidity

Pollination

Number of hives	No hives kept. There is no tradition of bee-keeping, as pollinators or for honey in these villages
Honey production	NA
Apple Pollinators	Bees (several types), Wasps, Thrips

Orchard Maintenance

	Today (date)	**10 years ago**
Species	Royal, Red, Rochard, Golden (new)	Red
Pruning	Mangsheer	No pruning
Spraying	As per temperature / humidity. If humid, spray for scape, if dry then spray for thrips	No spraying

Remarks:

10 years ago, commercialization of the crop and its maintenance began.

Survey of Meadows

Location: Sat Tal, area outside the Sadhu's house. Lake filled up during avalanche 10 years ago. Now peaty bog.

Herbaceous cover data sheet

Quadrat #	**1**	**2**	**3**
Species name (unknown #) /local name			
Doob grass	279	576	405
Unknown (sattal 1)	63	432	288
Trifolium Sp	99	108	

Location: Dharali Bugyal

Herbaceous cover data sheet

Quadrat #	**1**	**2**
Species name (unknown #) /local name		
Pyrola Karakoramica	3	
Ajuga	1	
Rhododendron (seedling)	1	
Eulaliopsis	present	present
Bistorta Affinis		70
Rheum sp		1
Mazus spp		1

Survey of Forests
Quadrats taken along transect from the village to Sat Tal

Quadrat #1(RHS of path)
Forest cover data sheet

	Seedlings	Saplings	Poles	Fullgrown	Dead
Species name (unknown #) /local name					
Pinus wallichiana	0	2	0	0	4
Cedrus Deodara	13	22	0	1	0
Berberis asiatica				6	
Spruce	1				
undergrowth	Wild berry (rubus sp.), doob grass, Neelkanth				

Quadrat #2(LHS of path)
Forest cover data sheet

	Seedlings	Saplings	Poles	Fullgrown	Dead
Species name (unknown #) /local name					
Pinus wallichiana	2	0		2	
Cedrus Deodara	52		2	7	
Berberis asiatica				2	
undergrowth	Wild berry (rubus sp.), doob grass, fern				

Quadrat #3 (downstream of the 1st lake)
Forest cover data sheet

	Seedlings	Saplings	Poles	Fullgrown	Dead
Species name (unknown #) /local name					
Pinus wallichiana	0	9	8	8	0
undergrowth	Wild berry (rubus sp.), doob grass, fern				

Quadrat #4 (Sat tal)

Forest cover data sheet

	Seedlings	Saplings	Poles	Fullgrown	Dead
Species name (unknown #) /local name					
Pinus wallichiana	13	20	12	6	
Cedrus deodara	0	0	0	1	
Picia smithiana	3	2	1	6	
Remek					
undergrowth	Wild berry (rubus sp.), doob grass, fern				

Transect walk (from sat tal to Dharali Bugyal)

Lowland (2400-2800m)

Trees	Shrubs	Herbs
Pinus wallichiana	Berberis erithroclada	Potentilla alrosanguinea
Cedrus deodara	Berberis msiginus	Bergenia purpurascens
Alsies pindrow	Berberis asiatica	Cyathula tomentosa
Picia smithiana	Berberis kochiniana	Rumes nepalensis
	Cotoneaster integrifolia	Fogopyrum esculentum
	Rubus foliolosus	Rhum acuminatum
	Rubus nepalensis	Aconogonum sp
	Viburnun spp	Rheum sp
	Ageratum conyzoides	Sarcococca wallichii
	Rumex potentia	
	Debregeasia hypoluca	
	Girardinia diversifolia	

Midland (2800-3200m)

Trees	Shrubs	Herbs
Pinus wallichiana	Rosa sp	Artemisia gmelinii
Cedrus deodara	Cotoneaster integrifolia	Artemisia dracunculus
Alsies pindrow	indigofera	Artemisia absinthium
Picia smithiana	Berberis spp	Anaphalis busua
	Debregesia hypoluca	Ageratum sp
Rhododendron compenulatum		Cardus eclelbergii
Betula ulesis		Tanacetum nubigenum
		Ginaphalium affin
		Saussurea cortus

Highland (3200-3600 m)

Trees	Shrubs	Herbs
	Rosa sp	Rheum webbianum
Betula ulesis		Rumex patentia
Rhododendron compenulatum		Rumex nepalensis
		Aconogenum molle
		Bistora affinis
		Fergopyrum spp
		Chenopodium foliolosum
		Pogostemon sp
		Dracocephalum spp
		Ajuga sp
		Anjelica glance
		Sterobilenthes sp
		Pyrola karakoramica
		Bergenia sp
		Geranium sp

Species harvested: Forests

Name	Use	Consumption (domestic/market)	Qty harvested today	20 yrs ago
Deodar	Wood	Domestic	200 trees p.a	More for constructing houses in market
Chir	Wood	Domestic		

Species harvested: Meadows

Name	Use	Consumption (domestic/market)	Qty harvested today	20 yrs ago
Chaura	Medicine	Domestic	Approximately 100-200 grams of each for each family	
Atees	Medicine	Domestic		
Salanpanja	Medicine	Domestic		
Deodar Sap	Ointment	Domestic		
Lado	Spice	Domestic		
Archan	Wounds	Domestic		
Brahmakamal	Worship	Domestic		

Dependence on non-timber forest products:

Name	Number of households harvesting today
Deodar	All
Pine	All
Deodar Sap	Elderly- maybe 50 households
Other herbs	50-60 households
Brahmakamal	All for shravan puja

Livestock

Earlier, yak-cow hybrids were common. These days, they are fast disappearing and only 3-4 of the old first-generation crossbreeds are left. Most of the cattle now are third or fourth generation crossbreeds, and these too are disappearing. Climate change could be a direct cause of this. Earlier, yak stock for breeding was obtained from the traders who would cross over the glaciers from Tibet. With the disappearance of these frozen passages, fewer traders are crossing over, and there is not enough stock available to maintain the quality of the cattle[1].

[1] Personal communication with Dr. Subadhra Sen

2. **Bagori**

Transhumance/ Livestock:

Figure 8: Shepherd at Bagori. This man was employed to herd the sheep and not a resident. ***(photo: Chicu Lokgariwar)***

	This year	10 years ago
Duration (no of months)		
Distance	In chaitra: Dharali Bugyal Winter: rishikesh	
Number of households	150	
Number of sheep	7 families, (4X200 + 3X60)	50hh (50X250)
Number of goats		
Number of cattle	400-450	~600
Quantity of wool	2 kg per harvest X 2 harvests	
Quantity of milk	1 Ltr	
Quantity of meat		
Income from wool	50 Rs/kg	
Income from milk		
Income from meat	150 Rs/kg	
Major diseases	Khudiya	
Quality of wool		
Length of wool fibre	Better in September harvest	
Main fodder species	Grass, crop remnants	

Horticulture:

Meeting with Mr. Jagdish Bhatt of the horticulture department, Harsil.

Area under cultivation

Village	Hectares cultivated
Dharali	20
Mukhba	15
Jaspur	10

Yield:

One tree yields 2 quintals of apples
One hectare yields 10-15 trucks of apples
Apple trees produce for 15 years in the dwarf varieties and upto 45 years in other trees.

Comments on lowering yield:

There is no rain in winter, which results in lower production of apples. This year, there was no snowfall[2]. This means that there will be no fruit production this year.

List of pests and insects:

Pests	Fungus
Scale	Black rust
Oliepis	Powdery mildew
Thrips*	Scab
Caterpillars	

*****Thrips are pollinators, but can become pests if they multiply beyond the threshold level.

[2] The first snowfall of the season occurred the day after this interview

3. Mukhba *(pop. 170)*

Figure 9: FGD with women residents, Mukhba ***(photo: Shreshtanand)***

Figure 10: Lizard. Southern aspect, Mukhba ***(photo: Chicu Lokgariwar)***

Ground Freezing

	First freeze	Number of incidents
Last Year	No freeze	0
10 years ago	1st week of Karthik	Till Baisakh
20 years ago	1st week of Asoj	Till Baisakh

Snowfall

	First snowfall	Number of days snowed	Last snow	Max depth
Last Year	October 2009	One day		
10 years ago	Ashwin		Baisakh	3’
20 years ago	Ashwin	12 days	Baisakh	4-5’

Remarks:
The sun today, (07 December) feels like the sun as it used to feel during Jyeshtha. Winters are warmer now. Cold spells still come suddenly. But there is no long-lasting freeze. The snow melts in a day or two.

Extreme Events:

Avalanche	There was a major avalanche 20 years ago
Hail	At least one hailstorm occurs every year during the month of chaitra
Cloudburst	The last one was three years ago

Agricultural Impacts:
Pests

Crop affected	Name of pest
Apple	Scale on buds
Apple	Black scab on buds
Apple	Mites

Apple	White fungus
Rajma	Insects that eat leaves
Potatoes	*Kalsundi*

Remarks: 20 years ago, only Wilson apples would be grown here. These being resistant, there were no diseases to the apple crop then.

Crop Cycle

Month	Activity
Chaitra	Repairing of fields, oiling of apples
Baisakh	Planting and ploughing
Jyeshtha	Cheena, aloo, marcha, kauni planting
Aashad	Ogal and rai planting
Shravan	Weeding and maintenance
Bhadrapad (bhado)	Harvesting Cheena, aloo, marcha, kauni, apples
Ashwin (Asooj)	Cutting grass, harvesting apples and rajma
Kartik	Grass and wood gathering
Aghain (mangsheer)	Maintenance, mulching, pruning, spraying
Poush	Bund repairs
Magh	Bund repairs
Phalgun	Bund repairs

This is the calendar that is normally followed from earlier times, without much change.

Crop production
(Focus group discussion in the village courtyard)

Production these days has increased, since the apple orchards have increased. The main factor causing a decrease in apple production is the south facing slope. This is dryer than the opposite slope and has less snowfall. This year, there were no apples at all. There was also no snowfall.

However, the people of Dharali tend to their orchards a lot more than the people of Mukhba. The trees are neglected here, and so they do not produce much.

Name of crop	Area Cultivated
Potatoes	10 naali
Rajma	35 naali (intercropped with apples)
Apples	50 naali

Time of flowering

Name of crop	Last year	5 years ago	10 years ago
Apples	Last week of March	Between 15-20 April	Between 15-20 April

Quadrat #1
Forest cover data sheet

	Seedlings	Saplings	Poles	Fullgrown	Dead
Species name (unknown #) /local name					
Pinus wallichiana	0	0	0	2	0
Cedrus deodara	0	4	0	7	0
Prunus armenica	0	0	0	1	0
Burberis lycium	1	0	0	4	0
undergrowth	Wild berry (rubus sp.), doob grass				

Quadrat #2
Forest cover data sheet

	Seedlings	Saplings	Poles	Fullgrown	Dead
Species name (unknown #) /local name					
Pinus wallichiana	0	7	1	4	0
Cedrus deodara	0	1	0	2	0
undergrowth	Tanacetum sp				

Quadrat #3
Forest cover data sheet

	Seedlings	Saplings	Poles	Fullgrown	Dead
Species name (unknown #) /local name					
Pinus wallichiana	0	3	0	0	0
Cedrus deodara	0	0	7	6	0
Burberis lycium	4	0	0	3	0
undergrowth	Rosa spp				

Quadrat #4
Forest cover data sheet

	Seedlings	Saplings	Poles	Fullgrown	Dead
Species name (unknown #) /local name					
Pinus wallichiana	12	4	1	3	0
Cedrus deodara	0	4	2	2	0
Burberis lycium	0	0	0	6	0
undergrowth	Rosa spp				

Among full grown trees of Cedrus deodara and Pinus wallichiana deodar trees are more numerous than pine. This shows that deodar is in abundance. However, the seedlings and saplings of pine are more which shows that pine is having more regeneration in recent years. Deodar is thus gradually being replaced by pine. **The area is not receiving adequate rain**

fall for several years and deodar needs the adequate moisture to grow but pine can grow in harsh conditions gregariously.

Herbaceous cover data sheet

Quadrat #	**1**	**2**	**3**
Species name (unknown #) /local name			
Artemisia spp	10	11	17
Potentilla spp	25	90	29
Rosa spp	0	0	0
Tanacetum sp	0	3	7

Species harvested: Forests

Name	**Use**	**Consumption (domestic/market)**	**Qty harvested today**	**20 yrs ago**
Deodar	Wood	Domestic		
Chir	Wood	Domestic		

Species harvested: Meadows

Name	**Use**	**Consumption (domestic/market)**
Chaura	Medicine	Domestic
Atees	Medicine	Domestic
Lado	Spice	Domestic
Archan	Wounds	Domestic
Brahmakamal	Worship	Domestic

Dependence on non-timber forest products:

Name	**Number of households harvesting today**
Deodar	All
Pine	All
Other herbs	Those who go to the bugyals
Brahmakamal	All (for the shravan puja)

Livestock

All households have around 2-4 cows, while 10 households have 10-12 cows.Earlier, Dzos (yak-cow crossbreeds) would be kept in the village. 30-35 years ago, chaurgai (the first generation crossbreeds) and pure-breed yaks would also be kept.

These would spend 6 months in the higher altitudes, and only come down in the winter. These are now being phased out and cows kept. This is because while left here in the winter, the Dzos eat the yards.10-12 households rear sheep and goats. Of these, most have around 30 animals. 5-6 have 70, and two families rear 150 and 150 heads. These are taken to a bugyal 10kms away in the summer ,and to Rishikesh in the winter.

Earlier, there was a good market for wool, and several buyers would come to the village. Now, no traders come here, possibly because of decline in wool quality

4. Jaspur *(Altitude: 2615 msl, pop.195)*

Ground Freezing

	First freeze	Number of incidents
Last Year	09 November	1
5 years ago	March-April (asooj)	2
10 years ago	Nov-dec	2

Snowfall

	First snowfall	Number of days snowed	Last snow	Max depth
Last Year	09 Nov 09	1		½ “
5 years ago	Kartik	10	Jaith	7’
20 years ago	Kartik	15	Chaitra	>7’

Agricultural Impacts:

Crop Cycle

Month	Activity
Chaitra	Sowing
Baisakh	Field operations
Jyeshtha	Rajma sowing
Aashad	Vegetable sowing
Shravan	Weeding
Bhadrapad (bhado)	Weeding
Ashwin (Asooj)	Harvesting of all
Kartik	Post-harvesting operations
Aghain (mangsheer)	Grass and wood collections
Poush	Pruning
Magh	No work due to snow
Phalgun	No work due to snow

Crop production

Name of crop	Area Cultivated (average nali per person)		
	today	5 years ago	10 years ago
Apple	6	6	6
Rajma	5	5	5
Potato	3		
Phaphra	2		
Kani	1		
Vegetables	2		

Name of crop	Production		
	today	5 years ago	10 years ago
Apple	100 Kg/tree	100 Kg/tree	100 Kg/tree
Rajma	200 Kg/5 nali	200 Kg/5 nali	>200 kg/5 nali
Potato	200 Kg /3 nali		
Cauliflower	20 Kg/nali		
Carrot	5 Kg/nali		

Time of Apple flowering

	Time of flowering		
	today	5 years ago	10 years ago
Apple	Last week of March	2nd week of April	2nd week of April

Orchard Maintenance

	Today (date)	5 years ago	10 years ago
Trees planted	December	December	December
Average age of trees	30	40	40
Trees grafted	All	All	All
Species	Royal, Red, Rochard, Golden (new)		
Source of planting material	Local	local	local
Pruning	Nov-Dec	Nov-Dec	Nov-Dec
Spraying	November, April	November, April	November, April

Forestry

Forest cover data sheet

Quadrat #	1	2	3	4	5
Species name (unknown #) /local name					
Pinus wallichiana	12	17	11	7	9
Berberis asiatica	2	1	4	12	3
Kathi	0	0	0	3	1

Note: Cedrus deodara is replaced by Pinus Wallichiana upto tree line in southern aspect as well as in previously degraded areas.

Shift in endangered species: Forests

Name	Coverage today	5 years ago	20 yrs ago
Atees	Almost nil	Present in the grasslands	Present in fields also
Salanpanjoo	Almost nil	Present in the grasslands	Present in fields also

Species harvested: Forests

Name	Use	Consumption (domestic/market)	Qty harvested today	5 years ago	10 yrs ago
Atees	Medicinal	Market	0	0	unlimited

Note: No dependence on forest products

Livestock:

There are only three shepherds in the village. Their details are as follows:

Kishan singh: 350 animals

Karn Singh: 40 animals

Jaipal Singh: 60 animal

10 years ago, their families has about 400 animals each. Now, no time to spend on herding as they have other businesses. Jaipal Singh has started a restaurant by the road, and each of them has orchards. They are of the opinion that the returns no longer match the effort involved. Earlier also used the animals for draft- for exchanging rajma for salt, etc. Now with the construction of the road, this use is also no longer there.

Most families have one or two cows and bulls.

The diseases are as follows:

Goats: Cherku (dysentery), *bumka, khurpaka, chamala, phodi,*

Cattle: *khurpaka*

Field Surveys: Pindar Valley

Dates of survey: 08 to 16 April 2010

Survey Team: Shresthanand, Chicu Lokgariwar

Information about the valley:

The Pindar valley is oriented towards the North, with the Kafni valley oriented towards the North-East. With an altitude range of 2100 metres (Loharkhet (1760 msl) to Bayalighar (3860 msl)), the area houses a wide number of ecosystems. A popular trekking route runs through Pindar and Kafni valleys. The economy of the villages is supported by, if not dependent on, tourism. Other main livelihood activities are collection of non-timber forest products and agriculture.

There are two villages in this valley, along with several rest stops which are not populated permanently. The details of these are as follows

Sr.No	Village	Population	Altitude	Work done
1	Dhakuri	Dak Bungalow	2680	Forest quadrat survey
2	Wachum		2020	Gram sabha meetings, transect walk
3	Khati		2210	Gram sabha meetings, forest quadrat survey, transect walk
3	Bayalighar	Dak bungalow	3860	Forest and bugyal quadrat surveys.

Survey Reports:

1. Wachum

Ground Freezing

	First freeze	Number of incidents
Last Year	November-January	
10 years ago	November-January	
20 years ago	November-January	

Snowfall

	First snowfall	Number of days snowed	Last snow	Max depth
Last Year	January 10	3 days	March 10	3" to 4"
10 years ago				2'0" to 2'6"
20 years ago	November-December		March	6'

Remarks:

- 20 years ago, snow would not melt all winter. Now it melts within a few days.

Weather Patterns

Changes in Seasonality

Month	Seasonal event
Chaitra	There is a slight increase in temperature, and some flowering of rhododendron. There is an occasional drizzle. A decade ago, it would rain more
Baisakh	It drizzles once or twice during this month
Jyeshtha	No rain
Aashad	No rain
Shravan	Heavy monsoon rains
Bhadrapad (bhado)	Heavy monsoon rains
Ashwin (Asooj)	Light rain
Kartik	Light rain
Aghain (mangsheer)	No rain, the cold begins around this time
Poush	The first snowfall is in this month.
Magh	It usually snows twice or more in this month
Phalgun	Snowfall approximately twice a month.

Rhododendron flowers through the months of February, March and April.

Crop Cycle

Month	Activity
Chaitra	Planting of potatoes is carried over from the preceding month
Baisakh	Planting of paahpar and oghal
Jyeshtha	Barley, wheat, rajma, finger millet. Irrigation needs to be done in this month
Aashad	Wheat
Shravan	Paaphar is harvested, and wheat is planted in the same fields
Bhadrapad (bhado)	Planting wheat in the fields
Ashwin (Asooj)	Planting barley. Some harvesting of potatoes begins
Kartik	Harvesting of potatoes continues.
Aghain (mangsheer)	
Poush	
Magh	
Phalgun	Sowing of potato

Remarks: Earlier productivity was good. But for the last 2-3 years there have been no crops. The significant change in productivity is reflected in the produce, which used to be 1 quintal and has reduced to 50kgs. This time there has also been no rain and no snow.

Name of crop	Area Cultivated today
Wheat	~800 nali
Amaranthus	1000 nali
Finger millet	<700 nali Largely for fodder
Potatoes	10,000 nali
Oil	10,000 nali
Rajma	500 nali Personal
Aogal	600 nali

Remarks:
The area under cultivation is the same as 5-10 years ago however the villagers reported that the productivity had fallen quite sharply.

Name of crop	This year
Apples	12 hecatres
Badam	5 hectares
Walnut	Very less 1.5 hectares

Remarks: The villagers are in the process of setting up of these orchards. Presently there was no production in these orchards.

Pollination

Number of hives	½ kg/per hive earlier 1 kg/per hive
Honey production	10% households earlier 50% households

Forest cover data sheet

	Flowering	Quadrat				
		1	2	3	4	5
Species name (unknown #) /local name						
Oak		9	11	6		16
Rhododendron		2	6fully grown 5 saplings 3 seedlings	14 fully grown 1		2
Viburnum species				1		
Taxus (Taxus Baccata)				1 fully grown 2 poles		
Major weeds		Moss, Rubus sp. present in all the quadrats				

* Critically endangered species and was isolated.

Remarks: A single chinar tree was observed outside of the quadrat.

Species harvested: meadows- anees, katki, ajadi(root), gokul(root used to make dhoop), chiji (used for dals etc.) every family has 2-3 goats. 20-25 people go to the bugyals to harvest.

Dependence on NTFP: Here too the villagers harvest 'jhola' which are sold to contractors. At present the villagers are able to harvest 60 mule loads worth of jhola. Seasonal grasses are also collected.

Transhumance/Livestock:

Month	This year	10 years ago
Chaitra (March)	leave for bugyal in sunderdhunga	The same as today
Baisakh (April)	No snow	Snow till august
Jyestha (May)	In bugyals from May to August	
Aashad (June)		
Shravan (July)		
Bhadrapad (bhado)(August)	Return in August	
Ashwin (asooj)		
Kartik		
Aghain (mangsheer)		
Poush		
Magh (Jan)		
Phalgun (Feb)		

Remarks: In total there are 25000 animals. Each goatherd has up to 800-900 goats with him. There has been no change in plants. The change in grass depends on the rains. The route that they follow is from Tatoli-Khatriya-Makhtoli-Satran.

2. Village: Khati

Formats for the baseline study

Ground Freezing

	First freeze	Number of incidents
This Year	Nov-Dec	Till march
5 years ago	Nov-Dec	Till March
20 years ago	Nov-Dec	Till March

Snowfall

	First snowfall	Number of days snowed	Last snow	Max depth
This Year	February	Once	Only once	No rain. Last time 6inches
10 years ago		Snow in April as well		
20 years ago	Nov-Dec	1-2 times a month	February	1.5 meters

Notes:

There has been an increase in temperature which has led to increased melting. If it rains in November, then it stays. Now it melts- *"Himalaya khali ho rahe hai"*

Weather Patterns:

Changes in Seasonality

Month	This year	20 years ago
Chaitra	Now warmer	Was cold. Plants dormant
Baisakh	Rain with hail	Some rain. Greening would start
Jyeshtha		
Aashad	Start of the monsoons strong rains	Monsoons gradually set in
Shravan	Strong rains	Continuous rainfall
Bhadrapad (bhado)	Strong rains	Rainfall continues
Ashwin (Asooj)	Weather is clear grass cutting begins	
Kartik	Rains accompanied by hailstorm, Grass and fodder collection continues	
Aghain (mangsheer)	Preparations to stock grass and firewood begins	
Poush	Stocking	
Magh	Stocking goes on till March	
Phalgun	No comments provided	

Notes:

Earlier during monsoons the rainfall was less severe. The intensity would increase gradually. At present the monsoons begin with severe rainfall with more extreme weather.

Jhumjhum *aaram se barish hoti thi. Aajkal khatarnak barish hoti hai.*

The following items are stored for the winter: 25 quintal wood, 1 ton fodder, 5 kg oil, 20 kg salt, 5 quintal wheat.

Agricultural Impacts:
Crop cycles

Month	(write name of crop in field)		
	This year	5 years ago	20 years ago
Chaitra			
Baisakh			
Jyeshtha	Harvesting of barley	Harvesting of Barley	Harvesting of barley
Aashad	Harvesting of wheat/Sowing of Amaranthus	Harvesting of wheat/Sowing of Amaranthus	Harvesting of wheat/Sowing of Amaranthus
Shravan			
Bhadrapad (bhado)			
Ashwin (Asooj)	Sowing of wheat/barley	Sowing of wheat/barley	Sowing of wheat/barley
Kartik	Harvesting of potato	Harvesting of potato	Harvesting of potato
Aghain (mangsheer)	Harvesting of Ramdana	Harvesting of Ramdana	Harvesting of Ramdana
Poush			
Magh			
Phalgun	Sowing of Potato		Sowing of Potato

Notes: Crops are organic so there has been no advancement in ripening. However, there has been an emergence of insects in potato. Also, with a decrease in snowfall there is decrease in productivity of crops.

Crop Production

Name of crop	(write hectares under cultivation)		
	This year	5 years ago	20 years ago
Barley	20kg		
Wheat	10kg		
Phaphar	Negligible		
Area under production (total)	Total=80 nalis		Total=300 nalis*

Notes: There are no permanent sources of water which has led to a lack of irrigation.
*Shyamlat(naap) and sacial which were cultivated previously were discontinued due to check from the forest department.

Horticulture: They had been provided with 4000 plants of apples but there were attacked by insects and dried up. Currently there is no significant apple crop.

Production

Name of crop	Quantity Today	5 years ago	20 years ago
Wheat			
Mandua	5 kg		20kg
Barley	15-20kg/nali		10kg/nail
Potato	25kg/nail		50kg/nail
Ramdana (affected by insects)	20kg/nail	Always affected by insects but now more	Earlier less
Rajma	1-2 nali 10-15kg/nail		Earlier less. Used old seed. Now with new seed from Bageshwar
Sarso#	Planted but no produce		

Notes: #when they plant mustard they have to take it to the oil press at Bageshwar. This was not economical for the villagers. Now the snow falls after seedling establishment which kills the barley seedlings.

Time of flowering

Name of crop	Flowering Today (date)	5 years ago	10 years ago
Rhododendron	Flowers late in the years of snowfall else earlier		
	Feb-Jan 1st flowering		March
	This year is a boom year for rhododendron		

Pollination

	Today (date)	10 years ago
Number of hives	5 hives	In every house 2-3 hives
Honey production	¼- ½ kg/ hive	Used to be more

Forestry:
Forests: Quadrat survey: 10 X 10 m, 5 nos

Forest cover data sheet	Flowering /seed	Quadrat #				
		1	2	3	4	5
Location		Near KMVN	At 1km from Khati			
Species name (unknown #) / local name						
Asculus Indica (Horse chestnut)	New growth	5	1	2 dry 1 mature	4	
Vibum		7	13	2		
Prirepa Utiliz		1				
Kharsu oak			24 1 pole	7 saplings	5	
Acer Oblungum (Himalayan maple)			5 saplings	1 seedling	2 full grown	
Unknown			4			
Alnus Nepalensis				1 full grown		
	Fern				Unknown	
	Vanfasha				Fern	
Undergrowth		Doob, oxalis	Doob		Moss, Oxalis	

Species harvested: Forests

Jhola (lichen) collected by the villagers and sold to contractors. The villagers have been engaged in this for the last seven years. These contractors process these to make dyes. The villagers were unaware of what these dyes are used for. Very low use of NTFP because of the forest dept.

Species harvested: Meadows

'Kida ghas' is collected by the villagers and sold to the forest dept. *'Brahman'* flowers in June. However for the last two years the flowering has reduced. Also the harvesting is long because the villagers are scared of the associated gods since the flower can only be touched by a pure person who knows all the 4 Vedas. The *'brahmakamal'* is harvested by all during the Nandadevi puja.

Quadrat surveys: Glacier base (Khatia)

Q1: Alpine grass, Sage, Moss, Potentela sp., Sebaceous., Salam panja (Orchis latifolia) (dry)
Q2: Salam panja(dry), Primula glomorata, Potentela sp., Moss, Spiria sp, Eulaliopsis,
Q3: Primula glomorata, Salam panja (dry)
Q4: Potentela sp., Primula Glomorata, Eulaliopsis, Salvia, Salam panja(dry), Moss, Daisy (compositae sp), Unknown white flower,
Q5: Hypoxis aura, Doob grass, Artemisa, Potentela sp.
Q6: Potentela sp, Spiria, Doob, Hypoxis aurea (not flowering), *jangli palak*,
Q7: Jangli palak (dry), potentela sp., Salvia, Sonchus sp., Doob, Unknown white flower
Q8: Jangli palak, Geranium, Hypoxis Aurea (not flowering), Unknown white flower

Forest cover data sheet	Quadrat #		
	1	2	3
Location	Towards Dwali		
Species name (unknown #) / local name			
Rhododendron Compenulatum (beginning to flower)	17		2
Viburnum (flowering)	4	6	
Taxus	1		
Bamboo	1		
Berberis Licium (leaves budding)	3	19	18
Rosaceae (leaf buds)	~50	3	1
Kharsu Oak		1	2
Undergrowth	Pahadi palak, sonkus artemis	Pahadi palak, sonkus artemis	eulaliopsis